Date: May 28, 2009

To: Ching-Pi Wang, Supervisor, TCP Uplands unit

From: Jerome Cruz, TCP

Subject: Weyerhauser Mill E site, Everett

A 10 year Data Review Report was recently submitted by Associated Earth Sciences, Inc. on the Weyerhauser Mill E/Koppers site in Everett.

The report concludes that since the completion of the remedial action, the containment system "is continuing to perform as intended and contaminant concentrations within the containment area continue to decline." The report goes on to recommend continued annual asphalt cap inspections for an additional five years and groundwater monitoring every two years.

This memo will detail the present status and recommendations for this site before turning over for periodic review.

Key issues

This site is in a post remedial action, periodic review phase of a completed consent decree.

Attachment A is a copy of a letter dated September 15, 1999, documenting a department decision which "finds that the remedial action requirements of the Decree have been met." The letter then indicates that the site is in its monitoring phase. Due to the fact that the site has a final approved consent decree with binding terms, there is at present little driving force to compel drastic revision or overhaul of the existing remedial system or compliance monitoring network to correct any inherent deficiencies that may be found upon site review. An example of an apparent deficiency in the existing remedial system may be found in my attached memo dated March 24, 2006 (Attachment B). The memo calculated the amount of contaminant that flows downward through the basal silt unit that the sheet pile containment system is keyed into. Judging from past records, it was also known that contaminants pass through the lower confining unit (basal silt), but apparently the Consent Decree was approved recognizing these conditions.

To date, arsenic in groundwater within the containment system continues to be out of compliance. The Performance and Compliance Monitoring Plan (PCMP), which is part of the consent decree, provides for measurement of contaminant analytes only at one well that is within the containment system (PZ-3A). No other wells outside of this system are being sampled on the site.

Immediate recommendations

1. The terms of the final approved Consent Decree has no specific language for reassessment of the remedial system for this site, nor is there language for corrective

action if contaminants are out of compliance. Under present constraints and conditions, the institutional controls and monitoring should continue indefinitely.

2. The analyte concentrations in PZ-3A and overall groundwater monitoring schedule should continue to be monitored at least annually (not every 2 years as recommended in the 10 year report), and indefinitely. There remains a lack of consistently low concentrations as seen in time series plots of contaminants. Although the 10 year report cites a decreasing trend, this trend may change as seen in earlier rising patterns in concentration.

3. Sampling events should continue following a more consistent time of the year to make water level and analyte measurements comparable. Furthermore, reports should indicate tidal stage in adjacent Snohomish River at the time of sampling. The last four annual sampling events were done in September. It is not known if this time of the year represents an average representative concentration or more conservatively a maximum concentration in the containment wall.

4. The site continues to have arsenic contamination above cleanup levels in groundwater. The Consent Decree does not detail a response or plan of action when contaminants are not in compliance following periodic review. Not only should the site stay open, a corrective action might be needed for the arsenic exceedance. Note that because this site is located at the Everett Smelter arsenic site, this may be reflective of area background, although this has not been proven. The report cites a 1997 Weyerhaeuser Feasibility Study as indicating that arsenic concentrations are below an upgradient concentration of 0.443 mg/L. The 0.443 mg/L value appears to have been cited as a proposed value for area background based on previous discussion on the arsenic exceedances at the site. The FS states that an investigation by EMCON showed that "groundwater arsenic concentration in the upper sand aquifer upgradient of the Former Mill E/Koppers Facility Site was approximately 0.054 mg/L (Hydrometrics, 1994)." Immediately upgradient of the site in the upper sand aquifer (on Weyerhaeuser property), average arsenic was 0.443 mg/L. Therefore, the quoted value of 0.443 mg/L refers to groundwater that is still part of the site and does not constitute background. Much of the measured arsenic data within the containment is above the Method A value of 5 µg/L (as per consent decree) and above 54 µg/L, the aforementioned quoted average value upgradient of the site. Likewise, it has not been adequately demonstrated what natural or area background is based on criteria stated in WAC 173-340-709.

5. The UECA periodic review person (Joe Hickey) should make an independent evaluation of the 5 and 10 year periodic review of this site. The PLPs should follow his recommendation for future actions at this site.

6. Cap monitoring and inspection should proceed as before. The PLPs have done a good job maintaining the integrity of the asphalt cap and fulfilling notification requirements of the institutional controls required in the consent decree.

Long term recommendations

Long term recommendations are presented in a technical advisory capacity only. This is recommended only if there is an opportunity or decision to implement such an action at the site:

1. One means to better evaluate the temporal variation in containment wall hydraulic performance is to determine water levels over a continuous period. A 48 hour tidal study of groundwater levels within and outside of the containment wall can be conducted to establish tidal variations in water levels and observe if the water level within the containment system consistently remains lower than levels outside the containment wall throughout a complete tidal cycle. As designed, the system was meant to keep water lower inside the containment wall compared to outside and thus maintain a hydraulic gradient inward to keep contaminants from escaping the containment wall while minimizing breakthrough at the basal confining unit. The water level measurements were taken once or twice a year (no measurement in 2005) and thus does not have the resolution to show temporal variation in water levels needed to show the degree to which inward gradients are sustained (and thus the continued performance of the system). This is especially the case in the diurnal tidal cycle where groundwater levels may be expected to be lower outside the containment system than within.
2. Contaminant mass loading through the basal confining unit is believed to occur (especially during low tide), but there are no measurements beneath the layer that allow for direct measurement and confirmation of mass loading. No wells or sediment pore water measurements exist that would confirm the amount of contaminants that goes into the Snohomish River.
3. A program decision should be made on whether this site should be reassessed due to the mass loading effects and monitoring deficiencies noted before. This should include legal opinion if terms of the consent decree will prevent or limit site re-evaluation and corrective action.

ATTACHMENT A

Construction Complete Letter from Ecology dated September 15, 1999

Paul

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

P.O. Box 47600 • Olympia, Washington 98504-7600
(360) 407-6000 • TDD Only (Hearing Impaired) (360) 407-6006

September 15, 1999

Mr. Stuart Triolo
Environmental Engineer
Weyerhaeuser Company
101 East Marine View Drive
Everett, WA 98201

Dear Mr. Triolo:

Thank you very much for the September 1, 1999 report entitled "Construction Report – Former Mill E/Koppers Site Remediation; Everett, Washington; September 1, 1999". The report was submitted to document the completion of the requirements outlined in Consent Decree No. 98-2-087186 filed in Snohomish County between the Department of Ecology and Weyerhaeuser Company. My staff reviewed the report and finds that the remedial action requirements of the Decree have been met. The project will now start a compliance monitoring phase. As started in Exhibits E and C of the Decree, Weyerhaeuser shall continue to monitor ground water and maintain the engineered cap for the next five years. Ecology and Weyerhaeuser will review data and exchange proposals after the five-year monitoring period to determine what future monitoring at the site is necessary.

We have already changed the status of the cleanup on the Department database from remedial action in progress to construction complete. The hazardous sites list reflects this change. The next hazardous sites list will indicate that the site is in a monitoring phase.

Thank you very much for your assistance during the last four years of cleanup activities in the Everett area. You kept the projects on track through one of Washington's wettest winters. Good luck in your future endeavors with Weyerhaeuser Company. If you have any questions concerning the cleanup please contact me or Paul Skyllingstad of my staff 360 (407-6949).

Sincerely,

Carol Kraege

Carol Kraege, P.E.
Industrial Section Manager
Solid Waste and Financial Assistance Program

CK:pes

ATTACHMENT B

Technical and Administrative Review Comments on the Weyerhaeuser Mill E formal MTCA cleanup site, 515 East Marine View Drive, Everett, Washington - Memo dated March 24, 2006

Date: March 24, 2006

To: Ching-Pi Wang, supervisor, TCP

From: Jerome B. Cruz, TCP

Subject: Technical and Administrative Review Comments on the Weyerhaeuser Mill E formal MTCA cleanup site, 515 East Marine View Drive, Everett, Washington.

As per your request, I have reviewed documents on the cleanup of this site and have provided technical and administrative comments and suggestions for improvement below.

Location and History

The Weyerhaeuser Mill E/Koppers site is located northeast of the City of Everett and along the western bank of Snohomish River. It is industrial property that is zoned M-2 heavy manufacturing, approximately 8.9 acres. The site was used for lumber storage from 1915 to 1948. From 1948 to 1963, it was used for treating lumber by American Lumber and Treating Corporation (Koppers Company). In 1963, Weyerhaeuser converted the facility into an engine maintenance shop which operated until 1984. At the northeast end of the site, a small-diameter log sawmill operated from 1971 to1984. In August 2005, Ecology was notified that Weyerhaeuser sold property that included Mill E to a subsidiary of Pacific Topsoils, Inc. The site was recently used to store pallets, but a January 22, 2002 letter scope of work letter from GeoEngineers documents a proposal for a Concrete Nor'West Batch Plant to be located above the asphalt cap that was installed as part of a remedial action in 1999. Records show that fairly recently, Ecology requested information on load bearing capacity and possible effects on cap of building or effects of work activities on integrity and performance of the cap.

Remedial Actions

Weyerhaeuser conducted an independent RI/FS in 1995. The indicator soil contaminants identified at the site were wood preservative chemicals pentachlorophenol (PCP), creosote, chromated copper arsenate (CCA), polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH). Ground water at the site contained dissolved and free phase wood preservative chemicals, metals including chromium and arsenic, and petroleum hydrocarbons. Arsenic was above area background.

A Consent Decree which included a Cleanup Action Plan was finalized in November 1998.

The Final Cleanup Action consisted of several activities:

1) Installation of an approximately 1,600 foot long vertical barrier wall (made of high density polyethylene) around the most contaminated portion of the site,
2) Excavation and off-site disposal of up to 1,200 cubic yards of hot spot soil in the former blow pit area,
3) Installation of a low permeability asphalt cap over the vertical barrier containment area to minimize precipitation recharge and prevent direct contact with contaminated soils,

4) Installation of a soil cap over portions of the site outside of the barrier wall to prevent direct contact with impacted soil,
5) Institutional controls such as deed restrictions to control exposure of future site workers to contaminants and to maintain the integrity of the barrier wall and cap, and
6) Long term monitoring and maintenance of these remediation structures.

A Performance and Compliance Monitoring Plan was prepared in August 1998. Asphalt cap and soil cover inspection was to be accomplished semi-annually for the first two years, including for storm events, and annually from years 3 through 5. Water level monitoring was carried out in 3 perimeter wells inside the barrier wall and 3 perimeter wells outside the barrier wall. All wells are screened in the upper sand aquifer. The monitoring frequency was quarterly for the first year, semi-annually for the second year, and annually for years 3 through 5. Monitoring well PZ-3A, located on the shoreward portion of the barrier wall, was sampled for arsenic, PCP, and TPH semiannually for the first year, and annually in years 3 and 5. The comprehensive five-year review was submitted on November 10, 2003.

Conceptual Site Model

Four hydrostratigraphic units were identified at the site. From top to bottom, they are: grade and mixed fill, the upper sand aquifer, the upper silt aquitard, and the lower sand aquifer (1994 draft RI/FS). The grade and mixed fill is unsaturated, ranging from 1 to 4 feet thick, and composed of sandy gravel, asphalt, crushed rock, wood debris and bark. The grade fill apparently was placed after 1974. The upper sand is fine to medium sand, averaging 5 to 6 feet in thickness and ranging from 1 to 10 feet thick. Much of the sand apparently was dredge fill sand emplaced upon estuarine tidal flats of the Snohomish River. The upper silt unit is a stiff, low plasticity to non-plastic silt with abundant organic matter and lenses of fine sand, sandy silt, and silty sand 0.1 to 0.2 feet thick throughout the unit. The average thickness is 8 feet and it ranges from 1 foot (near the shoreline) to 17 feet. The lower sand is found below the silt unit. It is composed of medium to coarse sand with trace gravel and wood debris. In one borehole, the thickness of the lower sand was 63 feet. It was interpreted to be fluvial sediment from the Snohomish River.

The average water table depth is 4 feet below ground surface. The upper sand unit is partially saturated below the site, and is recharged by precipitation and discharges to the underlying units and Snohomish River. The silt unit is a leaky aquitard between the upper and lower sand units. The lower sand unit is fully saturated. It is recharged from intermediate and local sources below and lateral to it, and by downward flow from the upper sand aquifer. Piezometric head in the lower sand aquifer is influenced by the tidal fluctuations in the Snohomish River

Status

- Ground water monitoring: Water table elevations within the barrier wall decreased from March 1999 to November 1999, then increased slightly in March 2000 and June 2000. In March 2001, water levels in the barrier decreased to lower than that of March 2000 and stabilized through June 2003.
- Water quality monitoring: Samples from PZ-3A, the lone well sampled for contaminants following the remedial action, yielded increasing TPH-G but at levels below the site

cleanup standard of 10,000 ppb. TPH-D increased from June 1999 to November 1999, and then decreased over June 2001 and June 2003. PCP was detected above the cleanup standard of 7.29 ppb in June 1999 and November 1999. It decreased to below the cleanup standard in June 2001 and below the laboratory reporting limit in June 2003. The total arsenic has been above the cleanup standard of 5 ppb throughout the 4 monitoring periods, but gradually decreased since November 1999 from 1410 ppb to 567 ppb.

- There apparently has been a property ownership transfer (see Location and History). Site was used to store pallets. Ecology requested information on load bearing capacity and possible effects on cap of building or effects of work activities on integrity and performance of the cap. This apparently was in response to a proposed batch plant to be constructed over on the site.
- Integrity of asphalt cap and adjoining cap around barrier wall continues to be maintained, although some small problems have been noted with scotch broom growth, minor cracks and asphalt heave, and soil fill integrity in small marginal spots outside the barrier wall boundary.

Figures 1 – 3 depict the water table and contaminant concentration trends in well PZ-3A. Figure 1 shows concentration vs. elevation. Figure 2 shows the change in concentration with time since barrier wall and cap installation, and Figure 3 shows elevation vs. time. Except for PCP, there does not appear to be large variations in contaminant concentration with water table elevation (figure 1). Figure 2 shows that there was a significant reduction in PCP with time. However, the time series plot of the hydrocarbon contaminant concentrations seem to show increases but with a leveling off with time since cap installation. This can imply essentially constant petroleum hydrocarbon source term loading and thus vertical contaminant loading to the lower sand aquifer continues to occur. Although it has been characterized as below the cleanup standard, it is unknown if this is a standard protective of water quality and aquatic organism in the river receptor. Arsenic remains above cleanup levels. Finally, the water table beneath the cap still shows fluctuation, although as expected it is much lower than the water table in the upper sand outside of the wall. Note that the other piezometer information is not plotted in this graph, but the total results may be found in the monitoring reports.

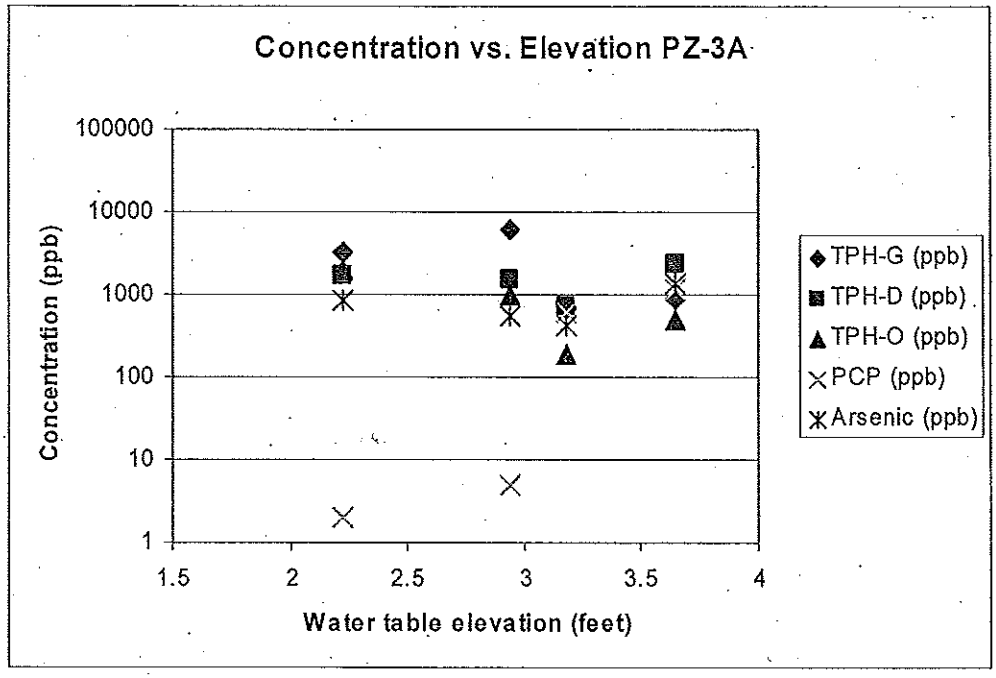

Figure 1. Contaminant concentration vs. water table elevation

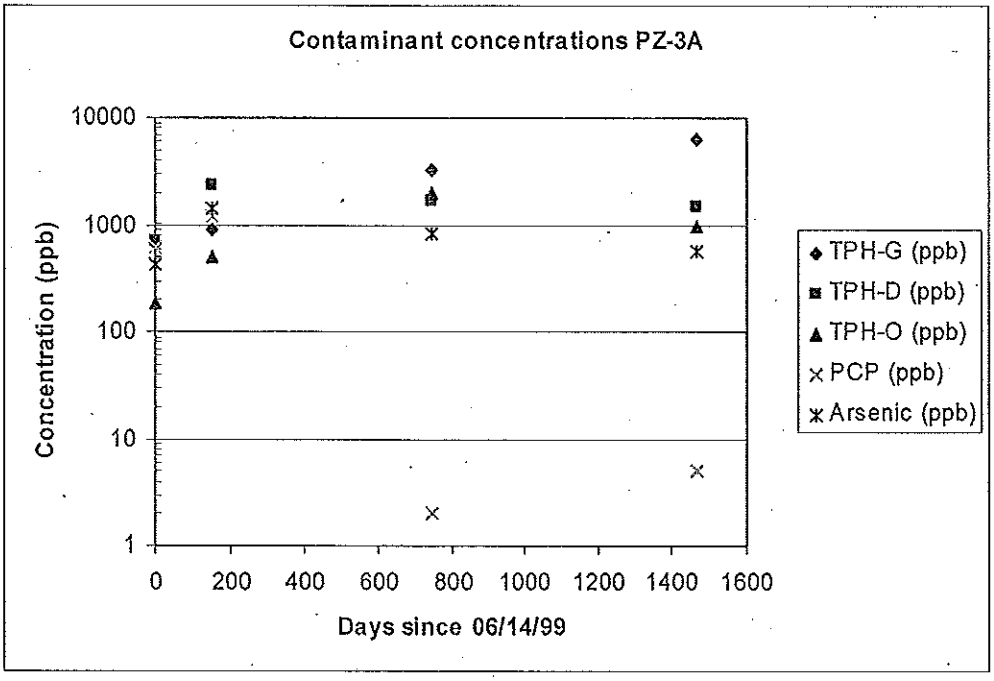

Figure 2. Contaminant concentration vs. time.

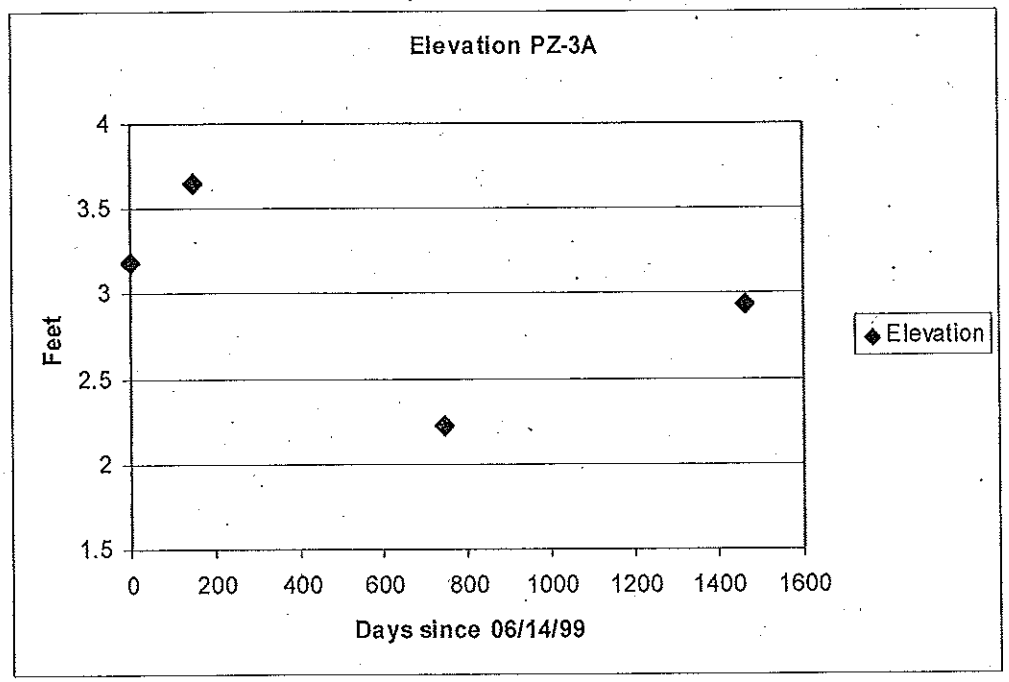

Figure 3. Water table elevation vs. time.

Technical and Administrative Comments

Implementation of institutional controls/restrictive covenant appears adequate, however, not much is known on public notice and transfer of liability and compliance responsibilities to new owner. Thus, responsible parties should continue to maintain integrity of cap, anticipate potential disturbances or disruptions to integrity of the asphalt cap, soil cap, and monitoring network given new ownership and new site use. The status should be made current to Ecology of such notice to new owners including transfer of MTCA responsibilities and the terms of the consent decree regarding transfer of property ownership.

The vertical leakage from the contaminated upper sand unit within the barrier wall through the underlying silt and into the lower sand unit does not appear to have been addressed. Consequently, contaminant loading from the upper sand to the lower sand and thus to Snohomish River does not appear to have been addressed as part of compliance and performance monitoring.

The design of compliance monitoring well network does not address downward flux and contaminant loading from the contaminated soil source in the upper sand unit within the containment wall. There should be wells screened in the lower sand aquifer to determine vertical gradients between upper sand and lower sand and through the silt unit through time. Note that a previous report identified such downward fluxes along with contamination in the lower sand unit (March 26, 1991 Hart Crowser Report Phase Ic Site Characterization Report).
The 1998 Performance and Compliance Monitoring Plan (EMCON, March 11, 1998) implied that this risk pathway was recognized and was part of the performance objectives:

(Page 2-2) "The water elevations within the contained portion of the upper sand aquifer are expected to decrease to a new elevation in equilibrium with the average hydraulic head in the lower sand aquifer. This will significantly decrease the contaminant flux from the upper sand aquifer down into the lower sand aquifer."
(Page 2-2) "... the primary measure of performance will be water levels inside and outside the barrier wall. If water levels inside the wall decline and reach a new equilibrium at approximately the average elevation of the hydraulic head in the lower aquifer, it can be presumed that the containment system (barrier and asphalt cap) are functioning as designed."
(Page 2-4) "The groundwater elevation data will also be used to assess the water balance within the containment system and hydraulic gradients across the containment. If the data indicates significant water flow into or out of the containment, Weyerhaeuser will notify Ecology and appropriate measures will be discussed."

Furthermore, the 2003 Annual Groundwater Compliance Monitoring and Five year Data Review Report (Shaw Environmental, Inc., November 10, 2003) provides on page 5-1 performance monitoring objectives that include "**Long-term reductions in flux of IHSs in deep groundwater migrating to the river demonstrated by reduced hydraulic gradients between shallow and deep aquifers.**"

However, the three monitoring wells within the wall and the three outside were screened only within the upper aquifer. Following this performance and compliance monitoring plan, no measurements were made on hydraulic head in the lower sand aquifer that would have provided vertical hydraulic gradient measurements that address leakage underneath the containment area. Therefore, this aspect of the performance objective was apparently not accomplished.

Comparative piezometer measurements using the present network allow for hydraulic gradient across the barrier wall within the upper sand unit only. The risk pathway from the upper sand through the silt and to the lower sand and Snohomish River remains unknown.

Suggested Improvements

- **Continue inspection of asphalt cap**
- **Maintain integrity of asphalt cap with new site use**
- **Continue implementation of institutional controls, legal and administrative obligations, and public notice with new owner. Possibly work with AG to review legal and regulatory issues and plan Ecology response or communication if it is determined to be necessary.**
- **Provide more in-depth technical analysis of reduced recharge and water table in containment wall in compliance and performance reviews.**

- **Characterize vertical leakage and contaminant loading through the underlying silt layer within containment wall**

One possible solution to monitoring vertical leakage through the silt unit is to have some performance monitoring wells screened in the lower sand aquifer. Nested piezometers are ideal, possibly in the same location as the present well network within the containment wall. This will allow vertical hydraulic gradients to be calculated and thus determine direction of vertical flow or leakage. An alternative is to install wells at the same locations as the performance monitoring wells located outside the containment area; however, they would be screened in the lower sand aquifer. Thus, the network would consist of the pre-existing three wells within the containment wall (screened in the upper aquifer,) and just outside of the wall, the other three compliance wells in the same locations as the other pre-existing outer wells but screened in the lower sand aquifer. This would allow for comparisons of head elevations between the saturated shallow zone in the wall (in the upper sand aquifer), and compare to the heads in the lower aquifer unit. The wells will be close enough to derive both horizontal and vertical hydraulic gradients between the two units.

The lower sand unit is in close hydraulic communication with the Snohomish River. Therefore, periodic changes in piezometric head are expected as dictated by tidal fluctuations in the river. If head in the lower sand is much lower than head in the upper sand in the containment wall, vertical downward gradients and thus downward vertical flow or leakage of contaminated water from the interior of the containment wall will occur. The degree to which such a process occurs, its attendant contaminant loading, and duration do not appear to be known.

Table 1 provides an idea of contaminant loading using hydraulic parameters and measurements predating containment by the barrier wall and asphalt cap. This provides an idea of pre-remedial action contaminant loading vertically through the basal silt aquitard and not simply horizontal flow through the contaminated upper sand aquifer. Following installation of the barrier wall and low permeability asphalt cap, two parameters may be expected to change and consequently affect these estimates of vertical contaminant loading: vertical hydraulic gradient, and contaminant concentrations. The reduced recharge caused by the asphalt cap may be expected to reduce significantly the hydraulic head in the upper sand aquifer; however, there appears to be little information that provides vertical gradient through the silt layer, both averaged and through tidal cycles.

If new estimates of vertical contaminant loading can be acquired, the estimates in Table 1 can be compared to post-remediation estimates and thus the effectiveness of the remediation and its protectiveness can be better assessed.

Table 1

Contaminant Loading vertically through silt - Weyerhaeuser Mill E							
Contaminant	Average Concentration (mg/L)	$Q_{low\ tide}$ (ft^3/day)	Q_{net} (ft^3/day)	Daily contaminant loading Low tide (lbs/day)	Net (lbs/day)	Yearly contaminant loading Low tide (lbs/year)	Net (lbs/year)
Gasoline	5.18	5.98	23.92	0.0019	0.0077	0.71	2.82
Diesel	9.09	5.98	23.92	0.0034	0.0136	1.24	4.95
Heavy Oil	2.81	5.98	23.92	0.0010	0.0042	0.38	1.53
TPH	15.8	5.98	23.92	0.0059	0.0236	2.15	8.61
Arsenic	2.17	5.98	23.92	0.0008	0.0032	0.30	1.18
PCP	1.622	5.98	23.92	0.0006	0.0024	0.22	0.88

Assumptions: one-way flow through lower silt confining unit, contaminant concentrations from upper sand aquifer without cap from RI/FS, 4.4 acre contained area, vertical K values from RI/FS, assume contaminants eventually go to river after entering lower sand aquifer. Low tide is 3 hours daily. Contaminants are assumed to behave conservatively (no attenuation during transport).