



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

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January 21, 2009

Dr. Douglas Morell
Golder Associates Inc
18300 NE Union Hill Road Suite 200
Redmond WA 98052-3333

Re: Long term groundwater monitoring frequency based on BIOSCREEN modeling of hypothetical contaminant travel times at the Landsburg Mine site in Ravensdale, Washington

Dear Dr. Morell:

The Department of Ecology (Ecology) thanks you and the Landsburg Mine PLP Group for the investment of time and resources into the BIOSCREEN modeling and recommended long term (greater than ten year and in perpetuity) groundwater monitoring period at the Landsburg Mine site.

Ecology has evaluated the BIOSCREEN report, along with the exchange of recommendations and comments received by the PLP Group and the city of Kent (Kent) through Aspect Consulting.

The long term monitoring scheme to be implemented at the subject site is provided in Table A below. It is based on evaluation of BIOSCREEN modeling simulations using the time between detection of contaminants at Method Detection Limits (MDL) at sentinel well locations and detection at one half of Cleanup Levels (0.5 CUL) at compliance well locations:

Table A. "In Perpetuity" Frequencies at all Site Wells

	Northwards	Southwards	Remarks
Wells	LMW-2, LMW-4, LMW-10, Deep North Sentinel Well (new), Shallow North Sentinel Well (new), LMW-6, LMW-7	LMW-3, LMW-5, LMW-8, LMW-9, LMW-11, South Shallow Sentinel Well (new), Dual South Sentinel/Cap Effectiveness Well (new)	Based on recommended frequencies in Golder Associates' BIOSCREEN modeling report and paired sentinel well – compliance well approach.
VOCs, TPH	2.5 years	5 years	
Metals, SVOCs, polychlorinated biphenyls, chlorinated pesticides	5 years	10 years	



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The frequencies in this table will be incorporated in the compliance monitoring plan and related sections of the Draft Cleanup Action Plan (DCAP) for this site. Compliance wells LMW-6 and LMW-7 will be monitored according to the frequencies established for the northern trench area wells.

Sentinel wells will be drilled in accordance with the number, location and depths in Golder's memo dated December 4, 2009. They will be installed after the CAP is finalized but before the remedial action (trench filling, low permeability capping) is implemented.

Attachment A provides Explanatory Notes on Ecology's decision for long term monitoring frequency based on the modeling and the network of sentinel wells.

The implementation of this long term groundwater monitoring plan, along with the response/travel times for corrective actions based on the BIOSCREEN modeling results (to be detailed in the DCAP), and repositioning of equipment or infrastructure at the south portal area for contingent groundwater treatment fulfills the proposed additional actions for the city of Kent offered by Ecology in its letter of October 7, 2008. Please note that according to the Model Toxics Control Act WAC 173-340-420, this monitoring plan is subject to the five year periodic review process. Upon each five year review of this site, the long term monitoring schedule can be modified or changed when evaluated under the review criteria of WAC 173-340-420(4).

The next steps for this site will be finalizing the Consent Decree and DCAP. Ecology will be in contact with you for this purpose.

Thank you,



Jerome B. Cruz, Ph.D., L.G., L.H.G.
Toxics Cleanup Program

jc/kp

Attachments

cc: William Kombol, Palmer Coking Coal Co.
Mike Mactutis, City of Kent Public Works
Robert F. Bakemeier, Bakemeier Law Firm (Bakemeier, P.C.)
Elliot Furst, Assistant Attorney General, Ecology Division
Robert Warren, WA State Department of Ecology
Ching-Pi Wang, WA State Department of Ecology
Ronald W. Timm, WA State Department of Ecology
Hun Seak Park, WA State Department of Ecology

Attachment A. Explanatory Notes on Ecology's decision for long term monitoring frequency based on the BIOSCREEN modeling

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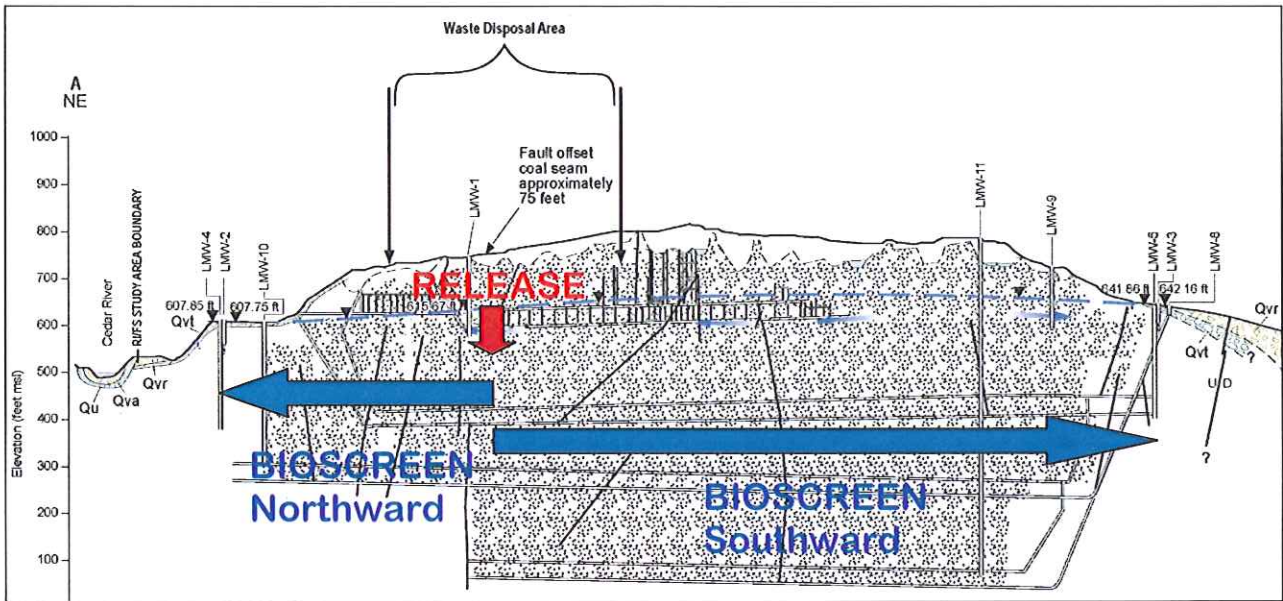
II. Summary of Recommended Monitoring Frequencies

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I. Reference Schematic of Modeled Pathways



II. Summary of Recommended Monitoring Frequencies

Northward Flow

	PLP [†] recommended	PLP* calculated	Kent recommended	ECY ^{††} decision	ECY Rationale
VOCs, TPH	2.5 years	0.4 year	0.25 year	POC wells and Sentinel wells: 2.5 years	PLP recommended frequency; Will require additional sentinel wells at north portal location
Metals, every- thing else	5 years	2.3 years	2 years **	POC wells and Sentinel wells: 5 years	Safety factor of 2; Will require additional sentinel wells at north portal location

† Refers to recommendations based on analysis of travel time from MDL at sentinel well to 0.5 CUL at compliance well.

* Refers to no sentinel well, “medium conservative” case using vinyl chloride (VOCs, TPH) and arsenic (metals, everything else) and their breakthrough times from MDL to 0.5 CUL (VOCs, TPH)

** Recommendation based on single well model (no sentinel wells) with most conservative results and increasing further the frequency.

†† Monitoring using sentinel well (300 feet south of compliance wells) and compliance wells LMW-2, LMW-4, LMW-10

Southward Flow

	PLP [†] recommended	PLP* calculated	Kent recommended	ECY ^{††} decision	ECY Rationale
VOCs, TPH	5 years	1.1 year	0.25 year **	POC wells: and Sentinel wells: 5 years	Based on BIOSCREEN medium conservative Δt (MDL to 0.5CUL) at single compliance well without sentinel wells; Metals measurements within Five year periodic review; Concerns by City of Kent
Metals, every- thing else	10 years	9 years	5 years **	POC wells: and Sentinel wells: 10 years	

† Refers to recommendations based on analysis of travel time from MDL at sentinel well to 0.5 CUL at compliance well.

* Refers to no sentinel well, “medium conservative” case using vinyl chloride (VOCs, TPH) and arsenic (metals, everything else) and their breakthrough times from MDL to 0.5 CUL (VOCs, TPH)

** Recommendation based on single well model (no sentinel wells) with most conservative results and further reduction of frequency.

†† Monitoring only at compliance wells LMW-3, LMW-5, LMW-8.

III. Assessment of Compliance Well -Only vs. Paired Sentinel Well - Compliance Well Approaches Toward Deriving Long Term Monitoring Frequency Based on BIOSCREEN Modeling.

Disadvantages of using compliance wells only (no sentinel wells) for determining monitoring frequencies using BIOSCREEN, especially if compliance monitoring and triggers are strictly implemented:

- Provides sampling intervals with unreasonable frequencies (unheard of in sites with no groundwater impacts)
- Strong possibility of being economically unsustainable
- Not logical given that past and current monitoring frequencies are less frequent than proposed frequencies, no reason for drastically increased frequency based on site history. Capping and runoff modification will cause hydraulic changes which put the south portal at less risk.
- Provides fewer safeguards due to lack of monitoring of sentinel wells which are much closer to source.
- Less lead time to respond with a corrective action at point of compliance. Kent has said that if contamination is detected at compliance wells, “it’s all over”. Not having sentinel wells to monitor will foster this situation.

Disadvantages of using paired monitoring of compliance wells and sentinel wells:

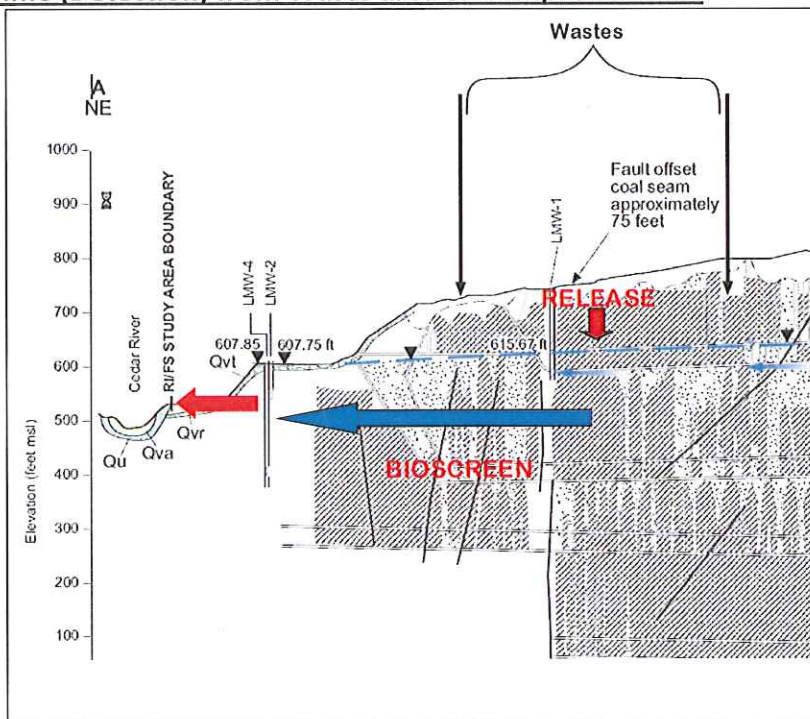
- Provides a longer monitoring frequency because of added time stemming from horizontal travel time between wells; nontechnical negative perception compared to more frequent monitoring
- Extra wells to install and monitor; added cost
- Critics of the cleanup discount the location of sentinel wells to intercept a plume. However, based on site data, the proposed sentinel wells are situated appropriately. Additionally, input from Kent on proposed sentinel wells was incorporated to ensure basic concurrence on appropriate location of the sentinel wells.

Salient Points on Two Approaches:

- Both are equally protective and should detect an outbreak of groundwater contamination if it occurs.
- The paired sentinel well-compliance well monitoring approach does not require overly frequent and uneconomic monitoring schedules.
- The paired sentinel well-compliance well monitoring approach affords more time to respond with contingency plans or corrective actions to protect receptors.

IV. Hypothetical Outcomes of Approaches Used To Derive Monitoring Frequencies Approaches

CASE 1. Travel Time (Detection) from Waste area to Compliance Well:



Using a hypothetical number for travel time of 36 months (therefore a monitoring frequency of 36 months) from waste area to Method Detection Limit at Well:

MONTHS WHEN SAMPLES ARE TAKEN



If contamination breaks out from waste area a month later (month 2) after the first sampling round on month 1:

MONTHS WHEN SAMPLES ARE TAKEN



RESULT: No detection during 2nd round (month 36) and the plume will have traveled past well an additional 35 months before detection (past MDL) only on the 3rd round. Not an acceptable approach for long term groundwater monitoring.

CASE 2. Using BIOSCREEN and Compliance Wells Only Approach (No Sentinel Wells)

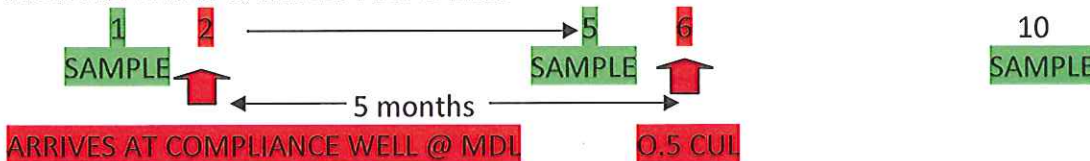
Example: Using results for Methylene Chloride monitoring frequency of 5 months based on breakthrough from MDL to 0.5 CUL at compliance well only. Travel time from waste area to well of 3 years 3 months.

MONTHS WHEN SAMPLES ARE TAKEN



If contamination arrives a month later (month 2) after the first sampling round on month 1:

MONTHS WHEN SAMPLES ARE TAKEN

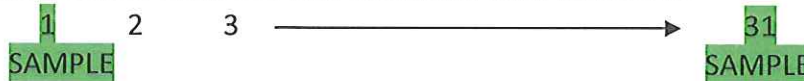


RESULT: At 2nd round of sampling, well will not reach action level (0.5 CUL) required to trigger action although contamination will have been detected. Concentration will be >MDL but <0.5 CUL. It will be a 4 year old plume when the 3rd round of samples is taken. There is time for warning; however, since it occurs at compliance well, the time for corrective action will likely be short. Engenders the perception that upon detection, contamination will have progressed too far.

CASE 3. Using BIOSCREEN and Sentinel Well – Compliance Well Approach. Utilizes the time difference from detection at MDL at a Sentinel Well and 0.5 Cleanup Level at the Compliance Well(s)

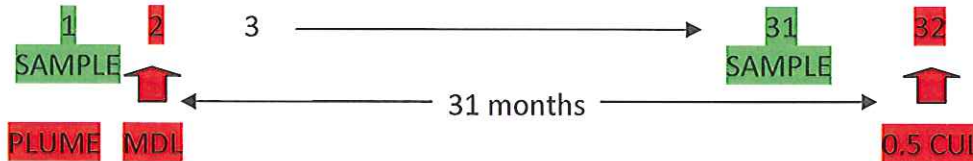
Example: Using a sentinel well with a 31 month (2 years, 7 months) monitoring frequency. Travel time from waste area to well of 3 years 3 months:

MONTHS WHEN SAMPLES ARE TAKEN AT SENTINEL WELL



If contamination arrives a month later (month 2) after the first sampling round on month 1:

MONTHS WHEN SAMPLES ARE TAKEN AT SENTINEL WELL



RESULT: At 2nd round of sampling, concentration at sentinel well will be >>0.5CUL (many orders of magnitude greater). The compliance well will be < MDL or nondetect. It will be a 5 year 9 month (5.72 years) old plume by the time the 2nd round of samples is taken. However, the plume will not have reached the compliance well locations. Substantial pre-warning will have occurred with sufficient time to mobilize a corrective action.

V. Sentinel Well Locations

Regarding Aspect Consulting’s suggested six alternative sentinel well locations (forwarded in an email dated 11/12/2009 by Kelly Peterson, Kent Public Works Department), Ecology will implement a good portion of the suggested wells locations and screen depths. There appears to be agreement between Ecology, Kent and the PLP Group that having sentinel wells is an appropriate approach for this site and that the wells are situated in the appropriate map locations for the most part.

Ecology would like to address the letter from Aspect Consulting of December 11, 2009 with the following observations:

1. The “Southern Shallow Sentinel Well and Cap Performance Monitoring Well 1” is located within the trench waste area and is more of a characterization well and not a sentinel well. It is also close to LMW-1 and due to the hydraulic connection within the mine workings, LMW-1 could provide a similar performance function as this proposed well. The RI/FS adopted the approach that the wastes are still in the northern trench zone and the outputs of the system will be monitored should a potential outbreak of groundwater contamination occur from this zone. Therefore, wells drilled within the waste area, aside from providing little decision-making value to the final preferred

cleanup alternative, can conceivably fail to function as a sentinel well if it exhibits groundwater contamination that may be within or beneath the waste disposal area.

2. The location of Aspect's "Southern Shallow Sentinel Well 2" agrees with Golder's proposed well.
3. Southern Shallow Sentinel Well 3 is not likely to be in a better position to detect groundwater contamination from the waste area and measure water tables in the trench compared to Golder's "South Shallow Sentinel Well" located at or near LMW-11. Golder's proposed well is not too far from Aspect's location at LMW-9 and should provide similar results, with the advantage that it is located closer to the waste area (better warning) and addresses a data gap (shallow water table elevation in this part of the site).
4. Aspect recommended locating two northern sentinel wells (Northern Shallow and Deep Sentinel and Cap Performance Monitoring Wells" at the northern edge of the waste disposal area, while Golder has proposed to site the wells approximately 300 feet further north, at the north portal area. Golder justified this location rather than Aspect's location due to high relief and poor accessibility. While Ecology agrees with Aspect that the location closer to the waste area should still be accessible, Ecology finds Golder's location to be equally protective due to the high hydraulic connectivity in the mine workings (e.g. see Baker tank discharge study in 1996 RI/FS) and similar due to the close proximity of both recommended locations. Furthermore, despite the 300 feet spacing between recommended locations, Aspect's location (for similar reasons stated above), may be a waste area well and would not serve as well as a sentinel well to its location.
5. Ecology does not agree with installing a north portal well within the gravel trench downgradient of the north portal because it will not be representative of water that comes from the mine. Glacial till deposits could contribute meteoric and/or perched water that will mix with groundwater at this location. Golder's "Shallow North Sentinel Well" is located at the north portal and will serve the same purpose while at the same time be screened in the mine/portal area rather than in glacial drift.