STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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July 23, 2019

Shane DeGross
BNSF Railway Company
605 Puyallup Avenue
Tacoma, WA 98421

Re: Ecology comments on draft submittal titled: LNAPL Transmissivity, Bioventing Respirometry, and NSZD Testing Work Plan

- **Site Name:** BNSF Track Switching Facility aka Wishram Railyard
- **Site Address:** 500 Main St., Wishram, Klickitat County
- **FSID No.:** 1625461
- **CSID No.:** 230
- **Agreed Order:** DE 12897

Dear Shane DeGross:

Thank you for the submittal of the above-referenced draft work plan in accordance with Agreed Order DE 12897. Below are the Department of Ecology's (Ecology) comments on the draft work plan. I have issued a conditional approval by email contingent upon your review of Ecology's comments and subsequent discussion. The approval will be final upon your response to the satisfaction of Ecology, which may include incorporation of changes to elements of the plan.

General Comments

Comment 1. Ecology views the proposed tests favorably in that the results will help inform the remedial alternatives for the Feasibility Study. However, we do not view the remedial options that these tests may support as a presumptive remedy. Specifically, we consider Natural Source Zone Depletion (NSZD) in its role as a polishing component that may potentially be implemented at the end of an active remedial effort or possibly in conjunction with more active remedial components since the Columbia River/Lake Celilo is a surface water receptor.

Comment 2. How long the source(s) will last is a key question. Ecology eventually expects the NSZD rates will be coupled with estimates of NAPL source mass so that a restoration timeframe as one of the criteria under WAC 173-340-360 (Selection of cleanup actions) can be calculated. An alternate method may be to look at average TPH concentration divided by the NSZD rate. It may also be necessary to evaluate the microbial kinetics of substrate contaminant utilization to assist in the prediction of the time required to bioremediate the site. It may be necessary to incorporate thermal or other enhancements to reduce the restoration period.

Garg, et. al, 2017 (GWMR 37, No. 3, pp. 62-81) attempted to answer a number of relevant questions that may improve understanding of NSZD. The answers they obtained may assist for optimization of NSZD as a proposed remedy component.

Comment 3. The RI investigation had had a number of LIF co-located soil sample collections but core sampling for determination of TPH saturation was limited to three cores. Determination of pore fluid saturations across the smear zone and through the soil column in the groundwater zone of submerged NAPL is an important parameter to assess.

Specific Comments

Comment 4. **Section 2.1, LNAPL Transmissivity Testing:**
You mention results of laboratory testing of LNAPL physical properties and simulations of in situ LNAPL behavior. What are the simulations and are these simulations in the RI report?

Comment 5. **Same Section:**
Provide disposal documentation in the subsequent standalone report or in the Feasibility Study.

Comment 6. **Same Section and Associated Field Form:**
Provide more detail on the frequency of measurements. Our expectation is that the measurements will be collected at sufficient intervals to plot the data in the API LNAPL Transmissivity Workbook. Section 6.2.35 of ASTM E2856-13 describes a best practice for the frequency of measurement of the interfaces.

The field form provided at the end of ASTM E2856 is a more complete data collection form for each well location than the simplified field form in the draft Work Plan. Our expectation is that sufficient data will be collected to enter the data into the API LNAPL Transmissivity Workbook and that data will be presented to Ecology as part of a deliverable, either as a standalone document or as an appendix to the Feasibility Study.

Comment 7. **Section 2.2, Respirometry Testing – Existing Bioventing System:**
You state that periodic monitoring of injection flow rates and induced pressures was performed at wells, WMW-3, -7, -8, and -12 in 2018 and 2019. However, I have been unable to find any reference to this remedial action in the RI Work Plan or its Addendum and to my knowledge, this data has not yet been submitted to Ecology. If not, please submit this data.

The draft plan states that the estimated radius of influence (ROI) of the existing system is approximately 90 feet, based on wellhead pressure measurements. This distance sounds relatively high. Is this ROI determined for soil vapor extraction or for bioventing?

Per the USACE manual, the ROI should differ depending on whether the system is SVE or BV. For bioventing, the oxygen ROI is a function of both air flowrates and oxygen utilization rates so it depends on site geology, well design, and microbial activity.

Each well labeled as soil vapor extraction is screened entirely within the vadose zone with a screen interval between 3 to 4 feet in length. Each well labeled air sparge is screened entirely in the saturated zone and has a screen interval of about 2.5 feet. In contrast, wells, WMW-3, -7, -8, and -12 are screened into the saturated zone as shown in Table 1. These latter wells were not designed initially for respirometry testing. What is the effect of having a screened interval that extends from vadose zone into the saturated zone? What is the effect of having the majority of the screened interval extending into the saturated zone?

In addition, according to Leeson and Hinchee (1996), Vol. 2, Section 2.6, states that proper construction is essential for monitoring localized pressure and soil gas concentrations. They state: "*To the extent possible, the monitoring points must be located in contaminated soils with greater than 1,000 mg/Kg of total petroleum hydrocarbon. If monitoring points are not located in contaminated soil, meaningful in situ respiration data cannot be collected.*" Can you verify that these well placements exist in areas where TPH is present at those concentrations?

Comment 8. **Section 2.2.1, Baseline Soil Gas Measurements:**
Will this step assess the vadose zone gas composition that is necessary to determine before application of the carbon traps?

Page 53 of Sweeney and Ririe, 2017 shows a well cap with valves. I assume you will install this type of cap with discrete sampling ports. Please confirm this detail. The USACE engineering manual, EM-1101-1-4001, shows an alternate wellhead completion design (Figure 5-19, pa 169).

With the existing bioventing system, did you obtain baseline soil gas measurements as well as measurements collected periodically to ensure that the system is delivering enough oxygen to meet the demand produced by biodegradation? If so, provide this data. If available, have you tracked the relative volatility shift in the petroleum hydrocarbon fingerprint of the soil vapors?

I did not see any monitoring points near the existing system that would allow periodic monitoring of the soil gas. According to the USACE Engineering Manual, Soil Vapor Extraction and Bioventing (EM-1110-1-4001, 2002), a "*sufficient number of monitoring points must be properly place to determine if vadose zone oxygen levels are being maintained.*"

With the existing system, have you assessed rebound after system shutoff and/or have you assessed whether the oxygen uptake rates have declined over time? Rebound may indicate presence of diffusion-limited soils. Have you assessed the target soil concentration by any other method?

Comment 9. **Same Section:**
What is the sensitivity of the RKI Eagle 2 multi-gas meter in parts per million for assessing the concentrations of oxygen, carbon dioxide, hydrogen sulfide, and methane?

Will you follow a company standard operating procedure (SOP) for calibration of the multi-meter and the PID? Please include the SOP or equivalent documentation regarding instrument calibration.

Comment 10. **Section 2.2.2, Respirometry Test:**
You mention the performance of an ISR test to estimate the biodegradation rate. Concerning the assimilative capacity of the substrate (Arcadis, Remediation Engineering: Design Concepts, 2017) are there other mass transfer limitations that may need to be assessed?

Have you assessed any of the factors, e.g. moisture content, pH, alkalinity that may affect observed in situ biodegradation rates (Section 1.4.3 of Leeson and Hinchee, 1996)?

Comment 11. **Section 2.3, Bioventing Test:**
Comment #7 on proper well construction applies here for the proposed purpose of WMW-1. I was unable to find the soil analytical results for WMW-1, -3, or -11. Is the soil analytical data available?

The plan refers to Figure 1 in lieu of the soil analytical data. This figure shows a footprint of dissolved-phase contamination generalized by exceedance of MTCA Method A groundwater cleanup concentrations but the footprint is not depicted with isoconcentration lines.

Comment 12. **Section 2.4.1, Soil Gas Measurements:**
You mention seven wells for respirometry tests. However, Section 2.2 lists eight wells. Please correct if this is a typo.

The annulus space of SVE/Bioventing wells should be tightly sealed. How can you ensure that the groundwater monitoring wells to be used have a sufficient seal to prevent short-circuiting?

Other requirements for soil gas monitoring points and bioventing wells are listed in the USACE Engineering Manual, EM-1110-1-4001. Does the construction of the groundwater wells meet these criteria?

How do you know that 4 days is sufficient time for the soil gas to reach equilibrium after system shutdown? Is this an arbitrary number or is it based on empirical data?

Comment 13. Section 2.4.2, Carbon Traps:
The proposed CO_2 passive traps have a two-week sampling period. Will this period only provide a snapshot of the intrinsic biodegradation rate? Temperature is a significant factor in biodegradation. Therefore, the timing of this test will capture the highest biodegradation rates when the ambient temperatures are near their highest. Are there plans for more than one two-week sampling event?

Do you intend to use other methods in lieu of having multiple two-week events to obtain a better annual representation of intrinsic biodegradation? For instance, long-term thermal monitoring using an existing well may provide information applicable throughout the year. In addition, the thermal monitoring can be coupled with source mass estimates for evaluation of the longevity of impact if NSZD is proposed as a remedy component.

At a minimum, will groundwater temperature be measured in the nearest wells when performing the flux measurements?

Comment 14. Same Section:
Changes in atmospheric pressure such as high winds may influence the CO_2 flux. Does evaluation of NSZD require collection of any meteorological data?

Comment 15. Same Section:
You did not include a duplicate sample at any of the NSZD locations. I recommend collection of a duplicate sample at one of the sample locations for assessment of variability in the data.

You can reach me at (509) 454-7836 if you have any questions regarding Ecology's comments.

Sincerely,

John Mefford

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Cleanup Project Manager
CRO Toxics Cleanup Program

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