**REDACTED**

**From:** THOMAS Wesley * DEQ <wesley.thomas@deq.oregon.gov>
**Sent:** Friday, July 14, 2023 12:18 PM
**To:** Taku Fuji <tfuji@anchorqea.com>; jenn.l.peterson <jenn.l.peterson@deq.oregon.gov>
**Cc:** Halah Voges <hvoges@anchorqea.com>; Rob Ede <robe@hahnenv.com>; Jen Mott <jmott@anchorqea.com>; LARSEN Henning * DEQ <Henning.LARSEN@deq.oregon.gov>
**Subject:** RE: Details of Ecological Soil RBC/PRG Information Requested

Taku,

As I mentioned in my email from July 3rd, DEQ has prepared some preliminary comments on the Gasco OU Ecological Soil COC and PRG tables that were transmitted to DEQ on May 22nd. Discussions regarding ecological PRGs are ongoing, and we anticipate additional discussions to resolve questions related to certain ecological soil PRGs. NW Natural has not yet provided tables proposing ecological groundwater PRGs. Therefore, the comments provided below should be considered preliminary.

1. Specific Comment #75a on the Draft RI/HERA Addendum stated DEQ's intent to assign PRGs to any analyte identified as a COC, including those with the potential for cross-media impacts. DEQ notes that NW Natural's response to Specific Comment #75a noted that DEQ and NW Natural will have further technical discussions regarding cross-media COCs during assignment of PRGs. To-date, NW Natural has not proposed further discussion of this topic. Organic COCs that pose ecological unacceptable risk in Fill WBZ groundwater should have a corresponding ecological soil PRG, and vice versa. DEQ requires ecological soil PRGs be developed for the following Gasco OU COCs with the potential cross-media impacts: benzene, toluene, dioxins/furans, carbazole, dibenzofuran, 2-methylphenol, 3-methylphenol, phenol, benzoic acid, acetone, carbon disulfide, and styrene. These PRGs should be taken from Table 1a of the 2020 Conducting Ecological Risk Assessments Internal Management Directive (IMD).
2. DEQ acknowledges that the PRG Memorandum did not require development of an ecological soil PRG for cyanide and sulfide. However, the PRG memorandum recognized that MGP residuals represent a long-term source of cyanide and sulfide leaching to groundwater. NW Natural is responsible for demonstrating how cyanide and sulfide leaching to groundwater from MGP residuals is addressed in the Gasco OU FS.
3. Additional COCs may be identified after completing the ongoing FS data gaps investigation. DEQ requires PRGs be developed for these COCs. These PRGs should be taken from Table 1a of the 2020 Conducting Ecological Risk Assessments Internal Management Directive (IMD).

4. Footnote "*": The footnote states "RBC below background levels and the PRG is based on background". Background upper threshold concentrations (UTLs) are not to exceed values to be used with individual point-by-point observations for background determinations. UTLs are not intended to be PRGs/cleanup values. Please update NWN Ecological PRG Table 2 to include the list of RBCs in the PRG list (blue columns), with another column to indicate a proposed background value and the statistic it represents.
5. Revise the ecological soil PRG table to include the applicable hot spot threshold value for each COC.
6. Please add appropriate footnotes that aluminum and iron ecological soil PRGs are pH dependent. During our June 13th meeting, Anchor QEA indicated that NW Natural is currently collecting soil pH data and will follow up regarding the application of pH-dependent PRGs.

Thanks,

Wes

**Wesley Thomas, P.E.**
Project Manager/Environmental Engineer
O: 503-229-6932
M: 971-263-8822
Wesley.Thomas@deq.oregon.gov

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**From:** Taku Fuji <tfuji@anchorqea.com>
**Sent:** Monday, July 10, 2023 3:24 PM
**To:** PETERSON Jenn L * DEQ <jenn.l.peterson@deq.oregon.gov>
**Cc:** Halah Voges <hvoges@anchorqea.com>; Rob Ede <robe@hahnenv.com>; Jen Mott <jmott@anchorqea.com>; THOMAS Wesley * DEQ <wesley.thomas@deq.oregon.gov>; LARSEN Henning * DEQ <Henning.LARSEN@deq.oregon.gov>
**Subject:** RE: Details of Ecological Soil RBC/PRG Information Requested

Jennifer, thanks for the requested information. We'll review the information on the derivation of the avian individual PAH RBCs and the HPAH and LPAH RBCs. I understand that there may be some comments on the ecological soil COC and PRG tables that were submitted to DEQ on May 22nd. If so, we look forward to reviewing these and we can schedule a meeting once we've had a chance to evaluate.

Take good care!

**Taku Fuji, Ph.D.|** he/him

**ANCHOR QEA, LLC**
tfuji@anchorqea.com


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**From:** PETERSON Jenn L * DEQ <jenn.l.peterson@deq.oregon.gov>
**Sent:** Monday, July 10, 2023 3:04 PM
**To:** Taku Fuji <tfuji@anchorqea.com>; THOMAS Wesley * DEQ <wesley.thomas@deq.oregon.gov>
**Cc:** Halah Voges <hvoges@anchorqea.com>; Rob Ede <robe@hahnenv.com>; Jen Mott <jmott@anchorqea.com>; LARSEN Henning * DEQ <Henning.LARSEN@deq.oregon.gov>
**Subject:** RE: Details of Ecological Soil RBC/PRG Information Requested

Hi Taku,

All the exposure and toxicity information from Los Alamos National Laboratory (LANL) can be found in their database, and associated reference materials (including the TRV Development Methods Document). The Los Alamos National

Laboratory ECORISK Database (Release 4.3) is the current version available. You may download the update from the Intellus New Mexico website with the instructions below.

https://www.intellusnm.com/

To download the database and user guides, go to the Documents section in the Intellus header bar, navigate to LANL Files >> Ecorisk Database, and download both .zip files in that directory.

Jennifer

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**From:** Taku Fuji <tfuji@anchorqea.com>
**Sent:** Monday, July 3, 2023 2:22 PM
**To:** THOMAS Wesley * DEQ <Wesley.Thomas@deq.state.or.us>
**Cc:** Halah Voges <hvoges@anchorqea.com>; Rob Ede <robe@hahnenv.com>; Jen Mott <jmott@anchorqea.com>; PETERSON Jenn L * DEQ <jenn.l.peterson@deq.oregon.gov>; LARSEN Henning * DEQ <Henning.LARSEN@deq.oregon.gov>
**Subject:** RE: Details of Ecological Soil RBC/PRG Information Requested

Wes,

Thank you for the detailed information that was requested during the June 13th meeting, we will review. We look forward to reviewing the comments on the Ecological Surface Soil COC/PRG Tables provided on May 22nd. Would it be possible to get the TRVs and exposure assumptions used to derive the non-T&E bird RBCs assumptions for benzo(a)anthracene, pyrene, and naphthalene? We are only requesting this information for the bird RBCs and do not need for the mammal RBCs.

We'll work to schedule a meeting after we've had a chance to evaluate this information.

Take care.

**Taku Fuji, Ph.D.|** he/him

**ANCHOR QEA, LLC**
tfuji@anchorqea.com


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**From:** THOMAS Wesley * DEQ <Wesley.Thomas@deq.state.or.us>
**Sent:** Monday, July 3, 2023 12:32 PM
**To:** Taku Fuji <tfuji@anchorqea.com>
**Cc:** Halah Voges <hvoges@anchorqea.com>; Rob Ede <robe@hahnenv.com>; Jen Mott <jmott@anchorqea.com>; jenn.l.peterson <jenn.l.peterson@deq.oregon.gov>; LARSEN Henning * DEQ <Henning.LARSEN@deq.oregon.gov>
**Subject:** RE: Details of Ecological Soil RBC/PRG Information Requested

Taku,

Thank you for the follow-up email. We have been working over the past couple of weeks to compile the information that you requested during our meeting on June 13th meeting. I've provided the requested information below. DEQ also has a

few comments on the tables that were provided on May 22nd, which we will provide in a separate email. Once you have had the opportunity to review the information below, we can work towards scheduling a meeting to discuss.

1. In addition to providing the parameters for the exposure and toxicity assumptions used for the avian LPAH and HPAH RBCs, it is important to recognize the importance of evaluating toxicity according to chemical class. Both EPA and DEQ have identified chemical groups representative of the toxicity of compounds that have similar chemical and toxicological properties and act with the same mode of action. This is outlined in DEQ "Evaluating Acceptable Risk and Potential Hot Spots for Chemical Classes" memo (https://www.oregon.gov/deq/filterdocs/Cleanup-Chemicalclasses.pdf). Los Alamos (LANL) does not use chemical groups for ecological risk assessment in accordance with its screening-level ecological risk assessment (SLERA) methods and did not adopt chemical group TRVs derived by EPA to remain consistent with these methods (LANL, 2014. *Toxicity Reference Value Development Methods for the Los Alamos National Laboratory*, Revision 1, LA-UR-20694).

   RBCs for chemical classes are more appropriate PRGs compared to individual chemicals within these classes. Risk based concentrations representing chemical classes are presented in DEQs Chemical Class Memo Table 1a. There are different approaches applicable to the calculation of risks from exposure to a chemical class. LPAH and HPAH fall under (1) on page 2 of the memo: "For a chemical class with constituents that are assumed to act with the same level of toxicity, sum concentrations of constituents to calculate a single concentration for comparison with risk-based concentrations." The calculation of risks from chemical classes is presented in (1) on Page 3: "For a chemical class with constituents that are assumed to act with the same level of toxicity, sum concentrations of constituents to calculate a single concentration for comparison with risk-based concentrations".

   **Derivation of Risk Based Concentrations:** DEQ used a hierarchy of information to calculate RBCs. DEQ ranks EPA-derived information for exposure, uptake and toxicity reference value data higher than information derived by LANL. DEQ used this hierarchy to calculate risk-based concentrations (RBCs) for soil.

   a. **DEQ Toxicity Reference Value Selection:** The EPA generates nationally accepted TRVs through Eco-SSL methodology and these toxicity values are considered to have a high confidence rating compared with other sources. Therefore, DEQ used EPA TRVs as the first source where available, and LANL TRVs as a secondary source.
      There are some important differences in the objectives and technical evaluation process in TRVs between EPA and LANL. Therefore, additional studies were available for mortality endpoints for birds for TRV development for LPAHs that were not identified by EPA. See EPA 2003, Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs), Attachment 4-4 *Standard Operating Procedure #5" Wildlife TRV Data Evaluation* and *Toxicity Reference Value Development Methods for the Los Alamos National Laboratory*, Revision 1, LA-UR-20694).
      i. **Deriving Chronic Effect Levels:** EPA excludes acute/subacute and sub chronic data in the development of TRVs. EPA does this to focus on establishing a dose protective of most species from adverse effects associated with long-term exposures (>90 days) and sublethal reproductive and growth endpoints (non-mortality). Los Alamos considers studies of shorter test duration including sub chronic (14-90 days) and acute (<14 days), and studies that report mortality as a test endpoint (See LANL 2014, Appendix B). LANL uses uncertainty factors to derive chronic effect levels consistent with EPA's definition (LANL 2014, Table A-13).
      ii. **Endpoints:** EPA only utilizes studies where reproduction / development and growth endpoints are available (mortality only not considered). Los Alamos includes reproduction / growth, and survival endpoints for toxicological information in the development of the TRV (LANL, 2015). DEQ used EPA endpoints where available, but also considered survival endpoints with appropriate uncertainty factors following LANL process.
      iii. **LOAEL Selection:**

1. If an EPA TRV was available for the NOAEL, DEQ selected the LOAEL from the same study from which the NOAEL was identified.
2. LANL calculates has a process for calculating their own LOAELs depending in the data availability. Section A-4.1.5 and Figure A-1 in *Toxicity Reference Value Development Methods* for the Los Alamos National Laboratory provides a step-by-step process for determined how to drive a LOAEL based effect level. Generally, where a NOAEL was not available, a factor of 0.1 applied to the LOAEL to estimate a NOAEL. Where a LOAEL was not available, a factor of 5 was applied to a NOAEL to estimate a LOAEL.

b. **LOAEL-based TRV Derivation for Total LPAHs and Total HPAHs:**
   i. LPAHs:
      1. Mammalian: 328 mg/kg/day based on 1-naphthalenacetic acid, EPA Eco SSL Table 6.1, Verschuuren et al., 1976. This is the same study selected by EPA for the NOAEL of 65.6 mg/kg/day.
      2. Avian: 150 mg/kg/day based on naphthalene, bobwhite quail, LANL 2015, Landis Assoc., Inc., 1985
   ii. HPAHs:
      1. Mammalian: 3.01 mg/kg/day based on benzo(a)pyrene, EPA Eco SSL Table 6.2, Culp et al., 1998. This is the same study selected by EPA for the NOAEL of 0.615 mg/kg/day.
      2. Avian: 1.07 mg/kg/day, benzo(a)anthracene, bobwhite quail, LANL 2015, Beat, B.N. 2007. A pyrene TRV was also available from LANL. The benzo(a)anthracene TRV was selected to represent HPAHs because it was considered higher quality study based on the endpoints tested sub chronic NOEL (benzo(a)anthracene) as compared to an acute NOEL (pyrene), and following EPA guidance on the selection of a representative.

c. **Exposure Information**: EPA exposure and uptake information was used as the primary source for ground feeding birds and mammals (Attachment 4-1, Guidance for Development Ecological Soil Screening Levels (Eco-SSLs), *Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs*). EPA exposure factors were used to calculate the total LPAH and total HPAH RBCs for birds and mammals.
   i. Food Ingestion Rates (FIR): 0.209 g dw/g bw/day mammalian, 0.214 g dw/g bw/day avian (Table 1 in Attachment 4-1).
   ii. Proportion of Diet that is Soil ($P_s$): 3% mammalian, 16.4% avian (Table 3 in Attachment 4-1).
   iii. Uptake, Soil to Earthworms ($C_{biota}$): Uptake Equations for Non-Ionic Organics, Table 4b in Attachment 4-1.
      1. Total LMW PAHs, Soil to Earthworms: $C_{earthworm}=3.04*C_{soil}$ (range for all PAHs 1.47 to 22.9)
      2. Total HMW PAHs: $C_{earthworm}=2.6*C_{soil}$ (range for all PAHs 1.33 to 2.94)

d. **Wildlife RBC Calculation:** The RBCs are calculated by solving the general equation below for the concentration in soil (Cs) that represents acceptable risk (HQ = 1.0). HQs that exceed 1.0 suggest that adverse effects are possible. This calculation requires chemical- and receptor-specific values for the TRV, and knowledge about the relationship between soil (Cs) and uptake into biota (Cbiota). More information can be found in Section 2.0 of DEQ's 2020 *Conducting Ecological Risk Assessments*. Exposure is estimated from calculated chemical intake of incidental soil ingestion and ingestion of biota as food:

   Exposure Estimate= $[(C_s \times P_s \times FIR) + (C_{biota} \times FIR)]$

   Therefore:

   HQ= $[(C_s \times P_s \times FIR) + (C_{biota} \times P_b \times FIR)]/TRV$

Where:
$C_s$ = concentration of contaminant in soil (mg/Kg [dry weight])
$P_s$ = Soil ingestion as proportion of diet (unitless)
$P_b$ = Biota ingestion as proportion of diet (unitless)
FIR = food ingestion rate (kg food [dry weight]/kg body weight [wet weight]/day)
$C_{biota}$ = Concentration of contaminant in biota (mg/Kg [dry weight])
TRV = toxicity reference value

2. **Derivation of TPH RBCs for Terrestrial Biota.** Table 1a of DEQ's ecological risk guidance includes terrestrial plant and invertebrate soil SLVs for gasoline and diesel products developed by the Washington Department of Ecology (WA DOE, Ecology). However, the compositions of these products do not resemble the MGP petroleum products and wastes released at the Gasco site. As part of their evaluation of petroleum toxicity to terrestrial plants and soil invertebrates, Washington DOE compared the results of their evaluation to those derived from a Canadian Study published in 2008. The results of the two studies yielded similar results for equivalent TPH fractions (i.e., F1 and F2 as defined below). However, an advantage of the Canadian Study is that it provided SLVs for the F3 fraction which is significant component of the petroleum contamination on the Gasco site. Based on a review of the two studies, it was concluded that the fraction-specific Canadian SLVs listed below enabled derivation of SLVs that more accurately reflected the composition and toxicity of contamination found in the various process and waste management areas of the Gasco site. The values represent TPH toxicity to terrestrial invertebrates (e.g., worms, insect larvae, etc.) TPH toxicity to plants (e.g., lettuce) was more variable and confidence in threshold values produced by the Washington and Canadian studies is lower. However, the invertebrate SLVs are considered protective of plants and other terrestrial organisms and are recommended for screening risks to terrestrial biota, in general. The following values from the Canadian Study were used to derive TPH-SLVs for each process and waste management area based on the Q25 of LC25 of terrestrial invertebrate toxicity:
   - F1 = C6-C10 aliphatic and aromatic hydrocarbons = 75 mg/Kg
   - F2 = C10-C16 aliphatic and aromatic hydrocarbons = 200 mg/Kg
   - F3 = C16-C34 aliphatic and aromatic hydrocarbons = 250 mg/kg

   The reference and link for the Canadian study is provided below:
   Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale Supporting Technical Document January 2008, Canadian Council of Ministers of the Environment.

   http://registry.mvlwb.ca/Documents/MV2010L1-0001/MV2010L1-0001%20-%20Canada%20Wide%20Standard%20for%20Petroleum%20HydroCarbons%20PHC%20in%20Soil%20-%20May12-10.pdf

Regards,

Wes

**Wesley Thomas, P.E.**
Project Manager/Environmental Engineer
O: 503-229-6932
M: 971-263-8822
Wesley.Thomas@deq.oregon.gov

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**From:** Taku Fuji <tfuji@anchorqea.com>
**Sent:** Monday, July 3, 2023 7:41 AM
**To:** THOMAS Wesley * DEQ <Wesley.Thomas@deq.state.or.us>
**Cc:** Halah Voges <hvoges@anchorqea.com>; Rob Ede <robe@hahnenv.com>; Jen Mott <jmott@anchorqea.com>
**Subject:** Details of Ecological Soil RBC/PRG Information Requested

Good morning Wes,

I wanted to follow-up on our June 13, 2023, Ecological Soil PRG Meeting and provide details of the information that was requested from Jennifer Petersen and Henning Larsen. I noted during the June 27, 2023, Human Health TPH RBC Meeting that there was some confusion on the information requested. Please see below for the details of the ecological soil RBC/PRG information:

1. Ecological Soil RBC/PRG Information Requested: Specific details on the parameters (values and sources) for the exposure and toxicity assumptions used in the calculations of the bird LPAH and HPAH RBCs. These include fraction of soil in diet, food intake rate, transfer factor, NOAEL and LOAEL TRVs. We would also like to request this information for the bird RBCs for benzo(a)anthracene, pyrene, and naphthalene.
2. Soil Biota TPH RBC: Current document(s) that show the Canadian Soil Standards for Petroleum Hydrocarbons and the current TPH percentile statistics for soil biota (e.g., earthworms).

Thanks, and please let me know if there are any questions related to this request.

**Taku Fuji, Ph.D. |** he/him
**ANCHOR QEA, LLC**
tfuji@anchorqea.com

6720 S. Macadam Ave, Suite 300
Portland, OR 97219
DD 503.972.5002
C 503.459.1088