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John A. Kitzhaber, MD, Governor

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May 8, 2014

Also Sent Via E-mail

Mr. Robert J. Wyatt
NW Natural
220 N.W. Second Avenue
Portland, OR 97209

Re: Draft Human Health and Ecological Risk Assessment Report
NW Natural "Gasco Site"
Portland, Oregon
ECSI Nos. 84

Dear Mr. Wyatt:

The Oregon Department of Environmental Quality (DEQ) reviewed the "Human Health and Ecological Risk Assessment Report – NW Natural Gasco Site" (Draft HERA Report) dated October 2013 (received October 24, 2013). The Draft HERA Report evaluates the potential risk to human health and ecological receptors associated with exposure to manufactured gas plant (MGP) contamination located in the uplands of the Gasco Site. Anchor QEA, LLC prepared the Draft HERA Report on behalf of NW Natural.

DEQ provided NW Natural with a preliminary review, including our position on the general status of the Draft HERA Report in a memorandum dated December 12, 2013. This letter provides DEQ's final review comments on the report. The primary purpose of this letter is to inform NW Natural that DEQ:

- Acknowledges the Draft HERA Report substantially moves the HERA forward to completion;
- Considers the Gasco Site HERA to be a framework for conducting the HERA of manufactured gas plant (MGP) contamination on the adjoining property owned by Siltronic Corporation; and
- Approves the HERA subject to NW Natural making the modifications identified in this letter and Attachment 1.

Additionally, certain conditions for DEQ approval require that NW Natural conduct sampling during the uplands feasibility study (FS) to address important site data needs identified by the Draft HERA Report.

For purposes of supporting the FS, DEQ previously informed NW Natural that besides determining that each complete exposure pathway at the Gasco Site represents unacceptable risk of exposure to human health and ecological receptors, the HERA should delineate areas of unacceptable risk by identifying the chemical of concern (COCs) present in environmental media. The HERA should also identify where on-site and at what concentrations COCs occur. This information taken together provides the basis for evaluating the site for hot spots of contamination, developing remedial action objectives for specific environmental media, and identifying remedial technologies applicable to contaminated media and areas of the site. DEQ considers this information essential to the FS given the long complex

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operational history of the former Gasco Facility; the magnitude and multiple sources of contamination present; the variety of contaminants exhibiting a wide range of physical, chemical, and fate and transport properties; and the significant occurrence of dense, non-aqueous phase liquid (DNAPL) beneath the site.

As indicated in Voluntary Agreement No. WMCVC-NWR-94-13 (and as amended), DEQ is providing approval of the Draft HERA Report subject to NW Natural addressing deficiencies by making the modifications identified in this letter and Attachment 1. When addressed in a revised HERA, the modifications will complete the HERA and allow the project to move forward into the feasibility study. Attachment 1 provides additional details and comments regarding the modifications identified in this letter needed to finalize the HERA Report (e.g., revising soil and groundwater iso-concentration maps). In addition, DEQ has attached comments in Attachment 2 that are intended to convey information, clarify our understandings, and/or communicate our position on items in the HERA. Attachment 2 also identifies comments that are relevant to the future Siltronic MGP remedial investigation (RI) and HERA. DEQ is not requesting that NW Natural respond to the Attachment 2 comments and/or revise the Draft HERA Report consistent with these comments.

HERA REPORT MODIFICATIONS REQUIRED FOR APPROVAL

TPH Data Use And Analysis

As previously communicated to NW Natural, DEQ considers total petroleum hydrocarbons (TPH) to be an important chemical of interest (COI) for the NW Natural Site (i.e., the Gasco Site and Siltronic Corporation property combined). The Draft HERA Report concludes that TPH does not significantly contribute to human health and/or ecological risk at the Gasco Site. DEQ disagrees and concludes from our review that the data and methods used and presented in the Draft HERA Report underestimate the concentrations of, and the risk associated with exposure to MGP TPH in soil and vapors. Furthermore, TPH data is lacking for groundwater. Consequently, DEQ concludes the HERA does not adequately evaluate the risk of exposure to human health and ecological receptors by TPH.

DEQ approves the Revised HERA Report for purposes of moving the project forward into the FS, subject to the condition that our approach to using composite data gaps soil sampling results for total PAHs and total MGP TPH and the proportions method will be utilized for all aspects of the HERA, including recalculating and summing hazard quotients (HQs) to develop a TPH hazard index (HI) for inclusion in the cumulative HI for non-carcinogenic COIs. The use of TPH concentrations estimated using this approach should be discussed in the uncertainty section of the Revised HERA Report. DEQ also requires NW Natural to sample for TPH to support the uplands FS scoping and planning process.

Regarding the lack of TPH data for groundwater, DEQ expected that NW Natural would be sampling TPH as it had been previously identified as an important COI for the HERA for all media at the Gasco and Siltronic sites. Consequently, DEQ understood TPH was already being analyzed for in groundwater. DEQ has come to understand that TPH is not currently being analyzed for in groundwater at either Gasco Site or Siltronic Site. DEQ acknowledges missing opportunities to add TPH to the list of groundwater sampling parameters during our reviews of the groundwater monitoring

programs. DEQ considers lack of TPH data for groundwater to be an important data need for the Gasco and Siltronic sites and will require it in future sampling events.

Based on this information and the status of the HERA, DEQ will not delay approval of the revised HERA to address this groundwater data need. DEQ will accept the Revised HERA Report for purposes of moving the project forward into the FS subject to NW Natural: 1) acknowledging in the uncertainty section that lacking TPH data the risk of exposure to human health and ecological receptors is underestimated for the groundwater pathways and for cumulative site risk overall; and 2) adding TPH to the groundwater monitoring program for both the Gasco Site and the Siltronic Site (i.e., the "integrated monitoring program").

DEQ requires that TPH be added to NW Natural's groundwater monitoring program beginning with the June 2014 sampling event. The data will be used to support the Siltronic HERA and the FSs for both properties. DEQ requests that NW Natural provide their within acceptance of this condition for groundwater prior to initiating the June 2014 monitoring event.

COI and Data Screening

The Draft HERA Report identifies site-related contaminants that are present in soil and groundwater at the Gasco Site at concentrations exceeding relevant screening criteria that were not on the original list of COI developed for the HERA. Table 2-1 from the Draft HERA Report lists the COI identified prior to preparation of the Draft HERA Report. Based on DEQ's review, the Draft HERA Report identifies many additional chemical of potential concern (COPCs), not included in the Table 2-1 list that contribute to risk and should be designated COPCs in the HERA.

Certain of these additional COPCs warrant analysis in the HERA as they are detected in high concentrations, contribute to risk, and have the potential to influence the outcome of the ecological risk assessment. The subset of additional COPCs identified for inclusion in the HERA are identified below with additional comments provided in Attachment1.

DEQ acknowledges that a set of COIs was identified prior to preparing the Draft HERA Report, however the Draft HERA Report includes calculations of hazard quotients (HQs) for most if not all analytes in the soil and groundwater datasets and identifies many COI representing additional risk (i.e., HQ > 1). The Draft HERA Report should have screened in these additional analytes as COPCs. However, only the HQs calculated for COIs in Table 2-1 of the report were carried forward in the analysis of risk. The additional COPCs identified during preparation of the draft report were not carried forward for analysis in the HERA.

DEQ approves the Revised HERA Report subject to the condition that NW Natural includes the information in the Revised HERA Report uncertainty section as indicated below and incorporate the following COPCs into the analysis of cumulative ecological risk as follows:

- Spent Oxide Area
  - Exposure to soil by birds and mammals should include sulfide and aluminum
  - Exposure to soil by plants and soil invertebrates should include aluminum, iron, and manganese

  - Exposure to groundwater in the Fill WBZ seeping onto the riverbank by birds and mammals should include aluminum and vanadium
- LNG Tank Basin
  - Exposure to groundwater in the Fill WBZ discharging into the basin by birds should include aluminum
- Fill WBZ
  - Exposure to groundwater by aquatic life should include vanadium, aluminum, carbon disulfide, iron, ammonia, barium, manganese, and isopropylbenzene
- Alluvium WBZ
  - Exposure to groundwater by aquatic life should include vanadium, aluminum, carbon disulfide, iron, ammonia, barium, manganese, and isopropylbenzene

While soil and groundwater analytical data are not available for all these COPCs in each area, data exists for the pathways indicated above in the ecological risk assessment. Data gaps in other exposure pathways for these COPCs should be discussed in the uncertainty section.

Besides the COPCs identified above, the Draft HERA Report identifies other COPCs, not included in Table 2-1, that are further discussed in Attachment 1 and need to be addressed. In addition, the Draft HERA Report identifies COI (i.e., detected analytes) for which screening criteria are available but were not screened in the ecological risk assessment. The additional COI are also discussed in Attachment 1. For clarification, DEQ is not requesting all of the COPCs and COIs identified in Attachment 1 to be incorporated into the analysis of cumulative ecological risk. DEQ does request that NW Natural acknowledge and identify analytes present at the Gasco Site with an HQ > 1 as COPCs, and discuss these COPCs and their contribution to risk in the uncertainty section. Once revisions to the draft HERA are complete, COPCs exceeding acceptable risk levels in the final HERA will be considered COCs and will be the focus of remedial actions in the FS.

Furthermore, COPCs identified in one media, for which analytical data are absent in other media (e.g. aluminum, perylene) should be discussed in the uncertainty section. DEQ further requests that the Revised HERA Report acknowledge the additional COI (i.e., those identified but not included in Table 2-1) and mention them and their occurrence in the uncertainty section.

To avoid misunderstandings going forward, the COPCs identified in the Draft HERA Report, including TPH and those DEQ identifies above and in Attachment 1, should be included in the analyte list for sampling done to support the Gasco Site FS. In addition, the initial COI list for the screening step NW Natural will perform in the Siltronic MGP RI should include all chemicals detected during the course of Siltronic site investigations and those identified here.

Vapor Intrusion and Volatilization to Outdoor Air Pathways

Based on our review of the Draft HERA Report, DEQ concludes that:

- The use of default RBCs in the evaluations of the vapor intrusion and outdoor air pathways underestimates the risk associated with those pathways;

- The risk associated with the volatilization to outdoor air pathway is not included in the sums of site-wide risk for the Gasco Site; and
- Two important COI for the Gasco Site (i.e., TPH, hydrogen cyanide) are not evaluated in the document.

DEQ acknowledges agreeing to use default RBCs for these pathways (and leaching to groundwater) with the goal of streamlining the HERA. That said, the assumptions inherent in the default RBCs result in the risk for these pathways being underestimated by an unquantified but potentially large amount. Upon reviewing the calculations and conclusions in the Draft HERA Report, DEQ concludes that using the non-conservative RBC screening approach identifies the vapor intrusion and outdoor air pathways as being complete and potentially important routes of current and ongoing and future human health exposure. DEQ further concludes that additional site-specific evaluations are warranted to further evaluate risk associated with both pathways. One approach for conducting additional evaluations is to develop site-specific parameters and RBCs and rescreening data for the Revised HERA Report. However, DEQ concludes that site sampling would also be needed to confirm these findings for purposes of the FS.

Based on the information above, DEQ approves the Revised HERA Report subject to the condition that:

- NW Natural acknowledges in the uncertainty section of the report that using default RBCs underestimates risk associated with the vapor intrusion and outdoor air pathways;
- NW Natural agrees the vapor intrusion and outdoor pathways are complete, represent unacceptable risk to human health, and that further evaluation is warranted; and
- Sampling and analytical work will be conducted during the FS scoping and planning process to further evaluate both pathways and sampling will include volatile organic compounds (e.g., benzene, ethylbenzene, and naphthalene), TPH, and hydrogen cyanide.

DEQ requests that NW Natural provide their written acceptance of this condition either concurrent with or prior to submission of the Revised HERA Report.

Consistent with previous communications, NW Natural should be advised that the risk associated with outdoor air volatilization will need to be re-evaluated during the future Siltronic HERA as both sites contribute to the risk associated with this pathway.

Calculation of Soil, Groundwater, and Area-Wide Exposure Point Concentrations

Consistent with the HERA Work Plan, NW Natural used USEPA's ProUCL (version 4.1, USEPA, 2010) for purposes of calculating 90%-UCLs. In situations where the sample size was adequate and ProUCL recommended a 95%-UCL, NW Natural selected the exposure point concentration (EPC) from the 90%-UCL results. This is appropriate. However, when ProUCL recommended that a 97.5% or 99%-UCL be used instead of the 95%-UCL to provide 95% coverage, NW Natural selected the 95%-UCL to represent the 90%-UCL. DEQ's review of the Draft HERA Report indicates that limiting the evaluation to the 95%-UCL could lead to an overall underestimate of hazard quotients by 20% to 30% compared to using the 97.5%-UCL where appropriate.

DEQ's approach on other sites is to apply the following method to identify the appropriate 90%-UCL:

- In cases where EPA identifies that the 95%-UCL does not provide coverage for 95% of the data, they provide an alternative UCL (i.e., 97.5%-UCL or 99%-UCL).
- Where EPA recommends using the 97.5%-UCL to provide 95% coverage, DEQ recommends using the 95%-UCL to provide 90% coverage.
- Where EPA recommends using the 99%-UCL to provide 95% coverage, DEQ recommends using the 97.5%-UCL (not the 95%-UCL) to provide 90% coverage.

DEQ approves the Revised HERA Report subject to the condition that where appropriate for soil and groundwater data, NW Natural will select values for the 90%-UCLs consistent with the approach above.

Integration of MGP Residuals

The presence of MGP residuals (e.g., lampblack, carbon pitch, tar, oil) at the Gasco Site is widespread and is a substantial contributor to site risk and a significant consideration for future cleanup work. However, the Draft HERA Report only mentions MGP residuals in the context of supplementing soil data at specific locations. DEQ will approve the Revised HERA Report subject to the condition that NW Natural present figures showing the distribution MGP residuals and how sampling locations and data spatially relates to the presence of MGP residuals in soil and groundwater. For this purpose, DEQ requires that the Revised HERA Report combine figures showing the depth and occurrence of MGP residuals in the fill and alluvium based on field observations and TarGOST® logging data, with sampling location figures and iso-concentration maps.

Wetlands Ponds

DEQ disagrees with NW Natural that the Wetlands Ponds located in the southern portion of the Gasco Site are insignificant pathways of potential risk to ecological receptors. The ponds have been features of the site for nearly 30-years. In addition, contrary to NW Natural's assertion that the ponds are ephemeral, aerial photos indicate that for the past 7-years the ponds remain full into the mid to late summer.

DEQ's continues to maintain that as long as the ponds exist they represent seasonal habitat for aquatic biota (i.e., invertebrates), provide transitory habitat for migratory birds, and enhance habitat for other terrestrial receptors during the precipitation season. Additionally, given the area is adjacent to the Willamette River; the ponds are likely used by resident receptors as well as migratory species.

Based on our review of the Draft HERA Report, DEQ concludes there is significant risk of exposure to ecological receptors by surface water and sediment in the ponds. DEQ conditionally approves the Revised HERA Report subject to NW Natural revising the draft report to reflect our determination and acknowledge the Wetlands Ponds will be carried forward into the FS scoping and planning process. Alternately, if NW Natural does not wish to carry the Wetlands Ponds forward into the FS scoping and planning process, NW Natural must clearly communicate its intentions in writing (either concurrent

with or prior to submission of the revised HERA report) to remove the habitat for this area in a project plan. The project plan should describe the actions to be taken to remove ecological habitat in the Former Tar Ponds Area, including the Wetlands Ponds, and provide a schedule for implementation and completion.

Groundwater and Human Health Risk

As indicated in the Attachment 1 comment to Section 2.1.3.3.2 (Alluvium WBZ Status) of the Draft HERA Report, DEQ's final determination regarding the reasonable likely future industrial use of groundwater in the Alluvium WBZ applies to within the NW Natural Site. Based on this determination DEQ requests that the Revised HERA Report include human health exposure to groundwater in the Alluvium WBZ under an industrial use scenario in the evaluation of cumulative risk for the Gasco Site.

Regarding the approach to evaluating risk to human health by exposure to groundwater in the Alluvium WBZ, NW Natural indicates that DEQ's risk-based concentrations (RBCs) for the "Ingestion and Inhalation of Tapwater" (RBCtw) under an industrial land-use scenario are overly conservative. The primary reason given by NW Natural is that the RBCtw assumes that groundwater will be used for drinking water. The Draft HERA Report suggests that a more representative scenario for the future industrial use of the Alluvium water-bearing zone (WBZ) includes the inhalation and dermal contact routes of exposure. DEQ concurs with NW Natural's proposed alternate approach. DEQ recommends that NW Natural use the EPA regional screening level (RSL) calculator to develop screening values to calculate an alternate estimate of the risk to human health associated with exposure to groundwater in the Alluvium WBZ through vapors and dermal contact. DEQ further recommends that this analysis be included in the Revised HERA Report for use in the FS. Otherwise, DEQ requests the risk estimates presented in the Draft HERA Report to be carried forward into the FS scoping and planning process.

If NW Natural elects to use the EPA RSL calculator to generate alternative screening values, DEQ requests that the input parameters be provided for our review and approval prior to use. DEQ's "TPH Data Use and Analysis" conditions for approving the HERA Report apply here.

Groundwater and Ecological Risk

The Draft HERA Report does not fully evaluate the risk of exposure to ecological receptors to groundwater in the Fill WBZ for the riverbank seepage (Fill WBZ) and/or Willamette River discharge pathways (Fill WBZ and Alluvium WBZ). Other than briefly describing and compiling the results of data screening, the Fill WBZ pathways are not discussed further. Although the Draft HERA Report indicates there is unacceptable risk to ecological receptors by exposure to groundwater in the Fill WBZ that seeps onto the riverbank and discharges into the LNG tank basin, these pathways are apparently not considered complete and significant exposure pathways and therefore not included in cumulative risk estimates. Furthermore, the Draft HERA Report only provides a cursory description of the results of screening the data for the Alluvium WBZ.

The Draft HERA Report implies groundwater source control measures (SCMs) will address the Fill WBZ and Alluvium WBZ pathways. Regarding the Fill WBZ SCMs, DEQ understands the Draft

HERA Report is referring to the interceptor trench. In addition, the report implies the hydraulic control and containment system (HC&C) system will address groundwater discharge to the river from the Alluvium WBZ. DEQ disagrees with both of NW Natural's assertions given: 1) the Fill WBZ interceptor trench is in the early planning stages; and 2) the HC&C system is currently undergoing testing and is not designed to address groundwater in the fill. Consequently, it is premature to conclude groundwater source control will address either WBZ. Regardless, the HERA should evaluate the ecological exposure pathways for both the Fill WBZ and the Alluvium WBZ in the absence of source control. DEQ will approve the Revised HERA Report, subject to the report being modified to fully evaluate the ecological exposure pathways associated with the Fill WBZ and Alluvium WBZ consistent with agreements reached prior to preparing the Draft HERA Report.

In evaluating the risk to ecological receptors by exposure to shallow groundwater, NW Natural and DEQ agreed to screen data from certain monitoring wells constructed in the Fill WBZ. The Alluvium WBZ was not included in these discussions. For purposes of the Revised HERA Report, DEQ recommends that NW Natural evaluate the risk to ecological receptors by exposure to deep groundwater by screening data from monitoring wells constructed in the Alluvium WBZ along the shoreline of the Gasco Site. DEQ further recommends that this analysis be carried forward into the FS scoping and planning process. Otherwise, DEQ requires that the approach already presented in the Draft HERA Report be used in the FS. Attachment 1 provides additional information regarding the wells to be used in the evaluation.

DEQ's "TPH Data Use and Analysis" and "COI and Data Screening" conditions for approving the HERA Report identified above in this letter also apply here.

Use of "Background" Concentrations

NW Natural compares the concentrations of metals to DEQ's recently issued regional background numbers. For clarification, the regional background metal values represent the 95th upper prediction limit of measured concentrations. Consequently the concentrations do not correspond to the typical exposure levels that mean concentrations represent.

DEQ approves the Revised HERA Report subject to the condition that NW Natural will characterize the risk of exposure to human health and ecological receptors by metals present at concentrations greater than background without subtracting out risk from exposure to background concentrations. The evaluation of the risk of exposure should be based on comparing metals concentrations to the mean concentrations of metals or the 90%-UCL on the mean. For clarification, DEQ does not require evaluation of risk for metals that are below background levels and will not require remediation of metals in soil to concentrations below background levels.

Uncertainty

The Draft HERA Report discusses uncertainty associated with evaluating risk to human health and ecological receptors in Section 3.6 and Section 4.6 respectively. Based on DEQ's review, these sections of the report present unbalanced and incomplete discussions of uncertainty by focusing on

potential overestimates of risk. DEQ does not accept the uncertainty evaluations presented in the Draft HERA Report.

DEQ has identified numerous significant sources of uncertainty in the Draft HERA Report that will underestimate risk at the Gasco Site. The largest sources include:

- Use and analysis of MGP TPH information for soil across the site;
- Lack of TPH data for groundwater;
- Missing COCs in the ecological risk assessment;
- Methods used to calculate soil, groundwater, and area-wide EPCs;
- Exposure route assumptions for the vapor intrusion and volatilization to outdoor air pathways;
- Lack of TPH and hydrogen cyanide evaluation for vapor intrusion, and
- Designation of locations where evidence of MGP residuals was observed and which lack analytical data as areas of "unacceptable risk" (i.e., arbitrarily designating HQ > 1 for materials at these locations).

For most of these cases DEQ provides comments in this letter that specify how NW Natural should address each source of uncertainty in the Revised HERA Report. DEQ's comments in Attachment 1 further discuss sources of uncertainty in the Draft HERA Report that will overestimate risk and question many of NW Natural's discussions regarding sources of uncertainty that overestimate risk. DEQ requires that these comments be addressed in the Revised HERA Report as well. In any case, DEQ will closely review the uncertainty section of the Revised HERA Report to ensure NW Natural's characterization of uncertainty is objective and balanced (i.e., discusses sources of uncertainty that underestimate and overestimate risk). In the interest of finalizing the HERA, DEQ recommends that NW Natural provide a draft of the uncertainty section for our review prior to submitting the Revised HERA Report. Alternately, DEQ may identify additional uncertainties to be included as part of our final approval of the revised HERA.

HERA ISO-CONCENTRATION FIGURES

The draft HERA report includes "iso-contour" figures (Figures 5-1 through 5-3) for soil that are based on calculated point-by-point EPCs divided by screening levels (SL). The conclusions of the risk assessment focus on these EPC/SL ratios. Although DEQ acknowledges that summary figures of risk can be helpful to visualize the extent of unacceptable concentrations at the site, Figures 5-1 to 5-3 are inappropriate depictions of risk. For example, for human health, the figures combine excess cancer risks and hazard indices to generate summed EPC/SL ratios that have no quantitative meaning. In other words, the figures do not present data evaluations in a manner that supports the hot spot determination and/or FS planning. DEQ requires that in addition to revising the EPC/SL ratio figures to reflect our comments on the Draft HERA Report, soil and groundwater iso-concentration maps be included in the Revised HERA Report. The iso-concentration maps submitted by NW Natural can be used for this purpose subsequent to being modified according to DEQ's comments in Attachment 1.

NEXT STEPS

DEQ requests that NW Natural submit the Revised HERA Report within 60-days of receiving the hard copy of this letter. In addition, DEQ requests that prior to the June 2014 monitoring event NW Natural confirm that TPH will be added to the groundwater analyte list. NW Natural and DEQ will meet on May 27, 2014 to discuss the status of NW Natural's review of DEQ's comments and the process for completing the Revised HERA Report. Prior to May 27th DEQ will arrange a meeting to provide an overview of our comments and conditions detailed in this letter and attachments to assist in NW Natural's review. DEQ believes this initial meeting will facilitate NW Natural's review of these documents and preparation of the Revised HERA Report.

DEQ acknowledges and appreciates the work NW Natural has completed to date on this very challenging project, and looks forward to receiving the Revised HERA Report, completing the Gasco Site HERA, and initiating work on the uplands FS.

Please don't hesitate to contact me with questions regarding this letter.

Sincerely,

Dana Bayuk
Project Manager
Cleanup and Site Assessment Section

Attachments: Attachments 1 and 2

Cc: Patty Dost, Pearl Legal Group
Ben Hung, Anchor QEA, LLC
Taku Fuji, Anchor QEA, LLC
Carl Stivers, Anchor QEA LLC
Rob Ede, Hahn and Associates, Inc.
Myron Burr, Siltronic Corporation
Alan Gladstone, Davis Rothwell Earle and Xochihua
James Peale, Maul Foster Alongi
Christine Budai, ACOE
Sean Sheldrake, EPA
Rich Muza, EPA
Lance Peterson, CDM Smith
Keith Johnson, NWR Cleanup & Site Assessment Section
Henning Larsen, NWR Cleanup & Tanks Section
Jennifer Petersen, NWR Cleanup & Tanks Section
Mike Poulsen, NWR Cleanup & Tanks Section
Cindy Bartlett, Geosyntec Consultants
ECSI No. 84 File
ECSI No. 183 File

ATTACHMENT 1

DEQ's Supporting Comments for Conditions for Approval
Human Health and Ecological Risk Assessment (HERA) Report
NW Natural GASCO Site, Portland, Oregon
Dated October 24, 2013

DEQ comments submitted May 8, 2014

TPH DATA USE AND ANALYSIS

Section 2.4.4, Page 23; Section 3.4.4, Page 55 (2nd paragraph); Section 3.4.4.3, Page 53, (3rd paragraph); Section 3.6.3, Page 68.

Much of the TPH data at the Gasco Site is available from analyzing shallow soil samples and most analyses were performed using EPA Method 418.1. DEQ recommended an approach for adjusting EPA Method 418.1 data upward to account for constituents missed by the analytical method (e.g., the lighter end of the MGP hydrocarbon mixture). As indicated in the Draft HERA Report (see Table 2-12) the adjustment requested by DEQ resulted in a minor change to the TPH concentrations detected using EPA Method 418.1 (i.e., generally a difference of less than 1%).DEQ notes that we were unable to replicate the ratios reported in Table 2-12.

Based on the minor change in adjusted TPH concentrations and consistent with DEQ's February 13, 2013 comments on the HERA Work Plan[1], DEQ estimated total MGP TPH concentrations using composite data gaps sampling results for total PAHs and total MGP TPH[2] and the proportions method. DEQ found that the ratio of TPH to total PAHs in composite samples range from between approximately 2 to 4, indicating that TPH concentrations are about two to four times higher than the concentration of total PAHs detected in MGP residuals. DEQ applied the calculated ratios to the samples most likely associated with the MGP residual material, and where PAH data was available but TPH data were not. DEQ determined that except at low concentrations and for a small number of individual samples, the MGP TPH concentrations estimated using composite data were much higher than the adjusted 418.1 results used in the HERA. Given this information, DEQ concludes the method used to adjust EPA Method 418.1 data underestimates MGP TPH concentrations at the Gasco site and the associated risk to a degree that substantially influences the results of the HERA.

Figure 1 shows the results of the comparison for the Former Retorts/Koppers Area that illustrates the above conclusions. The figure compares EPA 418.1 analyses, total PAH concentrations, and calculated TPH concentrations based on using composite sampling results. For the Former Retorts/Koppers Area, DEQ multiplied the 418.1 results by 2.64 based on the MGP TPH/PAH ratio determined from subsurface composite sample RA-5. For three of the five samples below,

[1] Anchor QEA, 2012, "Work Plan, Human Health and Ecological Risk Assessment, NW Natural Gasco Site," March (received March 22, 2012, supplemented May 29, 2012) a work plan prepared for NW Natural.
[2] Summed concentrations of gasoline-range, diesel-range, and residual-range petroleum hydrocarbons analyzed for using the NWTPH-Gx and NWTPH-Dx methods.

the calculated TPH concentration is substantially greater than the value estimated by adjusting the 418.1 value as done in the Draft HERA Report. The difference is less pronounced at low concentrations (MW-12-36, 0-0.2 feet). The deeper sample at location B-19, 6.5 to 7 feet is an exception with the EPA Method 418.1 results higher than the estimate based on the TPH/PAH factor.

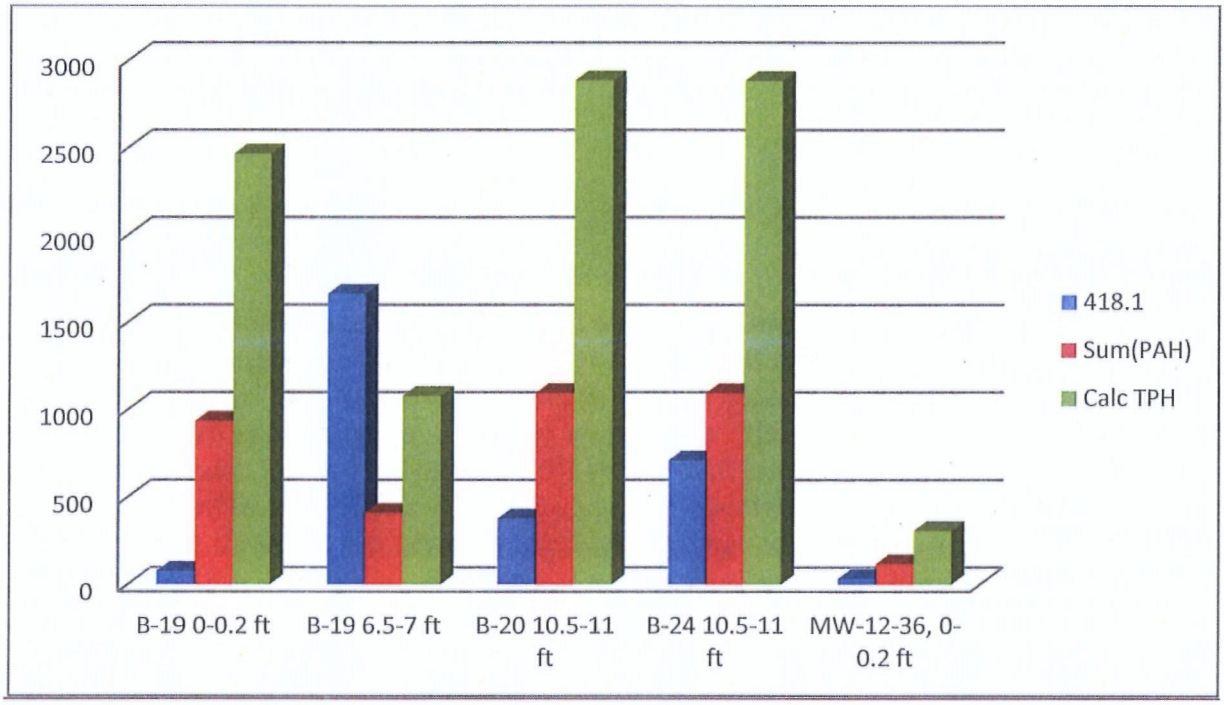

Figure 1. Former Retorts/Koppers Area Comparison of Soil 418.1 Results with Sum(PAH) and Calculated TPH Results (mg/kg)

The relationship between EPA Method 418.1 results and TPH concentrations estimated using TPH/PAH ratios derived from composite samples generally holds across the Gasco Site.

In addition to the composite soil data, DEQ's conclusion regarding TPH is also supported by a simple comparison of 418.1 data to total PAH concentrations. As shown in Figure 1 a straight-forward comparison of TPH concentrations detected in soil samples using EPA Method 418.1 that were adjusted upward using the approach recommended by DEQ, shows that in most cases TPH concentrations are much less than the total concentrations of PAHs in the corresponding sample. The results shown in Figure 1 contradict known relationships between concentrations of PAHs and TPH, as PAH concentrations should be a subset of the total TPH concentration. The relationship illustrated in Figure 1 holds for most soil samples collected and analyzed at the Gasco Site (i.e., for the majority of soil samples total concentrations of PAHs are greater than TPH concentrations detected using EPA Method 418.1).

DEQ concludes from our direct comparison of TPH concentrations to total PAH data and our calculations of MGP TPH concentrations using the proportions methods and total PAH results from composite soil samples, that adjusting the 418.1 results as was done in the Draft HERA Report significantly underestimates MGP TPH concentrations.

DEQ requires that the Revised HERA Report utilize MGP TPH concentrations calculated using composite data gaps soil sampling results and the proportions method for all aspects of the HERA, including recalculating and summing hazard quotients (HQs) to develop a TPH hazard index (HI) for inclusion in the cumulative HI for non-carcinogenic COIs.

Section 3.5.1, Page 56. This section of the Draft HERA Report discusses the calculation methods NW Natural used to estimate cumulative risks to human health by exposure area. The last sentence of the third paragraph states that, "For each non-carcinogenic COI, the HQs for the exposure area risk screening for all detected COI were summed to calculate a cumulative HI for the receptor and exposure scenario." This sentence is not entirely accurate as the hazard index (HI) calculated for TPH was not included in the cumulative HI for the receptor and exposure scenario.

DEQ requires that the Revised HERA Report quantitatively address estimates of TPH risk by including TPH HI in calculations of cumulative HI for non-carcinogenic COI. For clarification, TPH concentrations calculated using composite data gaps results and the proportions method detailed in our previous comment should be used for this purpose.

COI AND DATA SCREENING

Section 2.4.1, Use of Reporting Limits. It is unclear in the Draft HERA report whether the method detection limit (MDL) or method reporting limit (MRL) were used, and when/where estimated (i.e. "J" –flagged) results were used in calculations. Lastly, there are numerous discrepancies in the dataset where detection flags do not match data flags (e.g. detected data is U-flagged). DEQ requests that the Revised HERA Report clearly describe the data handling steps and qualifier assignments for all media evaluated in the HERA for each evaluation.

Section 3.6.3, Page 69, data use assumptions in the calculation of site-specific TPH RBCs. The evaluation of different assumptions for addressing non-detected values is not presented in Table 3-34, as cited in the Draft HERA Report. DEQ requests the table revised to include this evaluation in the Revised HERA Report.

Tables 3-19a through 3-23b. DEQ notes that the naphthalene risk-based concentration (RBC) listed in the table is correctly based on a carcinogenic endpoint. However, table column headings indicate the RBC is based in a non-carcinogenic endpoint. The tables should be revised accordingly.

Table 3-31, Gasco Upland Human Health Risk Screening – Point-by-Point - LNG Tank Basin Groundwater (Groundwater in Excavation). Table 3-31 compiles the results of calculating the HQs for 38 chemicals that are not included on the original COI list. DEQ considers all detected chemicals as COIs. DEQ also notes that screening levels for these chemicals are not listed in Table 3-10 (Surficial Fill Groundwater and LNG Tank Basin Screen Human Health Screening Levels). For completeness, DEQ requires that Table 3-10 in the Revised HERA Report be updated to include screening levels used to calculate the HQs presented in Table 3-31.

Table 3-32, Gasco Upland Human Health Risk Screening – Point-by-Point - LNG Tank Basin Groundwater (Volatilization to Outdoor Air). Table 3-32 compiles the results of calculating the HQs for 23 chemicals. However, only three of the chemicals on the list have screening levels listed in Table 3-10. Similar to the comment above, Table 3-10 in the Revised HERA Report should be updated to include screening levels used to calculate the HQs presented in Table 3-32.

Section 4.1.2, Exposure Pathways. Please revise the text to be consistent with the risk screening conducted in the risk assessment and the Final Screening Criteria Matrix, which includes the following ecological exposure pathways:

- Exposure of aquatic life, birds and mammals to wetland ponds;
- Exposure of aquatic life, birds and mammals to discharging surficial fill WBZ to the banks and sediments of the Willamette River;
- Exposure of birds and mammals to discharging surficial fill WBZ to the LNG tank basin; and
- Exposure of aquatic life to discharging Alluvium WBZ to the sediments of the Willamette River

Furthermore, some of these pathways listed above should have been included in the calculations of cumulative risk, including but not limited to birds and mammals exposed to contamination in the wetland ponds (surface water and sediment); groundwater in the Fill WBZ that discharges into the LNG tank basin, and; groundwater in the Fill WBZ discharging onto the riverbank as seeps.

Section 4.2, Risk Screening, PAH FCVs: All PAHs and final chronic values (FCVs) identified in EPA's *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures* (2003) should be included in the calculation of the Total FCV Toxic Unit for groundwater. Based on DEQ's review it is not clear whether 1-methylnaphthalene and/or 2-methylnaphthalene were included in the calculation. DEQ requests that the tables and text in the Revised HERA Report clarify which PAHs were used in the calculation at the Gasco Site.

Section 4.4, Risk Screening Results. The Draft HERA Report includes calculations of hazard quotients for most if not all analytes in the soil and groundwater datasets; however, only the HQs calculated for COIs in Table 2-1 of the report were carried forward in the analysis of risk. DEQ acknowledges that certain COIs were identified prior to preparing the Draft HERA Report to: 1) reflect information from the RI Report[3]; 2) enable the development of an approach for estimating concentrations of data-limited MGP COIs; and 3) calculate site-specific RBCs for MGP TPH. However, the Draft HERA Report identifies other chemicals that contribute to ecological risk. DEQ communicated to NW Natural as early as May 2011 that based on the site characterization work completed, the Gasco Site HERA should provide information for scoping and planning the uplands FS, including but not limited to; delineating areas of unacceptable risk by indentifying

[3] Hahn and Associates, Inc., 2007, "Remedial Investigation Report, NW Natural – Gasco Facility, Portland, Oregon," April 30, a report prepared for NW Natural.

the COCs present in environmental media and where on site and at what concentrations COCs occur.

DEQ concludes based on our review that the Draft HERA Report identifies COPCs in addition to those listed in Table 2-1. The additional COPCs are identified in this attachment. Certain of these additional COPCs warrant analysis in the HERA as they are detected in high concentrations, contribute significantly to risk, and have the potential to influence the outcome of the ecological risk assessment. This subset of COPCs warrant inclusion in the analysis of cumulative ecological risk and are identified and discussed in this comment letter and attachment. In addition, the Draft HERA Report identifies COI (i.e., detected analytes) for which screening criteria are available but were not screened in the ecological risk assessment. These COI are also discussed below.

DEQ is not requiring that all the COPCs and COIs identified here be incorporated into the analysis of cumulative ecological risk. As clarified below, DEQ does require that: 1) COPCs listed below be included in the analysis of cumulative ecological risk; 2) other chemicals present at the Gasco Site with an HQ >1 be listed as COPCs and their occurrence and contribution to risk be discussed in the uncertainty section of the Revised HERA Report; and 3) the COIs identified in the Draft HERA Report be acknowledged and mentioned in the uncertainty section.

Additional COPCs Identified for Inclusion in Analysis of Cumulative Risk. Based on an analysis of the distribution and magnitude of ecological risk HQs, DEQ requests that additional COPCs, including sulfide, aluminum, vanadium, carbon disulfide, iron, ammonia, barium, manganese, and isopropylbenzene be included in the calculation of cumulative risks in the Revised HERA Report. The specifics for completing the data screening are provided in DEQ's letter commenting on the Draft HERA Report. The ranges of HQs for these COPCs are presented below in Tables 1 and 2 for groundwater and soil, respectively.

- Groundwater. Table 1 compiles maximum groundwater HQs for the subset of COPCs that DEQ is requesting to be included in the analysis of cumulative risk. Although the maximum groundwater HQs are listed in Table 1, DEQ concludes from our review of the Draft HERA Report that these COPCs are present at HQs > 1 in numerous Fill WBZ and Alluvium WBZ monitoring wells located near the shoreline.

Table 1: Groundwater COPCs Not Identified in Table 2-1 in the Ecological Risk Assessment to be Included in Cumulative Risk	**Hazard Quotient Ranges**
Iron	>10,000
Barium Manganese Carbon Disulfide Aluminum Vanadium	>1000
Ammonia	>100
Isopropylbenzene (cumene)	>10
Sulfide	>1

DEQ notes that many of the COCs listed in Table 1 are also identified in the Portland Harbor Ecological Risk Assessment (final) with HQs >1 in transition zone water off the Gasco Site, including: barium (HQ = 86), iron (HQ = 180), manganese (HQ = 130), vanadium (HQ = 19), carbon disulfide (HQ = 870), and isopropylbenzene (HQ = 2.0).

- Soil. The data compiled for the Fill WBZ in the Draft HERA Report, in conjunction with HQs for the limited soil data for these COIs, indicate that the groundwater COPCs in Table 1 above are also potential soil COPCs at the Gasco Site. Groundwater COPCs that have limited soil data include aluminum, barium, vanadium, manganese, iron, carbon disulfide, and sulfide.

Table 2: Soil COPC's Not Identified in the HERA to be Included in Cumulative Risk Calculations

Receptor	COPC	Hazard Quotients
Plant	Iron	2,250
Plant	Aluminum	192
Plant	Manganese	1.4
Invertebrates	Iron	113
Invertebrates	Aluminum	16
Birds	Aluminum	4.3
Mammals	Aluminum	18
Mammals	Sulfide	37

The information in Table 2 is supported by the preliminary ecological screening of MGP residuals and contaminated soil data conducted for the Siltronic Site and presented in the MGP RI Data Summary Report[4]. Contaminant risk screening at the Siltronic Site shows that aluminum, iron, manganese, and vanadium exceed ecological soil benchmarks. These screening results support the need to identify the additional potential soil COPCs at the Gasco Site in Table 2.

Additional COPCs. Additional COPCs identified in groundwater in the Draft HERA Report, but not included in Table 2-1 or by DEQ in Tables 1 and 2 above include: calcium, benzoic acid, acrolein, styrene, nitrite as nitrogen, magnesium, hexachlorobutadiene, and acetone. For completeness, COIs present at the Gasco Site with HQs >1 should be listed as COPCs and their contribution to risk discussed in the uncertainty section of the Revised HERA Report.

DEQ is not requesting that the COPCs referenced here be incorporated into the analysis of cumulative risk based on consideration of a number of factors, including; the HQs for these

[4] Hahn and Associates, Inc., 2011, "Remedial Investigation Summary Report, Historical Manufactured Gas Plant Activities - Siltronic Corporation Property, 7200 NW Front Avenue, Portland, Oregon," March 31, a report prepared for NW Natural.

COPCs are small relative to other COPCs, and they are present in areas of the Gasco Site where substantial contamination by other COPCs is documented.

DEQ notes that sampling work conducted on the riverbank for the Draft EECA[5] included chemicals not previously analyzed for at the Gasco Site. Perylene is one such chemical. Perylene is notable because it is a PAH detected in riverbank soil at concentrations up to 94 milligrams per kilogram (mg/kg) which exceeds the HPAH terrestrial soil screening criteria. Perylene was only analyzed for in samples collected from locations near the top of the riverbank (i.e., in GST-series borings). Based on this information perylene is a Gasco Site COI and should be considered a COPC. The presence of perylene on the top of the riverbank and the lack of perylene data in upland soil and groundwater should be discussed in the uncertainty section of the Revised HERA Report.

As indicated in the comments letter and in this attachment, DEQ considers TPH to be an important COPC for the Gasco Site. The lack of TPH soil screening represents a potentially significant source of uncertainty in the ecological risk assessment. DEQ notes that soil TPH concentrations in the composite and discrete samples are both above TPH values designated by the State of Washington for ecological risk associated with petroleum fuel hydrocarbons (gasoline range, soil biota 100 mg/kg and wildlife 5,000 mg/kg and not saturation; diesel range, soil biota 200 mg/kg and 6,000 mg/kg wildlife and no soil saturation). DEQ acknowledges the State of Washington criteria are not identified in the HERA screening criteria matrix. That said, DEQ considers it important to acknowledge the ecological risk associated with TPH. Consequently, DEQ requests that the Revised HERA Report discuss the uncertainty associated with not screening TPH data in the context of the State of Washington criteria. DEQ's previous comments on adjusting TPH concentrations apply here as well.

COPCs identified in one media, for which analytical data are absent in other media (e.g. aluminum, perylene) should also be discussed in the uncertainty section.

Additional COIs. The Draft HERA Report identifies COIs that are not included in Table 2-1 for which screening criteria are available, but the COIs were not screened in the ecological risk assessment. The Draft HERA Report also identifies additional COIs for which screening criteria were not included in the report. Table 3 below provides additional ecological screening level values (SLVs) for additional groundwater COIs. Like the "Additional COPCs" identified above, DEQ acknowledges the additional COIs occur in areas of the Gasco Site where substantial contamination is documented or where MGP contamination and chlorinated volatile organic compounds from historic Siltronic releases (cis-1,2-dichloroethene) is occurring. DEQ requires that the ecological risk screening criteria tables be updated with COIs and SLVs for completeness and the additional COIs acknowledged and mentioned in the uncertainty section of the Revised HERA Report.

[5] Anchor QEA, LLC, 2013, "Draft Engineering Evaluation/Cost Estimate, Gasco Sediments Cleanup Site," May, a report prepared for NW Natural.

Table 3: Aquatic Life SLVs Not Identified in the Risk Assessment (ug/L) for detected COIs		
Chemical Name	**Aquatic Life SLV**	**References**
Cis-1,2-Dichloroethene	590	Region III BTAG
Trans-1,3-Dichloropropene	0.055	Tier II Chronic Value
Chloroethane	47	Tier II Chronic Value
Dinitro-o-cresol (4,6-Dinitro-2-methylphenol)	2.6	Env. Canada, 2009. LC50= 0.26 mg/L / 100 = 0.0026 mg/L (or 2.6 ug/L)
m,p-Xylene	13	Tier II Chronic Value
n-Butylbenzene	7.3	Tier II Chronic Value based on criteria for ethylbenzene
Nitrate + nitrite as nitrogen	2,000	Camargo et al, 2005
o-Xylene	13	Tier II Chronic Value
Potassium	53,000	Tier II Chronic Value
sec-Butylbenzene	7.3	Tier II Chronic Value based on criteria for ethylbenzene
Sulfate	14,830	EPA, 2010: LC50=1,483 mg/L / 100 = 14.83 mg/L
tert-Butylbenzene	7.3	Tier II Chronic Value based on criteria for ethylbenzene
Total phenols (unspecified)	4	EPA Region III BTAG

Camargo et al, 2005. *Nitrate toxicity to aquatic animals: a review with new data for freshwater invertebrates.* Chemosphere: 58: 1255-1267.

Environment Canada, 2009. *Screening Assessment, Phenol, 2-methyl-4,6-dinitro (DNOC).*

EPA 2010. *Final Report on Acute and Chronic Toxicity of Nitrate, Nitrite, Boron, Manganese, Fluoride, Chloride and Sufate to Several Aquatic Animal Species*, EPA 905-R-10-002, Region 5 Office of Science and Technology, Great Lakes Enviornmental Center, Michigan.

Appendix H. Appendix H of the draft HERA report includes a copy of NW Natural's October 31, 2011 technical memorandum proposing a site-specific ecological risk-based soil screening value for cyanide. DEQ considers Appendix H to be incomplete without a copy of our January 5, 2012 letter that provides our comments on the memorandum. The revised HERA report should include both the memorandum and DEQ's comments.

VAPOR INTRUSION AND VOLATILIZATION TO OUTDOOR AIR PATHWAYS

Section 3.3, Page 31. The draft HERA risk screening for the vapor intrusion and outdoor air pathways was performed by comparing calculated exposure point concentrations (EPCs) to DEQ's published generic RBCs. The use of generic RBCs is usually adequate to characterize risk at most cleanup sites. DEQ acknowledges previously agreeing to use default RBCs for these pathways (and leaching to groundwater) with the goal of streamlining the HERA. That said,

upon viewing the results calculated with the default RBCs, it appears the assumptions inherent in the default RBCs results in a potentially significant underestimation of risk.

For the volatilization to outdoor air pathway, the aerial extent of potential contamination is an important factor in modeling the attenuation of contaminant concentrations and for calculating a protective RBC. The general relationship that holds is that the larger the contaminant source area, the lower the air dispersion factor (Q/C), resulting in lower RBCs. Based on EPA work, the value of the Q/C dispersion term used by DEQ in developing generic RBCs corresponds to a source area of 0.5-acres, smaller than the area over which impacts have been documented on the Gasco and Siltronic sites. Similarly, the value of the dilution-attenuation factor (DAF) used in developing soil leaching-to-groundwater pathway corresponds to an area of 0.25-acres; also likely much smaller than the actual area where leaching is occurring.

DEQ concludes that even using the non-conservative (for the Gasco site) default RBC screening approach, unacceptable risk is identified for the outdoor air pathway. The Draft HERA Report identified unacceptable risk associated with exposure to benzene and naphthalene in outdoor air. In addition, the Draft HERA Report identifies unacceptable risk from TPH to outdoor air for the Retorts/Kopper area although the concentrations of TPH are likely significantly underestimated (see Figure 1 of this attachment).

Based on results presented in the Draft HERA Report, DEQ considers the outdoor air pathway to be complete and a potentially important route of current, ongoing, and future human health exposure. DEQ concludes that additional site-specific evaluations are warranted to further evaluate risk associated with this pathway. One approach for conducting additional evaluations is to develop site-specific parameters and RBCs and rescreening data in the Revised HERA Report. However, DEQ concludes that site sampling would also be needed to confirm these findings for purposes of the FS.

DEQ will not request further evaluation of the outdoor air pathway in the HERA. DEQ will instead require that NW Natural conduct sampling to further evaluate this pathway during the FS scoping and planning process.

Section 3.4.1.7, Page 46. The DEQ Risk-Based Decision Management (RBDM) model for vapor intrusion was adapted by the DEQ Tanks program for use in assessing releases from underground storage tanks (USTs). Consistent with the conceptual site model for USTs, which assumes subsurface releases of petroleum, the RBDM model assumes 100-centimeters of clean soil covers any contaminated soil. In contrast, at the Gasco Site highly impacted soil occurs over large areas within the upper 3-feet to 3.5-feet of the soil horizon. Consequently, contaminant sources are located nearer to potential receptors than the RBDM vapor intrusion model assumes. The RBC for the indoor volatilization pathway decreases as the separation distance between source and receptor decreases. Thus, the generic RBCs are likely not conservative everywhere for the Gasco Site.

Typically in these situations, DEQ would request that NW Natural develop site-specific RBCs for the vapor intrusion pathway by changing the value of the parameter (L_{cb}) that represents the thickness of clean soil beneath buildings (existing and hypothetical) in the Johnson and Ettinger

model. This would require that the occurrence of contaminated soil in the upper 3-feet be evaluated site-wide and L_{cb} factors be selected for each exposure area. That said, DEQ concludes that even using the non-conservative RBC screening approach from the RBDM, unacceptable risk is identified for the vapor intrusion pathway. The Draft HERA Report indicates that concentrations of naphthalene, benzene, and ethylbenzene exceed applicable screening criteria by large factors.

In order to move the project forward, rather than NW Natural developing site-specific vapor intrusion RBCs for each human health exposure area at the Gasco Site, DEQ requires that the vapor intrusion pathway be carried forward into the uplands FS. For clarification, DEQ will request that vapor sampling be conducted during the FS to evaluate remedial alternatives (e.g., sub-slab sampling beneath buildings).

Section 3.4.1.7, Page 46, and Table 3-24. DEQ notes that NW Natural's evaluations of the outdoor air pathway excludes two important COIs for the Gasco Site. For the volatilization to outdoor air pathway, TPH is left out of the summary of COIs although an RBC of 32,000 mg/kg was calculated for the Koppers exposure area. The volatilization to outdoor air RBC should be recalculated for the Koppers exposure area and other exposure units based on TPH concentrations estimated using composite data gaps sampling results and the proportions method.

In addition to TPH, cyanide compounds are not evaluated for this pathway. Cyanide compounds, including hydrogen cyanide, detected at the Gasco Site are volatile and highly toxic. DEQ acknowledges that hydrogen cyanide data is lacking to evaluate both the vapor intrusion and outdoor air volatilization pathways in the HERA. Consequently, DEQ requests that evaluation of hydrogen cyanide be carried forward into the FS as a data need.

Section 3.5.1, Page 57 (bottom paragraph). For vapor intrusion from groundwater and subsurface soil, contaminant concentrations nearest to a building are most relevant for evaluating risk. Thus, risk determinations for these pathways are made on a point-by-point basis rather than using the EPC for the entire exposure unit. Essentially, maximum concentrations within an exposure unit should be compared to the relevant RBC to evaluate potential risks. If risk from these exposure pathways is identified based on the comparison of individual data points, then the whole exposure area should be identified as having an unacceptable vapor intrusion risk. Similarly, exposure in excavations should be evaluated on a small scale. Averaging risks across an entire exposure area is not appropriate for either of these purposes. Table 3-24 therefore is a summary of information, but in a form that cannot be used for decision-making. DEQ requires that the Revised HERA Report rely on Table E-3-1 for soil and Table E-3-3 for groundwater to determine areas of unacceptable risk for vapor intrusion or excavation exposure. As indicated elsewhere in this attachment, vapor intrusion will be further evaluated during FS planning through sample collection and analysis.

Section 3.5.1, Page 59, top paragraph. The presence of high concentrations of cyanide in the subsurface beneath a building indicates potential risk of exposure via vapor intrusion. A vapor intrusion RBC for cyanide is not available. DEQ requests that the uncertainty section of the Revised HERA Report discuss the underestimation of risk that results from omitting a quantitative evaluation of cyanide vapor risk. As indicated in our comment to Section 3.4.1.7,

Pg. 46, and Table 3-24 above, given the lack of information, DEQ considers the potential risk of exposure by hydrogen cyanide through vapor intrusion to warrant further evaluation in the Gasco Site FS through future sampling and analysis.

Tables 3-19a through 3-23b. It does not appear that the risk associated with outdoor volatilization of naphthalene from soil, which was calculated to have a site-wide HQ of 17.6 and 15.8 (Tables 3-25a and 3-25b, respectively); was summed with other risks. As indicated in the table and text, volatilization to outdoor air from soil and groundwater represent "site-wide" risks that apply to all exposure units. In other words, the risk associated with this pathway should be combined with those from other exposure pathways risks in the Revised HERA Report, as appropriate.

USE OF "BACKGROUND" CONCENTRATIONS

Section 2.3.1.1, Background Levels of Metals in Soil, Pg. 18 (Last Paragraph). Anchor indicates DEQ published background soil values represent "*... a baseline concentration expected for that metal in soils in the region.*" This statement suggests that DEQ's published background values represent "typical" or mean concentrations of metals that should be compared to average concentrations at the site to assess risks. For clarification, DEQ background metal values represent the 95th upper prediction limit (UPL) of measured concentrations, and are only used in the initial screening step for identifying COIs. If the maximum concentration of a metal detected at the site exceeds a DEQ RBC and its corresponding 95th UPL on background, then a mean-to-mean statistical comparison should be performed utilizing the full site-specific and background data sets. DEQ considers either the mean concentrations of metals or the 90%-UCLs on the means to be more appropriate and requests NW Natural to use these values in the HERA.

For example, the Draft HERA Report indicates that two of the human health RBCs for soil (occupational worker RBC for arsenic; construction worker RBC for thallium) are less than regional background levels. DEQ considers either the mean concentrations for these metals or the UCLs on the mean to be more appropriate for use in the context of NW Natural's evaluation. The mean arsenic background concentration in the Portland Basin is 4.4 mg/kg, and the mean thallium background concentration is also 4.4 mg/kg.

Section 3.3.1.3, Page 33. NW Natural suggests that there is higher uncertainty associated with calculations of risk in situations where screening levels are less than background levels. DEQ disagrees. Our position is that there generally is no more uncertainty associated with calculated risks from chemicals with screening values below background levels than there is for other chemicals.

DEQ does not require evaluation of risk for naturally occurring metals that are below background levels, and will not require remediation of soil concentrations to below background levels. However, DEQ does require characterization of risk for metals present at concentrations greater than background, without subtracting out risk from exposure to background concentrations. DEQ requests the Revised HERA Report apply this approach generally. This comment also applies to Section 3.6.3, Page 67.

Section 4.6.3, Page 93. Anchor indicates that several ecological screening levels used in the ERA are less than DEQ regional soil background concentrations. DEQ's comment to Section 2.3.1.1 applies here.

CALCULATION OF SOIL, GROUNDWATER, AND AREA-WIDE EXPOSURE POINT CONCENTRATIONS

Section 2.5.1, Page 25, last paragraph/Section 3.2, Page 30, process to determine exposure point concentrations. DEQ's comments regarding the general approach used to calculate soil and groundwater, and area-wide exposure point concentrations (EPCs) are provided below.

Calculations of EPCs for Soil and Groundwater, General Approach. Soil EPCs calculated for the HERA were based on the 90% upper confidence limit (UCL) of the mean (90%-UCL) for each exposure area or for the entire site. In addition, 90%-UCLs were calculated on mean groundwater concentrations.

Consistent with the HERA Work Plan, NW Natural used USEPA's ProUCL (version 4.1, USEPA, 2010) for purposes of calculating 90%-UCLs. In general, when the minimum recommended sample size was not met (e.g. four or ten samples), the maximum detected value or maximum non-detect result was used as the EPC. In situations where the sample size was adequate and ProUCL recommended a 95%-UCL, the EPC was selected from the 90%-UCL results. In addition, when ProUCL recommended that a 97.5% or 99%-UCL be used to provide 95% coverage, NW Natural selected the 95%-UCL to represent the 90%-UCL.

As noted in the footnote on page 25 of the Draft HERA Report, EPA only provides recommendations for 95%-UCL statistics, not 90%-UCL statistics. DEQ recognizes that our comment on the risk assessment work plan may imply that the 95%-UCL should be used to represent the 90%-UCL whenever EPA determines that the 95%-UCL does not provide sufficient coverage. This was not our intent. For clarification, DEQ's approach on other sites has been to apply the method recommended for using the 95%-UCL for the 90%-UCL as indicated in our letter commenting on the Draft HERA Report as follows:

- In cases where EPA identifies that the 95%-UCL does not provide coverage for 95% of the data, they provide an alternative UCL (i.e., 97.5%-UCL or 99%-UCL).
- Where EPA recommends using the 97.5%-UCL to provide 95% coverage, DEQ recommends using the 95%-UCL to provide 90% coverage.
- Where EPA recommends using the 99%-UCL to provide 95% coverage, DEQ recommends using the 97.5%-UCL (not the 95%-UCL) to provide 90% coverage.

As presented in Section 3.2 of the Draft HERA Report, selection of 90%-UCLs for approximately half of the chemicals in groundwater was based on the procedure described in Section 2.5.1 for soil. The 95%-UCL was used to estimate 90%-UCL even when the EPA recommendation was to use the 99%-UCL to estimate the 95%-UCL value. DEQ's review indicates that limiting the evaluation to the 95%-UCL could lead to an overall underestimate of HQs by 20% to 30% compared to using the 97.5%-UCL where appropriate. Table 4 (attached) provides examples of using the 95%-UCL as the EPC where the 97.5%-UCL should have been used.

Area-Wide Exposure Point Concentrations. To calculate area-wide EPCs, the approach in the Draft HERA Report was as follows:

- When a compound was detected in all samples, use the average of all point-by-point EPCs;
- When a compound was not detected in any samples, average half of the reported detected limits (RDLs); and
- When some samples had detections and some did not, one of the following two approaches were used: 1) First substitute a non-detect result with half of the RDL, then average them with detections; and 2) Use the maximum detected value.

Based on the methods summarized above and our review of the results provided in Appendix D of the draft HERA report, the rationale for selecting one approach over another is not clear for a given compound. The selected area-wide EPC values in cases where some samples had detections and some did not (see 3rd bullet above) appear to always be the lower of the two approaches. The difference of the two approaches is often more than an order of magnitude. DEQ requests that the methods and rationale for calculation of the EPCs be clearly explained in the Revised HERA Report. In the interest of finalizing the HERA, DEQ recommends that NW Natural provide a draft of the explanation for our review before the Revised HERA Report is submitted.

The Draft HERA Report only noted in a footnote of Table 3-27 that an area-wide EPC was calculated as the average of the point-by-point EPCs. This information does not appear to be provided in the report. The area-wide EPC is used in the evaluation of the groundwater volatilization to outdoor air pathway. This pathway exhibits some risk (cumulative risk 8×10^{-6} due to naphthalene and benzene). The Draft HERA Report indicates that due to the large number of detected values for these two COCs, the impact of this issue is small on overall risk estimates. However, contribution to risk will likely increase using a Q/C dispersion term more representative of the Gasco Site. DEQ requests that additional information for the area-wide EPC calculation be discussed in the Revised HERA Report to supplement the Table 3-27 footnote.

INTEGRATION OF MGP RESIDUALS

Section 2.3.5, Pg. 20. DEQ considers the presence and occurrence of MGP residuals to be an important consideration at the Gasco Site. The Draft HERA Report does not integrate important field observations of MGP residuals with laboratory analytical data to provide a complete description of the extent and magnitude of impacts. For example, the distribution of MGP residuals observed during field work and based on Targost data should be overlain on figures showing soil and groundwater sampling locations and contaminant iso-concentration maps (i.e. Total TPH) to better ascertain the conditions between sampling points and to describe how the laboratory analytical data spatially relates to the presence of MGP residuals.

Consistent with agreements reached prior to preparation of the Draft HERA Report and for purposes of the Gasco Site HERA only, locations where evidence of MGP residuals were observed and which lack analytical data are considered areas of unacceptable risk. This is an arbitrary designation that assumes HQ > 1 for COPCs at these locations. This designation does

not represent a quantified determination of hazard. The unacceptable risk designation for MGP residuals should be fully discussed in the Revised HERA Report.

Section 3.5.2.4 Page 62, second paragraph. Risk from Contact with MGP Residuals. The report acknowledges the potential risks associated with contact to MGP residuals in the last sentence of this section. DEQ guidance states that the models used by DEQ to calculate RBCs for exposure to TPH are inappropriate if the TPH is in a separate phase. In this case, the assumption should be that the risk related to directly contacting product is unacceptable. The report identifies areas of product in Figures 2-6 and 2-7, with the sample locations also shown in Figures 3-1 and 3-2. For completeness, DEQ requires that the Revised HERA Report combine this information together on figures and on iso-concentration maps.

Appendix G. Appendix G includes an August 13 2013 technical memorandum that documents excavation and sampling work conducted during construction of the Treatment System Building foundation and footings. DEQ understands that MGP residuals (e.g., carbon pitch) remain in-place between 0.5-feet and 2-feet outside the building footprint and will require this information to be carried forward into the FS.

GROUNDWATER AND HUMAN HEALTH RISK

Section 2.1.3.3.2, Alluvium WBZ Status. In general, this section of the Draft HERA Report focuses on information presented in the RI Report and does not address DEQ's March 10, 2010 letter commenting on that document, and our January 5, 2012 letter commenting on NW Natural's updated Groundwater Beneficial Use Determination[6] (GBUD). Both of DEQ's comment letters provide reasons for concluding that future use of the Alluvium WBZ is reasonably likely. The purpose of DEQ's comments provided here is to confirm DEQ's final determination that industrial use of groundwater in the Alluvium WBZ is a reasonably likely future use of the resource.

DEQ has determined the lateral and vertical extent of the Alluvium WBZ to which the industrial use determination applies. During meetings between NW Natural and DEQ in May and June 2012, NW Natural provided information proposing that the portion of the Alluvium WBZ with sufficient yields to reasonably support industrial use is restricted to a limited geographic area on the Gasco and Siltronic properties where the Alluvium WBZ thickens and coarsens. The figure provided by NW Natural identifies the volume of the Alluvium WBZ meeting these criteria as being contained within the area bounded by the -110-feet City of Portland Datum (CoP). This elevation corresponds roughly to the top of the deep aquitard.

DEQ does not approve NW Natural's proposal. Until step-testing was conducted at extraction wells, information was not available to assess potential well yields from the lower Alluvium WBZ above the aquitard in the northern portion of the Gasco Site (i.e., at extraction wells PW-08, PW-09, and PW-10). Step-testing of extraction wells was performed during construction of

[6] Hahn and Associates, Inc., 2011, "Updated Beneficial Use Determination for Groundwater, NW Natural Gasco and Siltronic Properties, 7900 NW St. Helens Road, and 7200 NW Front Avenue, Portland, Oregon," October 21 (received October 24, 2011), and report prepared for NW Natural.

the Alluvium WBZ source control measure (the well-based hydraulic control and containment system). The results of step-testing in the northern portion of the site indicate the hydraulic conductivity (K) of the lower Alluvium WBZ (i.e., the portion of the Alluvium WBZ above the deep aquitard and/or in contact with the Columbia River Basalt [CRB]) ranges between 400 feet/day (PW-8-68) and 1,250 feet/day (PW-9-92). Well logs indicate the lower Alluvium is 20-feet to 40-feet thick in this portion of the site. A rough estimate of the yield for a 6-inch well that fully-penetrates the lower Alluvium and operates for 16-hours per day (8-hours of recovery daily) is greater than 50 gallons per minute. Based on this estimation, DEQ concludes the lower Alluvium WBZ in the northern portion of the Gasco Site has the capacity to supply groundwater for industrial purposes.

DEQ acknowledges the geometry of the Alluvium WBZ is a factor in evaluating reasonably likely future industrial use of the groundwater. Assuming the west edge of Highway 30 is the approximate western limit of the alluvium, the extent of the Alluvium WBZ north of the Gasco Site is reduced by proximity of the CRB to the river and the shape of the U.S. Moorings Site embayment. Between the shared property line of the Gasco Site and U.S. Moorings Site embayment, the lateral extent of the alluvium decreases from approximately 800-feet to about 250-feet. Based on this information, and the reasonably likely future land and water use of the U.S. Moorings Site by the Army Corps of Engineers, DEQ concludes the effective limit of the Alluvium WBZ for industrial purposes is within the NW Natural Site boundary.

Section 2.1.3.3.2, page 11 (top paragraph)/Section 3.4.3, Page 49/Page 66, last paragraph. NW Natural indicates that DEQ's risk-based concentrations (RBCs) for the "Ingestion and Inhalation of Tapwater" (RBCtw) under an industrial land-use scenario are overly conservative because they assume that groundwater will be used for drinking water. NW Natural also indicates that, "The potential industrial use for alluvial WBZ groundwater would be for industrial process supply water, where occupational workers could be exposed to vapors or direct contact from the water, but not from use of the alluvial WBZ as a drinking water supply." Based on this information NW Natural concludes that including ingestion overestimates risk because using the Alluvium WBZ as a source of drinking water is not a reasonably likely future use of groundwater.

Section 2.1.3.3.2 suggests that a more representative scenario for the future industrial use of the Alluvium WBZ includes the vapor and dermal contact routes of exposure. DEQ agrees this scenario is appropriate.

Both DEQ's RBDM spreadsheets and EPA's regional screening level (RSL) calculator[7] are able to exclude ingestion as a route of exposure. However, DEQ notes that exposure due to dermal contact is not included as a route in the derivation of the DEQ groundwater occupational RBCtw. Depending on the properties of the chemical, exclusion of dermal exposure from the exposure analysis could underestimate risk.

The EPA RSL calculator can be adjusted for use in this situation. NW Natural can use the EPA calculator to develop screening values to calculate an alternate estimate of the risk to human

[7] See http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

health associated with exposure to groundwater in the Alluvium WBZ through vapors and dermal contact. Based on this information, DEQ gives NW Natural the option to use the EPA RSL calculator to evaluate the potential risk of exposure to human health by groundwater in the Alluvium WBZ via the inhalation and dermal contact routes of exposure. This analysis can be included in the Revised HERA Report.

If NW Natural elects to use the EPA RSL calculator to generate alternative screening values, DEQ requests that the input parameters be provided for our review and approval prior to use. The screening values should be based on a reasonable maximum site-specific exposure scenario (e.g., a supply well installed in an exposure area exhibiting maximum groundwater contamination). Otherwise, DEQ requests the risk estimates presented in the Draft HERA Report for industrial use of groundwater be carried forward into the FS scoping and planning process. DEQ's comments on "TPH Data Use and Analysis" apply here.

Based on DEQ's review of the Draft HERA Report, TPH data for groundwater is lacking for the Gasco and Siltronic sites. DEQ considers the lack of TPH data to represent a significant data need for the Gasco and Siltronic sites. DEQ requests that NW Natural collect groundwater samples for TPH analysis beginning with June 2014 sampling event to support the Gasco Site FS and the Siltronic HERA and FS.

In addition to discussing RBCs, NW Natural makes a point of indicating that Siltronic's use of groundwater is at high volumes. DEQ notes that Siltronic's industrial need does not necessarily mean that all groundwater extracted for industrial use beneath the NW Natural Site will be at high volumes.

GROUNDWATER AND ECOLOGICAL RISK

DEQ's "TPH Data Use and Analysis" and "COI and Data Screening" comments in this attachment apply here.

Section 2.3.2, LNG Tank Basin Groundwater. DEQ identified several wells in surficial fill for use in the evaluation of human health and ecological exposure to groundwater in the Fill WBZ in the vicinity of the water in the LNG tank basin. Monitoring well MW-06-32 was one of the wells selected for use in the evaluation. Although NW Natural agreed to include MW-06-32, the installation was not evaluated in the Draft HERA Report. According to NW Natural, the well was dropped from the evaluation because it is being used for DNAPL removal and is no longer being sampled. NW Natural decided to exclude MW-06-32 without discussion with DEQ. DEQ notes that the Draft HERA Report continues to reference MW-06-32 in the LNG Tank Basin evaluation (see Table 3-10). DEQ does not accept the information provided in the Draft HERA Report as sufficient justification for excluding MW-06-32. DEQ requests that the Revised HERA Report include MW-06-32 in the LNG Tank Basin evaluation and that use of the monitoring well be discussed in the uncertainty section of the Revised HERA Report. This comment applies to the human health risk assessment also.

Section 4, Page 71 and Section 4.4.3, Page 83. The Draft HERA Report does not evaluate the soil leaching to groundwater pathway in the ecological risk assessment. DEQ acknowledges this

exposure pathway was not identified in the Screening Criteria Matrix. The lack of evaluation represents a gap in the Gasco Site HERA.

The typical method of calculating an RBC for ecological receptors is identical to that used for the human health risk assessment, however because the point of exposure is the Willamette River the target concentrations in groundwater become the aquatic SLVs. Given the availability of groundwater data for the Gasco Site, DEQ believes the extent of groundwater contamination can be used to delineate the portion of plume exceeding SLVs. Iso-concentration maps of groundwater contamination for the Fill WBZ and the Alluvium WBZ will be used for this purpose. DEQ's comments regarding the lack of TPH data for groundwater applies here. In other words, DEQ requires the results of analyzing TPH in groundwater samples collected beginning in June 2014 to be used to supplement groundwater data going forward into the FS.

Section 4.4.3, Alluvium WBZ Groundwater. In evaluating the risk to ecological receptors by exposure to shallow groundwater, NW Natural and DEQ agreed to screen data from certain monitoring wells constructed in the Fill WBZ. The Alluvium WBZ was not included in these discussions. For purposes of the Revised HERA Report and consistent with the approach taken with the Fill WBZ, DEQ proposes that NW Natural evaluate the risk to aquatic life by exposure to deep groundwater discharging into the Willamette River by screening data from monitoring wells constructed in the Alluvium WBZ along the shoreline of the Gasco Site. DEQ requires that NW Natural use all of the Alluvium WBZ monitoring wells shown in Figure 2-5 of the Draft HERA Report except MW-7-60, MW-8-56, MW-10-61, MW-14-110, MW-15-50/66 for this purpose. DEQ further recommends that this analysis be carried forward into the FS scoping and planning process. Otherwise, DEQ requires that the results of the approach already presented in the Draft HERA Report be used in the FS.

Section 4.4.2 and 4.4.3, Surficial Fill WBZ and Alluvium WBZ Groundwater. Groundwater data for TPH is unavailable. However as previously communicated to NW Natural, DEQ considers TPH to be an important COI for the Gasco Site and the Siltronic facility in soil, vapor, and groundwater water. The ecological risk assessment for the Portland Harbor (final) shows transition zone water samples off the Gasco Site have HQs >1 for TPH fractions as follows: Aliphatic hydrocarbons C_4 - C_6 (HQ = 7.3), Aliphatic hydrocarbons C_6 - C_8 (HQ = 4.3), Aliphatic hydrocarbons C_{10} - C_{12} (HQ = 540), Aromatic hydrocarbons C_8 - C_{10} (HQ = 2.7).

As indicated elsewhere, DEQ considers the lack of TPH data for groundwater to be a significant data need for the Gasco Site FS and the Siltronic HERA and FS. As indicated in the letter commenting on the Draft HERA Report and elsewhere in this attachment, DEQ requires that NW Natural begin collecting groundwater samples for TPH analysis in June 2014. The data can be used to evaluate exposure to aquatic receptors by TPH in groundwater using screening level values as follows:

- Aliphatic hydrocarbons C4-C6: 128 ug/L
- Aliphatic hydrocarbons C6-C8: 54 ug/L
- Aliphatic hydrocarbons C8-C10: 9.5 ug/L
- Aliphatic hydrocarbons C10-C12: 2.6 ug/L
- Aromatic hydrocarbons C8-C10: 212 ug/L

The screening values listed above are established in the *Final Portland Harbor Remedial Investigation Report* (see Appendix G, 2013).

Wetlands Ponds

Section 2.1.3.2. This section provides NW Natural's opinions on the status of the Wetlands Ponds located in the southern portion of the Gasco Site. DEQ concurs with NW Natural that there is no reasonably likely industrial use of water in the ponds, and the ponds are degraded due to historic site activities. However, DEQ disagrees with NW Natural's conclusions that the ponds are ephemeral and have no reasonable likely beneficial uses. The ponds have been present in their current configuration for nearly 30-years. Review of aerial photos indicates that from the summer of 2005 through 2012 ponding occurs through the mid to late summer months of the year, indicating that for at least 7-years the ponds are year-round features. Based on this information DEQ continues to maintain that as long as the ponds exist they represent seasonal habitat for aquatic biota (i.e., invertebrates), provide transitory habitat for migratory birds, and enhance habitat for other terrestrial receptors during the precipitation season. Additionally, given the area is adjacent to the Willamette River, the ponds are likely used by resident receptors as well as migratory species.

The soil, sediment, and surface water data available for the Wetlands Ponds are limited to three sample locations. Based on the available data, detections of COI in soil/sediment and surface water significantly exceed the screening criteria selected to evaluate the ponds. To fully assess the Wetlands Ponds, a more complete soil, sediment, and surface water dataset and a more thorough characterization of resident aquatic species, and resident, transitory, and migratory species are needed to support the HERA. DEQ and NW Natural agreed to conduct the HERA using available data to the maximum extent practicable. Absent the additional characterization , DEQ must conclude from the evaluation of available soil, sediment, and surface water data presented in the Draft HERA Report that the Wetlands Ponds pose an area of significant unacceptable risk to ecological receptors and should be carried forward into the uplands FS planning process.

As indicated in the comments letter, DEQ identifies an alternative approach to carrying the Wetlands Ponds forward into the FS. If NW Natural does not wish to carry the Wetlands Ponds forward into the FS scoping and planning process, NW Natural must clearly communicate its intentions in writing for removal of the habitat in a project plan. The project plan should describe the actions to be taken to remove ecological habitat in the Former Tar Ponds Area, including the Wetlands Ponds, and provide a schedule for implementation and completion.

These comments also apply to Section 4.4.4 and 4.4.5 of the Draft HERA Report.

UNCERTAINTY

Section 2.5.1, Page 25, last paragraph/Section 3.2, Page 30, process to determine exposure point concentrations. As indicated in our comment on determining EPCs for soil, groundwater, and area-wide above, DEQ's review of the approach NW Natural used to select UCLs concludes

that limiting the evaluation to the 95%-UCL could lead to an overall underestimate of HQs by 20% to 30% compared to using the 97.5%-UCL where appropriate.

Section 3.4.1.5.1, Page 42 (Occupational Worker) and Page 43 (Construction Worker). NW Natural indicates that the risk to occupational and construction workers from exposure to carcinogenic PAHs (cPAHs) in surface soils is biased high due to migrating a sample collected at B-13 from 10.5 to 11-feet below ground surface (bgs) upward into the surface interval. DEQ does not agree with this presumption. There are examples at the site where the concentrations of site COIs in the surface soil interval are greater than subsurface detections (e.g., B-55, 2.5 to 3-feet). Consequently, based on available data there is evidence that the actual concentrations of cPAHs at B-13 could be higher.

Migrating this and other samples upward is consistent with agreements reached between NW Natural and DEQ on handling and using soil data for purposes of the HERA. NW Natural and DEQ agreed to rely on available data and focused supplemental sampling combined with additional lines of evidence (e.g., presence of MGP residuals) to meet the needs of the HERA rather than conduct extensive site-wide sampling for COI lacking analytical data. Lack of available surface soil data is the reason it was necessary to estimate surface soil concentrations using deeper soil data. The uncertainty with this evaluation can be reduced if additional surface samples in this location are collected and analyzed to support the FS scoping and planning process.

In addition to discussing vertical migration of soil data, NW Natural states that "Building G" (i.e., the equipment storage building) eliminates potential exposure to subsurface soil for occupational workers. For clarification, a building may eliminate current contact with soil, but it does not eliminate potential future contact with soil.

Section 3.4.3, Page 49. DEQ's comment to Section 2.1.3.3.2, page 11 (top paragraph); Section 3.4.3, Page 49/Page 66, last paragraph, applies here.

Section 3.4.4.1, Page 50. NW Natural states that, "...site-specific TPH RBCs were calculated using the worst case soil conditions present in each former MGP process and storage area and they provide conservative site-specific RBCs for use in screening TPH data from the Site." NW Natural's understandings of the purpose of the data gaps soil sampling and use of the data are incorrect. Consistent with DEQ guidance, site-specific RBCs for MGP TPH are calculated based on the relative concentrations of TPH fractions and constituents in MGP residuals, not absolute concentrations. The calculation method is intended to yield equivalent RBCs for the same source material whether samples exhibit low or high concentrations. Subsurface composite samples intentionally focused on MGP residuals for this purpose. Collecting samples of MGP residuals for analysis does not result in "conservative site-specific RBCs," instead it results in appropriate and representative site-specific RBCs. There is no reason to think that high concentrations of TPH fractions and/or constituents in soil will be associated with a low TPH RBC. Note that this comment also applies to the first paragraph of Section 3.4.4.3 (see Page 53).

Section 3.4.4.2, Page 52 (Surface Soil Composites). This section of the Draft HERA Report compares the results of analyzing surface soil composites collected during the June 2012 data

gaps sampling event, to site-specific MGP TPH RBCs. DEQ requested that surface soil composite data be evaluated in the HERA as these samples are more likely to be representative of surface soil exposure.

DEQ acknowledges the section compares surface soil composite data with site-specific RBCs from Table 3-35a. DEQ believes Tables 35-a and 35-b further support the conclusion that TPH concentrations are underestimated in the Draft HERA Report. The draft report does not attempt to compare discrete and composite data. DEQ acknowledges NW Natural's concern regarding combining discrete and composite data in a risk evaluation. However, DEQ considers it appropriate to consider and discuss the discrete/composite data comparison in the uncertainty evaluation. For example, based on discrete samples collected from the former Tar Pond area, the average TPH concentration was 2,500 mg/kg, with total TPH analyses performed using one half the detection limits (Table 3-3a). This average value is likely an underestimate of average exposure based on the result from the composite surface sample. Composite surface soil samples were collected from locations previously sampled, and are likely to be good representations of average concentrations. There are three types of MGP residual materials sampled in the Former Tar Pond Area (Lampblack, Tar Pond, and Koppers), so it might be difficult to determine if any one composite sample or their average or some other approach would be appropriate for comparison with data from the whole area. However, a detailed evaluation is not needed as Table 3-35a indicates composite sample concentrations of TPH are all similar (19,390 mg/kg, 15,116 mg/kg, and 16,820 mg/kg) and all substantially above the average based on discrete samples (2,500 mg/kg).

Similarly, the composite surface soil sample from the Koppers Area (TPH concentration of 16,820 mg/kg) is substantially higher than the average TPH value of 3,100 mg/kg based on discrete samples (Table 3-6a).

DEQ requests that the comparisons summarized above for the Former Tar Ponds Area and the Koppers Area be presented in the uncertainty section of the Revised HERA Report. Based on DEQ's review of the Draft HERA Report, the discrepancy between average TPH concentrations in discrete samples and the TPH concentration detected in composite samples is not as great for the remaining human health exposure areas at the Gasco Site.

Section 3.5.1, Page 59, top paragraph. DEQ's comment to Section 3.4.1.5.1, Page 42 above applies here.

Section 3.6. The language of this section could be understood to call into question the agreements for reasonable maximum exposure (RME) scenarios, which normally would be evaluated in standard risk assessments. Examples are provided below. Text from the Draft HERA Report is extracted in quotes followed by DEQ's comments.

Regarding the use of sample NBCCS-002 (4.5 to 5-feet bgs) NW Natural states:

> "The sample depth and location underneath the groundwater treatment plant building indicates that exposures to occupational and construction workers are impossible and that the HI calculated for occupational and construction worker

> exposures for surface soils in the Office Area are based on inappropriate and unrealistic assumptions." (Page 64, second paragraph.)

DEQ disagrees with this statement as the use of the referenced sample was necessary because adequate data from shallower depths and nearby locations is not available. For example, MGP residuals similar to what was observed within the treatment plant building footprint could remain in-place north of the building. The uncertainty with this evaluation could be reduced if surface samples in this location were collected. DEQ will request this to be done to support the uplands FS. However, consistent with other DEQ comments, NW Natural and DEQ agreed to rely on available data and focused supplemental sampling combined with additional lines of evidence (e.g., presence of MGP residuals) to meet the needs of the HERA rather than conduct extensive site-wide sampling for COI lacking analytical data. Lack of available surface soil data is the reason it was necessary to estimate surface soil concentrations using deeper soil data.

The detected total cyanide concentration at the referenced sample location is nearly one percent. DEQ considers this data to indicate a potentially serious vapor intrusion problem. Subsurface soil data were not screened for vapor intrusion of cyanide because calculation of a screening level is problematic. Currently, DEQ's RBC spreadsheet considers cyanide to be an inorganic compound and therefore non-volatile. However, hydrogen cyanide is known to be highly volatile, and evidence is available to indicate this form of cyanide is present at the site. DEQ requests that the potential risk of exposure to occupational, construction, and excavation workers by hydrogen cyanide be acknowledged and discussed in the uncertainty section of the Revised HERA Report. DEQ further requests that hydrogen cyanide in vapor be carried forward into the FS for further evaluation.

In using samples collected from depth at Boring B-13 in the surface soil dataset NW Natural states:

> "The inclusion of results from this sample in the surface soil dataset results in an inaccurate EPC calculation for the determination of carcinogenic risks to occupational workers and construction workers." (Page 64, third paragraph. Italics in original text.)

Without adequate characterization and sufficient data for statistical evaluations, some agreed-upon subsurface soil samples were also included in the upland surface soil risk assessments. The above statement is for sample location B-13 in the LNG area. A surface soil sample from this location was not collected. No other samples near this location were fully evaluated. Sample B-11 (approximately 100 feet north of B-13) was analyzed for TPH at 0-0.2 feet, but not for PAHs. The TPH concentration of 1600 mg/kg at B-11 may not address PAH contamination at this location. The TPH concentration measured at B-13 was 3,700 mg/kg, even though the estimated revised TPH concentration is 77,000 mg/kg using a total PAH concentration of 29,000 mg/kg, composite sampling results, and the proportions method. Using data from a deeper sample from B-13 helps inform potential concentrations in the vicinity of this soil boring and other portions of the exposure area that were not adequately characterized for all relevant chemicals. The TPH EPC may be inaccurate because it underestimates risk.

The Draft HERA Report states that:

> "For the point-by-point screening of alluvial WBZ groundwater against Occupational Worker (Tap Water) RBCs, the majority of the COIs that exceeded this RBC were based on maximum detected (or non-detected) concentrations of COIs measured in these monitoring wells (Table E-3-24) and do not represent potential exposures to alluvial WBZ groundwater." (Page 65, Section 3.6.2, first paragraph.)

The use of maximum concentrations to evaluate the risk associated with many COI is a consequence of the statistical methods utilized to analyze the groundwater dataset. In other words, statistically, there was insufficient data available for an EPC other than the maximum concentration to be used or the calculated UCL exceeded a maximum concentration. Based on this information, maximum concentrations are appropriate to represent potential exposure in these cases.

The Draft HERA Report states that:

> "These subsurface soil composites were specifically selected to include soil intervals containing MGP residual observations and represent worst case soil conditions." (Page 65, Section 3.6.2, second paragraph.)

Subsurface composite samples were intentionally focused on MGP residuals not to represent worst case soil conditions but to provide a representative sample of the residual material for purposes of calculating site-specific MGP TPH RBCs. To the extent that workers in subsurface soil will not exclusively contact MGP residuals, the assumption is conservative, but subsurface composites are not the primary data used to evaluate risk.

The Draft HERA Report states that:

> "The additional uncertainties that have been identified in this uncertainty section describe specific assumptions that may compound the existing conservatism that is included in the HHRA, which results in risk estimates that are beyond the reasonable maximum exposures experienced by a receptor." (Page 70, top paragraph.)

DEQ disagrees with this statement. The agreements reached between NW Natural and DEQ that form the basis of the HERA Work Plan were developed to result in reasonable maximum exposures (RMEs) in the absence of full characterization of the nature and extent of contamination at the site. DEQ believes NW Natural's characterization of uncertainty to be inappropriate by discussing only those aspects of the HERA that would tend to overestimate risk. As indicated by DEQ, there are many important examples where underestimates of risk occur within the Draft HERA Report. DEQ requests that NW Natural remove the language in the Draft HERA Report that implies the Gasco Site HERA approach does not result in appropriate RMEs. In addition, DEQ requires that the uncertainty section(s) of the Revised HERA Report be substantially revised and NW Natural's characterization of uncertainty is objective and balanced (i.e., discusses sources of uncertainty that underestimate and overestimate risk). If acceptable language cannot be arrived at, DEQ may elect to identify additional appropriate uncertainties to be considered an addendum to the final HERA.

Section 3.6.3, Page 68, use of MGP residual observations as qualitative indications of human health risk. The Draft HERA Report states that:

> "There is uncertainty related to whether unacceptable risk would be present for the construction or excavation worker based on the more limited exposure duration and frequency assumptions for these receptors. While NW Natural agrees that MGP residual observations are indications of qualitative risks to occupational workers in the surface soil depth interval, there is uncertainty as to whether unacceptable risks would be present based on MPG residual observations for the construction work or excavation worker."

This statement is not supported by any actual data analysis in the HERA, such as a comparison of COI concentrations in samples with and without MGP residuals.

Boring locations where MGP residuals were identified are shown in Figure 3-2, which also shows areas of unacceptable risk. Except for construction workers in the LNG Containment Basin, the entire site represents unacceptable risk to construction and excavation workers. In addition, as discussed above and in the comment below, DEQ believes that MGP TPH risks are significantly underestimated using the methodology presented in the Draft HERA Report.

DEQ maintains that contact with MGP residuals constitutes an unacceptable risk to construction or excavation workers. All things being equal, the presence of MGP residuals will contaminate indoor air, outdoor air, and groundwater to a greater degree than if MGP residuals were not present. Consequently, exposure to MGP residuals or media mixed with MGP residuals will likely lead to higher human health risks. Thus, the overall assessments of risk for these pathways are biased low. The presence of MGP residuals and the associated risk will have to be further evaluated for purposes of scoping and planning of the FS.

Section 3.5.1, Page 56. DEQ's first comment in the "TPH Data Use and Analysis" section of this attachment regarding the exclusion of TPH from calculations of cumulative non-carcinogenic risk applies here.

Section 4.6, Uncertainty Analysis. The uncertainty section for the ecological risk assessment does not discuss any key uncertainties relative to data gaps for different COIs in different media and/or COIs not included in Table 2-1. The uncertainty section should be revised to incorporate a balanced discussion of the uncertainties associated with COIs in the available data and risk analysis. In addition, similar to DEQ's comment on Section 3.4.4.2, Page 52 above, surface composite data can be used as another line of evidence in the risk assessment for surface soil risk and add context to the discussion of uncertainty. Examination of this data showss that for Total LPAHs and HPAHs the conclusions in the risk assessment would be the same, and the incorporation of deeper soil data to supplement the data collected from 0-0.2 feet was therefore a reasonable approach to deal with uncertainties in the representation of the dataset to the full 0 to 3 feet exposure unit.

HERA ISO-CONCENTRATION FIGURES

Section 5, Page 98 and Figures 5-1 to 5-3. The draft HERA report includes "iso-contour" figures (Figures 5-1 through 5-3) for soil that are based on calculated point-by-point EPCs divided by screening levels (SL). The conclusions of the risk assessment focus on these EPC/SL ratios. Although DEQ acknowledges that summary figures of relative risk are helpful to visualize the extent of unacceptable concentrations at the site, Figures 5-1 to 5-3 are inappropriate depictions of risk. For human health, the figures combine excess cancer risks and hazard indices to generate summed EPC/SL ratios that have no quantitative meaning related to risk. For cumulative risk, the common and preferred method is to present contours of excess cancer risk and hazard indices in two separate figures. For carcinogens, it is more important to present contours of concentration or excess risk for each individual carcinogen. This is because the acceptable risk level of 1×10^{-6} that applies to individual carcinogens is generally more restrictive than the cumulative acceptable risk level of 1×10^{-5} that applies to all carcinogens.

The Draft HERA Report indicates that, "As an alternative method for presenting this information, with DEQ's concurrence, iso-contours based on calculated point-by-point EPC/screening level (SL) ratios were prepared." This is incorrect. DEQ did not provide concurrence for using EPC/SL ratio figures. DEQ requested the presentation of iso-concentration contours maps in the risk assessment. Typically, figures focus on the primary chemicals of concern for a site based on the findings of the risk assessment. NW Natural agreed to include soil and groundwater iso-concentration maps in the Draft HERA report. NW Natural submitted iso-concentration figures for soil on December 3, 2013, and groundwater iso-concentration contour maps on January 15, 2014 separately from the Draft HERA Report. The maps were prepared without DEQ's involvement. DEQ requests that in addition to EPC/SL iso-contour figures, the Revised HERA Report include soil and groundwater iso-concentration maps per our comments below.

DEQ requests that soil iso-concentration maps be revised consistent with following comments:

- Add figures for additional COCs including TPH (concentrations adjusted per DEQ comments) and ethylbenzene;
- Add and label contours associated with applicable human health RBCs and ecological SLVs on each figure;
- Revise the notes to document the sampling locations and data shown (e.g., soil data use tables) and Note #5 to indicate the figures are intended to support uplands FS planning; and
- Incorporate available information from the Siltronic site to depict the distribution of the COCs at least to the property line as figures appear to truncate data and artificially restrict COC occurrence to the Gasco Site.

DEQ requests that groundwater iso-concentration maps be revised consistent with the following comments:

- Add figures for additional COCs including benzene (Fill WBZ), Total PAH Toxic Unit FCV, aluminum, iron, and vanadium (figures for TPH to be prepared after June 2014 sampling event);
- Add and label contours associated with applicable human health RBCs and ecological SLVs on each figure;

- Revise the notes to document the sampling locations and data shown and revise Note #5 to indicate the figures have been prepared to support uplands FS planning;
- Incorporate groundwater data from the northern portion of the Siltronic property to depict the distribution of COCs at least to the property line as figures apparently truncate data and artificially restrict COC occurrence to the Gasco Site;
- Add monitoring wells MW-6-32, MW-11-32, MW-13-30, and MW-18-30 to iso-concentration maps for the Fill WBZ; and
- Do not include data from monitoring well MW-15-66 in the plots as DEQ has previously identified the data from MW-15-50 as being representative of the Alluvium WBZ at this location.

The submission of these revised maps will provide a very helpful tool for visually depicting the key COCs present in soil and groundwater and where on site and at what concentrations COCs occur. The figures will also support and FS scoping and planning process.

Regarding Fill WBZ, NW Natural elected not to include certain monitoring wells on the iso-concentrations maps, including MW-6-32, MW-11-32, MW-13-30, and MW-18-30. DEQ understands the figures were not included because of the presence of DNAPL. DEQ considers the groundwater data from these omitted monitoring wells to be more representative of site conditions than removing them from consideration. Excluding them from the figures effectively indicates groundwater contamination does not occur at these locations, which would be an inaccurate and misleading conclusion. Consequently, DEQ requires these monitoring wells to be included in iso-concentration maps of the Fill WBZ. NW Natural should be advised that groundwater data from the monitoring wells to be installed along the Gasco/U.S. Moorings property line (MW-39F, MW-40F, and MW-41F) will be used to fill in the data gaps for the Fill WBZ in the northern portion of the Gasco Site.

Table 4 - Examples of 95%-UCL Used as the EPC Where Pro-UCL Recommended the 97.5%-UCL

Risk Exposure Area	Group	Chemical Name	CAS Number	Units	COI Flag	Sample Count	Count of Detects	Frequency of Detection (%)	Minimum Detected Result	Maximum Detected Result	Maximum Non-detected Result	Maximum Overall Result	Maximum Overall Result Detect Flag	ProUCL 90% UCL	ProUCL Statistics	EPC	EPC Detect Flag	EPC Statistic	Comparison	
																			97.5UCL value	97.5UCL/ 95UCL Ratio
Surface Soil																				
Former Spent Oxide Area	CONV	Cyanide, total	57-12-5	mg/kg	Yes	19	17	89	0.222	61	0.5	61	Y	34.31	95% KM (Chebyshev) UCL	34.31	Y	UCL	43.61	1.27
Former Spent Oxide Area	PAH	Benz(a)anthracene	56-55-3	µg/kg	Yes	25	23	92	70	574000	60	574000	Y	151460	95% KM (Chebyshev) UCL	151460	Y	UCL	199482	1.32
Former Spent Oxide Area	PAH	Benzo(a)pyrene	50-32-8	µg/kg	Yes	25	22	88	100	767000	60	767000	Y	203790	95% KM (Chebyshev) UCL	203790	Y	UCL	267757	1.31
Former Spent Oxide Area	PAH	Dibenz(a,h)anthracene	53-70-3	µg/kg	Yes	25	20	80	62	159000	65	159000	Y	43764	95% KM (Chebyshev) UCL	43764	Y	UCL	57616	1.32
Former Spent Oxide Area	PAH	Indeno(1,2,3-c,d)pyrene	193-39-5	µg/kg	Yes	25	23	92	90	738000	60	738000	Y	178214	95% KM (Chebyshev) UCL	178214	Y	UCL	235432	1.32
Former Tar Pond Area	PAH	Benzo(a)pyrene	50-32-8	µg/kg	Yes	42	41	98	100	1170000	13.4	1170000	Y	297837	95% KM (Chebyshev) UCL	297837	Y	UCL	369493	1.24
Former Tar Pond Area	PAH	Chrysene	218-01-9	µg/kg	Yes	42	41	98	66	1480000	13.4	1480000	Y	365409	95% KM (Chebyshev) UCL	365409	Y	UCL	457606	1.25
Former Tar Pond Area	PAH	Indeno(1,2,3-c,d)pyrene	193-39-5	µg/kg	Yes	42	40	95	100	522000	63	522000	Y	160925	95% KM (Chebyshev) UCL	160925	Y	UCL	197629	1.23
Former Tar Pond Area	PAH	Naphthalene	91-20-3	µg/kg	Yes	42	35	83	88	27600000	670	27600000	Y	4493617	95% KM (Chebyshev) UCL	4493617	Y	UCL	5862808	1.30
LNG Operations Area	PAH	Benz(a)anthracene	56-55-3	µg/kg	Yes	11	9	82	120	564000	50	564000	Y	278170	95% KM (Chebyshev) UCL	278170	Y	UCL	375683	1.35
LNG Operations Area	PAH	Benzo(a)pyrene	50-32-8	µg/kg	Yes	11	9	82	185	942000	50	942000	Y	464653	95% KM (Chebyshev) UCL	464653	Y	UCL	627511	1.35
LNG Operations Area	PAH	Benzo(b)fluoranthene	205-99-2	µg/kg	Yes	11	9	82	135	752000	50	752000	Y	371501	95% KM (Chebyshev) UCL	371501	Y	UCL	501365	1.35
LNG Operations Area	PAH	Chrysene	218-01-9	µg/kg	Yes	11	9	82	160	811000	50	811000	Y	399991	95% KM (Chebyshev) UCL	399991	Y	UCL	540219	1.35
LNG Operations Area	PAH	Dibenz(a,h)anthracene	53-70-3	µg/kg	Yes	11	8	73	85	89900	50	89900	Y	44762	95% KM (Chebyshev) UCL	44762	Y	UCL	60389	1.35
LNG Operations Area	PAH	Indeno(1,2,3-c,d)pyrene	193-39-5	µg/kg	Yes	11	9	82	55	519000	50	519000	Y	256563	95% KM (Chebyshev) UCL	256563	Y	UCL	346153	1.35
LNG Operations Area	PAH	Naphthalene	91-20-3	µg/kg	Yes	11	5	45	87	13000000	50	13000000	Y	6673358	95% KM (Chebyshev) UCL	6673358	Y	UCL	9049470	1.36
Former Retorts/Koppers Area	PAH	Benz(a)anthracene	56-55-3	µg/kg	Yes	21	19	90	120	1490000	50	1490000	Y	414533	95% KM (Chebyshev) UCL	414533	Y	UCL	549433	1.33
Former Retorts/Koppers Area	PAH	Benzo(a)pyrene	50-32-8	µg/kg	Yes	21	18	86	480	2020000	50	2020000	Y	554645	95% KM (Chebyshev) UCL	554645	Y	UCL	736752	1.33
Former Retorts/Koppers Area	PAH	Chrysene	218-01-9	µg/kg	Yes	21	19	90	140	1650000	50	1650000	Y	457636	95% KM (Chebyshev) UCL	457636	Y	UCL	606017	1.32
Former Retorts/Koppers Area	PAH	Dibenz(a,h)anthracene	53-70-3	µg/kg	Yes	21	17	81	150	500000	1000	500000	Y	130387	95% KM (Chebyshev) UCL	130387	Y	UCL	175324	1.34
Former Retorts/Koppers Area	PAH	Indeno(1,2,3-c,d)pyrene	193-39-5	µg/kg	Yes	21	17	81	435	1460000	1000	1460000	Y	382669	95% KM (Chebyshev) UCL	382669	Y	UCL	513703	1.34
Subsurface Soil																				
Former Spent Oxide Area	PAH	Benz(a)anthracene	56-55-3	µg/kg	Yes	29	26	90	70	574000	60	574000	Y	150566	95% KM (Chebyshev) UCL	150566	Y	UCL	195883	1.30
Former Spent Oxide Area	PAH	Benzo(a)pyrene	50-32-8	µg/kg	Yes	29	25	86	50	767000	60	767000	Y	203431	95% KM (Chebyshev) UCL	203431	Y	UCL	264093	1.30
Former Spent Oxide Area	PAH	Dibenz(a,h)anthracene	53-70-3	µg/kg	Yes	29	22	76	62	159000	65	159000	Y	43223	95% KM (Chebyshev) UCL	43223	Y	UCL	56227	1.30
Former Spent Oxide Area	PAH	Indeno(1,2,3-c,d)pyrene	193-39-5	µg/kg	Yes	29	25	86	90	738000	60	738000	Y	178948	95% KM (Chebyshev) UCL	178948	Y	UCL	233380	1.30
Former Tar Pond Area	PAH	Benz(a)anthracene	56-55-3	µg/kg	Yes	52	49	94	23.1	1240000	50	1240000	Y	239114	95% KM (Chebyshev) UCL	239114	Y	UCL	297532	1.24
Former Tar Pond Area	PAH	Naphthalene	91-20-3	µg/kg	Yes	52	40	77	88	27600000	3350	27600000	Y	3864568	95% KM (Chebyshev) UCL	3864568	Y	UCL	4981351	1.29
LNG Operations Area	PAH	Benz(a)anthracene	56-55-3	µg/kg	Yes	13	11	85	28	564000	50	564000	Y	234791	95% KM (Chebyshev) UCL	234791	Y	UCL	317045	1.35
LNG Operations Area	PAH	Benzo(a)pyrene	50-32-8	µg/kg	Yes	13	11	85	32	942000	50	942000	Y	392195	95% KM (Chebyshev) UCL	392195	Y	UCL	529572	1.35
LNG Operations Area	PAH	Dibenz(a,h)anthracene	53-70-3	µg/kg	Yes	13	9	69	85	89900	50	89900	Y	37907	95% KM (Chebyshev) UCL	37907	Y	UCL	51137	1.35
LNG Operations Area	PAH	Indeno(1,2,3-c,d)pyrene	193-39-5	µg/kg	Yes	13	11	85	27	519000	50	519000	Y	216626	95% KM (Chebyshev) UCL	216626	Y	UCL	292220	1.35
LNG Operations Area	PAH	Naphthalene	91-20-3	µg/kg	Yes	13	6	46	87	13000000	50	13000000	Y	5587739	95% KM (Chebyshev) UCL	5587739	Y	UCL	7572766	1.36
Former Retorts/Koppers Area	PAH	Benz(a)anthracene	56-55-3	µg/kg	Yes	28	25	89	120	2450000	50	2450000	Y	612487	95% KM (Chebyshev) UCL	612487	Y	UCL	801042	1.31
Former Retorts/Koppers Area	PAH	Benzo(a)pyrene	50-32-8	µg/kg	Yes	28	24	86	480	2780000	50	2780000	Y	736388	95% KM (Chebyshev) UCL	736388	Y	UCL	961979	1.31
Former Retorts/Koppers Area	PAH	Dibenz(a,h)anthracene	53-70-3	µg/kg	Yes	28	21	75	150	500000	1000	500000	Y	138502	95% KM (Chebyshev) UCL	138502	Y	UCL	182528	1.32
Former Retorts/Koppers Area	PAH	Indeno(1,2,3-c,d)pyrene	193-39-5	µg/kg	Yes	28	24	86	50	1800000	1000	1800000	Y	484869	95% KM (Chebyshev) UCL	484869	Y	UCL	637246	1.31
Former Retorts/Koppers Area	PAH	Naphthalene	91-20-3	µg/kg	Yes	28	16	57	81	8300000	500	8300000	Y	1621808	95% KM (Chebyshev) UCL	1621808	Y	UCL	2187811	1.35

ATTACHMENT 2

Additional DEQ Comments
Human Health and Ecological Risk Assessment (HERA) Report
NW Natural GASCO Site, Portland, Oregon
Dated October 24, 2013

DEQ comments submitted May 8, 2014

These comments on the Draft HERA Report apply to the HERA (and Siltronic MGP RI) as indicated, and are provided as observations for the administrative record only. DEQ does not require written responses to these comments.

Section 1.1. NW Natural indicates the Draft HERA Report is a screening level risk assessment and that screening levels used in the HERA are based on "standard default risk-based screening levels." NW Natural then concludes that using the default screening criteria produces a conservative determination of site risk. For clarification, use of default of screening levels are not conservative if the assumptions used to calculate the default values are relevant to the site exposure pathways and receptors. DEQ considers the default screening values to be generally applicable to the Gasco Site. As discussed in Attachment 1, the exceptions are the vapor intrusion, outdoor air volatilization, and leaching to groundwater pathways where default RBC assumptions are not conservative enough for use at the Gasco Site.

Section 2.1.2. Section 2.1.2 provides an overview of the chronology of risk assessment documents prepared by NW Natural for the Gasco Site. DEQ has not reviewed the section and is not providing comments.. As DEQ has indicated previously, the current HERA process began with DEQ's issuance of our March 10, 2010 letter reviewing the RI Report and the 12/04 Risk Assessment.

NW Natural states that, "Management resolution of issues related to the completion of this HERA Report and mutual agreement between DEQ and NW Natural to move forward with the preparation of this HERA Report occurred February 23, 2012." DEQ acknowledges that agreements were reached on certain issues important to the HERA during the February 23, 2012 meeting, however the approach to preparing the Draft HERA Report, and resolution of key technical issues therein involved a long process of many meetings, discussions, and numerous exchanges of correspondence between NW Natural and DEQ since that meeting.

Section 2.1.3.3.3. Basalt Status. In reviewing information regarding the beneficial use of groundwater in Alluvium WBZ, DEQ reiterates our previous requests for NW Natural to develop an approach for locating and determining the status of the historic basalt water supply well on the Gasco Site. DEQ will follow-up on this matter in a separate letter.

Section 2.4.2, Pg. 21. The second bullet near the bottom of the page indicates that in cases where all analytes of a totals analysis were non-detect, the concentration for the totals concentration was based on one-half the highest MRL. Under these circumstances the total concentration

should be represented by the sum of one-half of all the collective MRLs rather than simply one-half the highest individual MRL. Please follow this protocol in future data reports, including the Siltronic MGP RI and/or HERA.

Section 2.5.1, Page 25, last paragraph/Section 3.2, Page 30, process to determine exposure point concentrations. For Theil-Sen analysis, the 90% upper confidence band values from the last (i.e. most recent) sampling event were selected as the EPCs. For most locations where Theil-Sen values were calculated, the last samples were collected during September or October 2012. However, there are cases where the most recent samples were collected as early as 2006. Using the Theil-Sen values from 2006 to represent current groundwater condition is questionable in cases where data trends are present at the monitoring well location. This is also an issue for the UCL values calculated from wells where more recent data is unavailable. DEQ acknowledges that this situation could apply to other monitoring wells exhibiting increasing or decreasing data trends. This comment is applicable to the groundwater data analysis NW Natural will be conducting during preparation of the Siltronic MGP RI and/or HERA.

Section 2.5.2.1, Page 27, Calculation of Exposure Point Concentrations, Groundwater. The Draft HERA Report states that "...non-detects were replaced with the minimum non-detect result (USEPA, 2009). Consistent with ProUCL guidance (USEPA 2010b), data treatment was not applied to non-detects prior to calculation of 90%UCLs." However, more specific information regarding non-detect data treatment for non-detect results is needed. Based on DEQ's review of the EPC calculations and data treatment, the following was noted.

In the Draft HERA Report, the minimum Method Detection Limit (MDL) of an entire dataset (here a dataset refers to the data for a given compound at a given monitoring well) is used for non-detect data in the Mann-Kendall and Thiel-Sen evaluations, rather than the maximum Reporting Detection Limit (RDL) that was used in the UCL calculations. Based on DEQ's communications with Anchor QEA in a teleconference on December 6, 2013, DEQ understands that the Draft HERA follows the USEPA Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance (USEPA, 2009), which states that "non-detects can be treated by assigning them a common value lower than any of the detected measurements."

USEPA guidance does not specifically recommend using the minimum MDL. Although DEQ acknowledges that for the Gasco Site HERA substituting non-detects using minimum MDL or any other value that is lower than any of the detected measurements produces the same Mann-Kendall results, it is our opinion that using minimum MDL in the Theil-Sen evaluation can lead to an overestimation or underestimation of the exposure point concentrations depending on the situation. This is because in the Theil-Sen evaluation, not only is the relative order of the values important (as in the Mann-Kendall analysis), but the range of absolute values also affect the Theil-Sen confidence band. By substituting non-detects with the minimum MDL, rather than the maximum RDL or the MDL below the lowest detected value, the trend line can be biased either low or high, depending on the locations and where the non-detected values fall in a particular data series. DEQ requests that the future Siltronic MGP RI and HERA use a common non-detect value close to but not equal to the minimum detected concentration (e.g., common non-detect value equal to 95% of the minimum detected concentration).

DEQ understands from the information presented in this section that for increasing groundwater concentration trends, if the upper confidence band was greater than the maximum detected value, NW Natural's approach was to use the maximum detected value in the risk assessment. DEQ disagrees with this approach and considers it reasonable to presume, if not expect, that a future value could exceed the current maximum. DEQ requests that the future Siltronic RI and/or HERA use the upper confidence band value in these situations.

Section 3.4.1.2.1, Page 37. DEQ notes that the estimated risk of exposure to a construction worker from thallium in soil was due to a high detection limit. Risk levels thallium in soil based on high detection limits also occurred in other areas of the Site. Based on the results of Gasco Site HERA, DEQ is not requesting NW Natural to respond to this comment. DEQ does request that NW Natural discuss the reason for high detection limits and the potential effect on data use and analysis in the future Siltronic MGP RI and HERA if a similar situation(s) arises.

Section 3.4.4.2, Page 52 (Subsurface Soil Composites). The primary purpose of subsurface soil composite sampling was to collect samples representative of MGP residuals and use the analytical results to calculate site-specific RBCs for MGP TPH. Consequently, screening subsurface soil composite sample results against the RBCs would not necessarily be representative of average exposure to subsurface soil except in areas of the Gasco Site where the distribution of MGP residuals occupies a considerable portion of the depth interval of interest. The former Tar Ponds Area represents one such area and the TPH concentrations detected in composite subsurface samples may represent a reasonable worst-case for evaluating exposure to construction and/or excavation workers. This comment is being provided as it applies to areas of the Siltronic Site such as the former effluent pond area and could be relevant to the future Siltronic MGP RI and HERA.

MPs - Section 3.4.4.3, 2nd paragraph. NW Natural indicates that, "...very few of the existing samples contain the necessary TPH-Dx and TPH-Gx data to sum and provide an appropriate estimate of TPH concentrations because those parameters were added by DEQ after it had deemed the RI data complete." DEQ disagrees as our March 10, 2010 letter commenting on the RI Report identified the lack of site-specific TPH data as a data gap that required additional evaluation going forward, including sampling and analysis to characterize composition.

Section 3.6.3, Page 68, DEQ direction to use lowest human health screening levels. NW Natural states that DEQ directed the use of the lower of DEQ RBCs or EPA RSLs as the screening value in the HERA. DEQ provided no such direction to NW Natural. Consistent with DEQ guidance, the agreed-upon approach for this project was to use DEQ RBCs as screening values, and in the absence of RBCs, EPA RSLs were to be used. DEQ considers this approach to be appropriate, being neither over-protective nor under-protective. Tables 3-8 through 3-11 explicitly show which screening values were selected based on the agreed-to approach. The tables show that default DEQ RBCs were selected as screening values even if lower EPA RSL values existed, and that EPA RSL values were selected as screening values even if (in the absence of default RBCs) lower site-specific RBCs were calculated.

Tables 3-1 to 3-6, Gasco Upland Human Health Summary Statistics (see also Appendix D, ProUCL Output Files and Groundwater Evaluation). Based on DEQ's review of the ProUCL

calculations, inappropriate selection of UCL types as compared to recommendations by ProUCL occurred in some cases. For the following chemicals, ProUCL recommended both KM(t) and Bootstrap UCL types, with a warning that the Bootstrap method may not be reliable due to limited sample size:

- Arsenic in the FAMM Area surface soil;
- Benzene in the Former Tar Pond area surface soil;
- Benzene, mercury, and thallium in the Former Spent Oxide Area subsurface soil;
- Fluorene in the FAMM Area subsurface soil;
- Arsenic in the Former Tar Pond Area subsurface soil;
- Acenaphthene in the Office Area subsurface soil; and
- 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and toluene in the Retort-Koppers Area subsurface soil.

In these cases, the UCL recommended by the Bootstrap method was selected, but the selection was not qualified and/or discussed in the context of the ProUCL warning. DEQ requests that the Revised HERA Report explain the UCL selection and potential limitations using the Bootstrap method. In addition, for nickel in the Office Area in surface soil, the 90% "Approximate Gamma" UCL (used when n > 40) type was selected for compounds with sample sizes < 40.

DEQ requests that this comment be carried forward and applied during preparation of the future Siltronic Site HERA.

Tables 3-12 through 3-17. Screening values for soil and groundwater are presented in Tables 3-8 to 3-11. However, there are chemicals presented in Tables 3-12 to 3-17 for which screening values were not developed (i.e., o-xylene, m-xylene, p-xylene, and m,p-xylenes [xylene isomers]). DEQ simplified our RBCs to cover total xylenes. For purposes of the HERA, NW Natural should have used the RBC for total xylenes to screen data for each of the xylene isomers. DEQ requests that this comment be applied to the data screening NW Natural will conduct for the future Siltronic MGP RI and HERA.

Section 4.3, Risk Screening. The Draft HERA appears to have summed detected concentrations of o-xylene and m,p-xylene then screened the resulting total concentrations against the Tier II SLV for total xylenes. This approach is incorrect because as shown in Table 3 of Attachment 1, the SLV for total xylenes should be used to screen individual isomer concentrations and each result should be incorporated into screening tables. DEQ requests this protocol be used for the future Siltronic MGP RI and HERA data screening.

Section 4.3.2, Cyanide. DEQ did not approve the use of the NW Natural's alternative cyanide screening value because hydrogen cyanide was measured in the working space during on-site drilling activities. DEQ considers field measurements performed on the Gasco site to be affirmative evidence of the presence of hydrogen cyanide in site soils.

Section 4.5.1, Cumulative Ecological Risks. Based on DEQ's review, it appears NW Natural averaged hazard indices (HIs) for receptors evaluated on a point-by-point basis. DEQ considers the averaging of hazard indices calculated from boring locations within each exposure area to be

inappropriate. DEQ requests that NW Natural evaluate point-by-point HIs on a location-specific basis in the future Siltronic MGP HERA.

Appendix A. Appendix A includes a revised version of the "Work Plan, Human Health and Ecological Risk Assessment, NW Natural Gasco Site, DEQ February 13, 2013 Comments and NW Natural Response" (Response Matrix). DEQ considers Appendix A to be an incomplete record of the final approved HERA workplan. The initial version of the matrix shown in Attachment A was provided to DEQ during a meeting on March 6, 2013 in response to DEQ's February 28, 2013 comments letter on the HERA Work Plan. DEQ's March 15, 2013 e-mail provides comments on the initial version of the matrix. For completeness, copies of our February 28, 2013 letter and March 15, 2013 e-mail should be included in Appendix A of the Revised HERA Report.