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January 31, 2025

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via electronic delivery (email)

**Re: DEQ Comments on the Gasco OU – IRAM ISS Prism Design Basis
Former Gasco Manufactured Gas Plant Operable Unit
Portland, Oregon
ECSI# 84 and # 183**

Bob Wyatt:

The Oregon Department of Environmental Quality (DEQ) reviewed the *Gasco OU – IRAM ISS Prism Design Basis*¹ (ISS Design Basis) for the Former Gasco Manufactured Gas Plant Operable Unit (Gasco OU) submitted by Anchor QEA on behalf of NW Natural. The ISS Design Basis was prepared under the Voluntary Agreement for Remedial Investigation/Feasibility Study, as amended^{2,3,4}.

DEQ's interim removal action measure (IRAM) decision letter⁵ identifies the required IRAM elements, which include in-situ stabilization and solidification (ISS) of upland dense non-aqueous phase liquid (DNAPL) in a zone adjacent to the shoreline beneath the current hydraulic control and containment (HC&C) system alignment (herein referred to as the "nearshore upland ISS area of interest"). The ISS Design Basis summarizes NW Natural's approach for delineating preliminary ISS prisms within the nearshore upland ISS area of interest. This approach appears to rely primarily on interpolations of DNAPL within various depth intervals that NW Natural developed using available historical DNAPL observations, including DNAPL accumulation in wells, measured DNAPL saturation values, TarGOST® data, and soil boring log descriptions.

DEQ assumes that NW Natural submitted the ISS Design Basis to seek our approval of the ISS prisms in advance of submitting the IRAM BODR. We understand that the IRAM design will necessarily include establishing the ISS prisms within the nearshore upland ISS area of interest. However, DEQ did not request the ISS Design Basis in advance of the IRAM BODR and we consider it premature to review and approve the ISS prisms until after NW Natural completes additional DNAPL delineation. Our comments herein identify examples of DNAPL delineation data gaps that should be addressed during the IRAM pre-design investigation. In addition to DNAPL delineation within the nearshore upland ISS area of interest, our comments are intended to clarify our expectations for ISS prism development during the design. DEQ is not requesting a revised ISS Design Basis. NW Natural should develop ISS prisms for DEQ approval as part of the IRAM design after completing the pre-design investigation.

¹ Anchor QEA. 2024. Gasco OU – IRAM ISS Design Basis, Gasco OU, ECSI No. 84. Prepared for NW Natural. November 22.

² DEQ. 1994. Voluntary Agreement for Remedial Investigation/Feasibility Study. DEQ No. WMCVC-NWR-94-13. August 8.

³ DEQ. 2006. First Addendum to Voluntary Agreement for Remedial Investigation/Feasibility Study. DEQ No. WMCVC-NWR-94-13. July 19.

⁴ DEQ. 2016. Second Addendum to Voluntary Agreement for Remedial Investigation/Feasibility Study. DEQ No. WMCVC-NWR-94-13. October 11.

⁵ DEQ. 2024. Letter to Bob Wyatt (NW Natural), Regarding: Gasco OU Interim Removal Action Decision, Former Gasco Manufactured Gas Plant Operable Unit, Portland, Oregon, ECSI #84 and #183. July 3.

General Comments

- 1) The ISS Design Basis evaluation primarily discusses the methodology for interpolating and mapping DNAPL developed for the *Feasibility Study Report*⁶ (Gasco OU FS). The series of DNAPL distribution figures illustrate areas where DNAPL is likely to be encountered across the Gasco OU, but do not have the resolution necessary to establish design-level ISS prisms. NW Natural should develop a 3-dimensional (3D) DNAPL model within the upstream nearshore upland ISS area of interest and the surrounding area to support ISS prism design. In addition, future design deliverables should use the 3D model and cross sections, both parallel and normal to the shoreline, to illustrate DNAPL extent and proposed ISS prisms.
- 2) The ISS prisms exclude certain DNAPL observations without the necessary technical support. DEQ has the following comments:
 - a) In the *Source Control Interim Remedial Action Measure Concept and Agreement to Move into Design*⁷ (IRAM Concept) letter, NW Natural proposed using a multiple lines of evidence (LOE) approach to evaluate retention or elimination of an area containing DNAPL from ISS prisms. In our comments on the IRAM Concept letter, DEQ clarified that: 1) we have not approved exclusion of any DNAPL from the ISS prisms, and 2) NW Natural may present a LOE evaluation justifying exclusion of any new or existing DNAPL observations from the ISS prisms for DEQ approval in future design deliverables. Based on the information provided in the ISS Design Basis, DEQ does not approve exclusion of any existing DNAPL observations from the ISS prisms at this time. NW Natural may present a LOE evaluation proposing exclusion of individual DNAPL observations from the ISS prisms in future design deliverables, but only after filling necessary DNAPL data gaps and developing the 3D DNAPL model and cross sections. Any such LOE evaluation should focus on assessing whether ISS treatment of individual DNAPL observations would or would not have a benefit towards achieving IRAM source control and removal action objectives (SC/RAOs) relative to cost. While not listed in the IRAM Concept letter, DEQ considers the potential for DNAPL to impact dissolved phase groundwater concentrations as a relevant LOE for considering exclusion of a DNAPL observation from the ISS prisms.
 - b) The ISS Design Basis appears to rely on DNAPL mobility classifications (i.e., potentially mobile, transitional, residual) developed for the Gasco OU FS as a primary basis for the preliminary ISS prisms. Specifically, the ISS prisms exclude areas interpolated as containing residual DNAPL from the ISS prisms. These DNAPL mobility classifications do not correspond to achieving the IRAM SC/RAOs or to establishing the feasible or practical limits for DNAPL treatment with ISS. DEQ does not approve using DNAPL mobility classifications as a basis for defining the ISS prisms. Consistent with our previous discussions, excluding any DNAPL (residual or otherwise) from the ISS prisms is subject to DEQ approval and requires a supporting LOE evaluation that demonstrates that ISS treatment would not have a benefit towards achieving IRAM SC/RAOs relative to cost.
- 3) DEQ approval of the ISS prisms requires complete delineation of DNAPL within the upstream nearshore upland ISS area of interest and a robust understanding of DNAPL extent in three dimensions. DEQ has identified several potential data gaps related to DNAPL delineation and

⁶ Anchor QEA, Ede Environmental, LLC, and Severson Environmental Services, Inc. 2024. Feasibility Study Report, Gasco OU, ECSI No. 84. Prepared for NW Natural. December 16.

⁷ Ede Environmental, LLC. 2024. Letter to Wes Thomas (DEQ), Subject: Source Control Interim Remedial Action Measure Concept and Agreement to Move into Design, NW Natural Gasco Site, 7900 NW St. Helens Road, Portland, Oregon. May 9.

limitations with relying on DNAPL interpolations as the ISS design basis. We request that NW Natural meet with us to discuss data gaps in more detail to inform the pre-design investigation scope before submitting the IRAM BODR. Below are examples of (but not a complete list of) of some of these potential data gaps.

- a) Soil borings used for DNAPL interpolations were collected between 1995 and 2024. DEQ questions the validity of some of the older borings, particularly where DNAPL migration may have been influenced by groundwater advection or operation of the HC&C system (i.e., in areas where well logs did not observe DNAPL, but DNAPL was observed in nearby borings advanced at later dates and/or entry into nearby wells was observed later). For example, within Zone 1, DNAPL was not observed in B-01 (advanced in 1998), but potentially mobile DNAPL was later observed in nearby borings (PW-06L, PW-06U, GST-06) and DNAPL entry into the PW-06L well screen was observed in 2024. DEQ questions whether the B-01 boring log remains temporally relevant for the purposes of ISS delineation.
 - b) In areas with lower data density, the DNAPL interpolation assumptions incorrectly imply the absence of DNAPL (or presence of residual DNAPL). For example, for Zones 1 and 2 in the 0-25 feet below the base of the Fill WBZ interval, potentially mobile DNAPL was observed in MW-38U, PW-01-80, and PW-05. However, the DNAPL interpolation assumptions suggest a larger footprint of residual DNAPL between these points (that NW Natural incorrectly excludes from the ISS prisms – Refer to General Comment #2b). DEQ does not believe that there are adequate data within this area to determine the potential nature and extent of DNAPL to the extent necessary to support the ISS prism delineations. Additional data are needed in this area, or NW Natural should include the entire area between these points mapped as residual DNAPL within the ISS prisms.
 - c) DNAPL observations are not always laterally delineated. For example, the ISS depth for a large portion of Zone 2 is based on DNAPL observations in the 25-50 feet below the base of the Fill WBZ interval. Within this depth interval, DNAPL observations in PW-13U are not delineated in the riverward direction.
 - d) DNAPL observations are not always vertically delineated. For example, in Zone 4, ISS depths are largely based on the 50-75 foot below the Fill WBZ interval, with a large zone between B-04B, PW-03-85, and the TG-PW11U clusters mapped as potentially mobile or transitional DNAPL. However, deeper intervals within this area lack the data necessary to justify terminating ISS treatment within the 50-75 foot below the Fill WBZ interval.
 - e) The relatively large interpolated residual DNAPL footprint in the Alluvium WBZ that coincides with the currently estimated upstream limit of the deep ISS barrier wall reflects a higher degree of uncertainty. More robust lateral delineation of DNAPL along the Siltronic shoreline is necessary to support the IRAM design to define the upstream boundary of the nearshore upland ISS area of interest.
 - f) DEQ requires additional DNAPL delineation near the Fab 1 building upgradient of the current nearshore upland ISS area of interest to design the ISS prisms and to determine the actions necessary to achieve the SC/RAOs.
- 4) In addition to the distribution of DNAPL within the upstream nearshore upland ISS area of interest, DEQ believes that other engineering or design factors are also relevant to the ISS prism design. For example, the proposed ISS prisms result in small gaps of areas with no ISS treatment surrounded by

areas that will be treated (notably in Zones 1 and 2). Conversely, there are very small and isolated ISS prisms (notably in Zones 3 and 4). DEQ believes it is unlikely that these small gaps in treatment or small and isolated ISS prisms are practical to construct and could create challenges with hydraulic control performance and achievement of SC/RAOs. The IRAM design should consider these engineering factors when proposing a revised ISS prism layout.

Specific Comments

- 1) **Section 2, Nearshore Upland ISS Area of Interest.** The second paragraph describes the upstream and downstream boundaries of the nearshore upland ISS area of interest. These boundaries should be adjusted, as needed, to encompass all DNAPL along the top of the riverbank. Specifically, the nearshore upland ISS area of interest should include PDI-137 and PDI-219 RAB to the northwest, and TG-7Sb to the southwest unless the pre-design investigation results show that DNAPL is absent in these areas.
- 2) **Section 3, ISS Prism Delineation.** DEQ has the following comments:
 - a) This paragraph states that the preliminary ISS prisms were conservatively established using multiple LOEs. Since the ISS prisms exclude DNAPL observations, DEQ disagrees that they were conservatively established.
 - b) DEQ conveyed the need for the IRAM to include ISS treatment of residual DNAPL, unless otherwise approved by DEQ based on a LOE evaluation, during both the February 20, 2024 and April 11, 2024 meetings.
- 3) **Section 3.2.1, DNAPL Interpolation.** DEQ has the following comments:
 - a) This section summarizes DNAPL saturation levels and TarGOST %RE values corresponding to various DNAPL mobility classifications. The approach for correlating TarGOST %RE and DNAPL saturation to potential DNAPL mobility classifications was developed to simplify the Gasco OU FS evaluations. DNAPL mobility across the Gasco OU is complex and depends on several factors (in addition to DNAPL saturation levels), including DNAPL physical and chemical properties, soil types and textures, aquifer properties, and wettability, all of which vary across the Gasco OU. DEQ does not intend to rely on these simplifying correlations or DNAPL mobility classifications outside of the Gasco OU FS evaluations for which they were developed.
 - b) The first bullet states that if measurable DNAPL has been observed in a well, that location is considered to contain potentially mobile DNAPL at the “depth interval that intersects the well screen.” Future deliverables should clarify that potentially mobile DNAPL was assigned to each of the depth interval(s) that intersect the well screen in situations where the well screen crosses multiple intervals. Well screen intervals should be included in the supporting tables in future deliverables.
 - c) The last paragraph states that residual DNAPL polygons were manually adjusted using professional judgement and the conceptual site model in areas with relatively sparse data. Where manual adjustments are made to figures showing DNAPL extent in future deliverables, please provide representative examples and supporting rationale for the manual adjustments.
- 4) **Section 3.2.2, Evaluation of Residual DNAPL Areas.** DEQ has the following comments:
 - a) The first paragraph states that during the February 20, 2024 meeting, “DEQ requested that NW Natural further evaluate the data in areas classified as residual DNAPL outside of the preliminary

ISS prisms to confirm the residual classification or determine whether they should be included in the ISS prisms due to potential mobility.” This statement is incorrect. During the February 20th meeting we clarified that residual DNAPL requires removal and/or treatment to the extent feasible. Our understanding based on the February 20, 2024 meeting was that NW Natural would include residual DNAPL observations in the ISS prisms or support excluding individual DNAPL observations based on multiple LOEs evaluation that would be subject to DEQ approval. To the extent that future deliverables reference meetings and discussions between NW Natural and DEQ, please more accurately represent the nature and intent of DEQ’s input and feedback during those meetings.

- b) This section proposes two new LOEs to support exclusion of residual DNAPL from the ISS prisms. DEQ does not approve these LOEs or find them useful for determining whether ISS treatment would or would not have a benefit towards achieving IRAM SC/RAOs relative to cost.
- 5) **Section 3.2.3, ISS Prism Vertical Extent.** The vertical extent of the ISS prism must be based on the deepest DNAPL observation, regardless of its mobility classification, unless otherwise approved by DEQ on a case-by-case basis.
- 6) **Section 4, Summary and Conclusions.** DEQ has the following comments:
- a) The last paragraph states that if NW Natural determines that prism refinement would be beneficial in reducing the ISS treatment of non-DNAPL-impacted soils, then an ISS prism refinement work plan will be submitted to DEQ. The ISS Design Basis does not provide enough information to show that DNAPL has been adequately delineated to support the IRAM design (refer to General Comments). Additional DNAPL delineation may result in reduced or expanded ISS prisms.
 - b) This section ends by stating that “NW Natural and DEQ have previously agreed that areas within the Nearshore Upland ISS Area of Interest that are not included as part of the IRAM ISS treatment will be evaluated as part of the Gasco OU Feasibility Study Report.” DEQ has not agreed to defer any DNAPL removal and/or treatment within the nearshore upland ISS area of interest to the Gasco OU FS.
- 7) **Table 1, Summary of MGP Residual Observations and DNAPL Classifications.** DEQ has the following comments:
- a) In several instances, DNAPL observations are recorded in the deepest interval that was logged, suggesting that vertical delineation of DNAPL may be incomplete. Examples include DG-CORE-18, GST-06, MW-38U, MW-PW2L, P-42, PW-02L. In addition, Table 1 does not correlate DNAPL observations between nearby borings to determine whether each individual boring was advanced deep enough to vertically delineate DNAPL. Creation of the 3D DNAPL model will help resolve this need.
 - b) The depth intervals below the base of the Fill WBZ do not clearly relate to the depths below the ground surface provided in boring logs, making it difficult to compare the boring log depths to the depth intervals in the table. DEQ requests that future deliverables more clearly correlate depths below the Fill WBZ, depths below the ground surface, and elevations. In addition, DEQ requests including the total logged boring depths and the deepest DNAPL observation, both relative to the depth below ground surface, for each location.
 - c) Creation of the 3D DNAPL model will help resolve this need.

- d) The table summarizes MGP observations according to depth intervals that were developed to support the Gasco OU FS. These depth intervals are relatively large and do not effectively convey how the vertical extent of DNAPL is determined within the larger depth intervals. Creation of the 3D DNAPL model will help resolve this need.
 - e) Some of the locations are listed multiple times in the table (e.g., DNAPL was observed in in the core log and DNAPL entry has occurred). Listing the same location in multiple places makes it difficult to cross reference with the DNAPL distribution figures. Creation of the 3D DNAPL model will help resolve this need.
 - f) As we indicated in our comments⁸ on the *DNAPL Monitoring Semiannual Summary Report (January 1 through June 30, 2024)*⁹, the top of the PW-06L well screen is approximately 20 feet below the deepest previous DNAPL observation in nearby borings, suggesting that DNAPL has migrated vertically over a relatively large distance to and into the Lower Alluvium WBZ in this area. Given this observation, DNAPL may have migrated deeper than previously observed in other locations within the nearshore upland ISS area of interest. The IRAM design should consider this potential and ensure that DNAPL is vertically delineated and included in the ISS prisms.
- 8) **Table 2, Evaluation of Residual DNAPL Areas.** DEQ has the following comments:
- a) The ‘conclusions’ column of the table indicates that several borings were classified as containing residual DNAPL based on TarGOST %RE values consistent with background values. Please clarify whether NW Natural considers TarGOST %RE values consistent with background values to represent residual DNAPL or the absence of DNAPL.
 - b) For TarGOST logs with %RE above background, revise the descriptions to indicate the percentage of signal responses above the background thresholds. For example: for TG-10, what percentage of the TarGOST signal was above/below the background response between 100 and 125 feet below ground surface (bgs)?
 - c) Given the DNAPL observations in the overlying intervals, DEQ does not anticipate approving excluding DNAPL in DG-CORE-23 from the ISS prisms.
- 9) **Table 3, ISS Prism Areas and Volumes.** DEQ recommends that depth of the deepest DNAPL observation within the prism be included in the table.
- 10) **Figure 7, DNAPL Distribution 75 to 100 Feet Below Base of Fill WBZ.** The DNAPL polygons associated with PW-06L appear very small considering the lateral distance between PW-06L and other locations where no DNAPL was historically observed. DEQ considers the delineation of DNAPL near PW-06L to be a data gap.
- 11) **Appendix A, Boring Logs.** The DNAPL classifications based on boring logs appears inconsistent. For example, in some cases a description of ‘coated with oil’ leads to a potentially mobile classification, and in others a residual classification. Based on the boring log descriptions, DEQ questions some of the DNAPL classifications, including but not limited to the following: B-4 from 37-49 feet bgs; B-29 from 27.5-29 feet bgs; B-58 from 30.5-33.5 and 35-37 feet bgs; B-59 from 5-8

⁸ DEQ. 2024. Letter to Bob Wyatt (NW Natural), Regarding: DEQ Response to the DNAPL Monitoring Semiannual Summary Report (January 1 through June 30, 2024), Former Gasco Manufactured Gas Plant Operable Unit, Portland, Oregon, ECSI #84 and #183. November 7.

⁹ Anchor QEA. 2024. DNAPL Monitoring Semiannual Summary Report (January 1 through June 30, 2024). NW Natural Gasco Site. ECSI No. 84. Prepared for NW Natural. September 17.

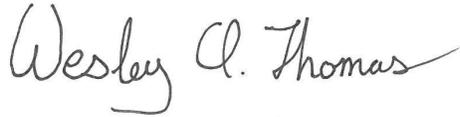
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feet bgs; DG-Core-18 from 28-28.5 feet bgs; DU-11U from 19.4-19.5 feet bgs; MW-16-45 from 46-48 feet bgs; MW-18-125 from 30-48 feet bgs; and MW-37U from 29.1-35 feet bgs.

Please contact me at (971) 263-8822 or Wesley.Thomas@deq.oregon.gov if you have questions regarding this letter.

Sincerely,



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