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July 3, 2025
Project No. M8128.02.031

Wesley Thomas
Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600
Portland, OR, 97232

Bob Wyatt
NW Natural
Portland, OR

Re: Siltronic Comments on NWN's IRAM BODR

Dear Wes Thomas and Bob Wyatt:

On behalf of Siltronic Corporation (Siltronic) Maul Foster & Alongi, Inc. (MFA) has prepared this letter providing comments on NW Natural's (NWN's) Interim Removal Action Measure (IRAM) Basis of Design Report (BODR), dated May 9, 2025, prepared by Anchor QEA, Sevenson Environmental Services, Inc., and Ede Environmental, LLC, on behalf of NWN for the NWN Gasco Site, and submitted by NWN to the Oregon Department of Environmental Quality (DEQ) under DEQ voluntary agreement No. WMCVM-NWN-94-13.

Siltronic has reviewed the document with a focus on the components of the report affecting Siltronic's property and/or operations. Siltronic recognizes and appreciates that NWN provides more detail of the proposed components of the remedy in the IRAM BODR than previous design deliverables, which is helpful for Siltronic to understand how the remedy will impact its operations and property. While many new details regarding the proposed remedy are provided in the IRAM BODR, Siltronic identified several elements of the document that have the potential to impact Siltronic's property or operations. On June 10, 2025, MFA and NWN's consultants (Anchor QEA and Ede Environmental, LLC) met to discuss these questions and concerns. This letter provides Siltronic's comments on the IRAM BODR, as discussed with NWN, and recommendations regarding how Siltronic's concerns with the remedy's impacts on its operations and property will be addressed in the next version of the IRAM BODR and/or future design deliverables. Siltronic's geotechnical consultant, Columbia West Engineering, Inc. (Columbia West), has also reviewed relevant portions of the IRAM BODR and prepared comments, which are included as an attachment to this letter. Below are Siltronic's general comments on the IRAM BODR, organized by topic.

Materials Management

The IRAM BODR provides new information regarding materials that will be generated and require management on the upland. The report details the proposed work platform for the first time; a significant construction element that is estimated to generate approximately 54,000 cubic yards (cy) of soil that will require management. Additional materials generated include approximately 7,000 cy of riprap (as part of the riverbank ISS augering for the in-water remedy) and 44,000 cy of ISS swell.

To consider materials management on its Property, Siltronic will need to have details of the types and volumes of materials that are proposed to be generated and managed on Siltronic's property, including handling methods for disposal or reuse. The proposed work platform will generate a massive amount of soil for disposal, which will require trucking, loading, and potentially stockpiling.

Siltronic will work with NWN directly to identify potentially appropriate areas for stockpiling materials, if needed, and Siltronic will need to approve the trucking route on the Siltronic property, as well as understand the frequency of trucks estimated to enter its property. Siltronic anticipates that NWN will provide documentation in upcoming design documents of the type, quantities, handling approach, sequence, and transport and disposal approach for each potential waste stream. This information is critical for Siltronic prior to agreeing to provide access to NWN and its contractors to ensure minimizing disruption of its operations and ensuring the safety of its workers.

Lastly, regarding the Figure 5-1, Materials Management Design Framework Diagram, Siltronic understands this framework is intended for broad use by NWN for both the upland and in-water remedies and therefore not all materials and management processes presented on the diagram will be applicable for the IRAM barrier wall. Siltronic notes that a decision flow path is provided for F002-listed wastes (which Siltronic understands that NWN chooses to apply to trichloroethene [TCE] and its degradation products). This diagram indicates F002-listed wastes will be temporarily stockpiled and disposed of as hazardous waste at a subtitle C facility. DEQ has previously provided conditions for no-longer-contained-in determinations for F002-listed wastes for the GOU.[1] Siltronic recommends that the process identified for management of nominal F002-listed wastes documented in Figure 5-1 be revised to include pursuit of such no-longer-contained-in determinations, as appropriate. Siltronic understands that it is unlikely that TCE and its degradation products would be generated during the work platform soil excavation activities described in the IRAM BODR because the work is conducted outside the TCE source area and excavation depths will remain within the fill water-bearing zone. But because the framework proposed in Figure 5-1 may be applied to work conducted beyond implementation of the IRAM, it would be appropriate to include Siltronic's proposed change here. If TCE or its degradation products are detected in soils requiring disposal and that soil meets the criteria for a no-longer-contained-in determination, costly delays in treating the material as hazardous waste can be avoided. Additionally, the resulting pre-characterization testing proposed in the IRAM BODR should eliminate the need for stockpiling.

Geotechnical Analyses

The IRAM BODR describes focused geotechnical explorations and analyses that will be performed during future design stages, including evaluating bearing capacity for equipment loads during construction within the work platform, liquefaction and cyclic softening risks, slope stability and seismically induced ground deformations for temporary slopes during construction and following barrier wall construction, and the effects of groundwater drawdown with the expansion of the HC&C system. Columbia West reviewed the proposed evaluations and analyses and has developed comments that are provided in the attachment to this letter. The BODR provides high-level information on what geotechnical analyses will be performed but does not provide information on how certain conditions will be mitigated or controlled based on the results of the geotechnical analyses. For example, in Section 5.2.3.4 of the IRAM BODR, it describes methods for analyzing bearing capacity and settlement but does not indicate what mitigating measures will be implemented if equipment exceeds the bearing capacity of the soil or if excessive settlement is predicted.

Additionally, some details of the proposed focused geotechnical analyses were not provided in the IRAM BODR. For example, the BODR states that potential for liquefaction will be evaluated but does not describe what methods will be used to do this or compute deformations. Several other analytical

[1] DEQ. 2023. Wesley Thomas, Oregon Department of Environmental Quality. *No Longer Contained-In Determination, Gasco Operable Unit, Portland Oregon*. February 8.

details are omitted from the IRAM BODR. Columbia West's attached letter provides specific comments where additional details are requested and recommendations for specific analyses to be performed.

Lastly, Siltronic continues to have concerns regarding the stability of an ISS barrier wall. Appendix D of the IRAM BODR describes the proposed scope and methods of an ISS treatability study, which includes testing for unconfined compressive strength of the ISS-treated soil samples. A preliminary target strength of 20 pounds per square inch (PSI) was selected for the treatability study, with the understanding that the ISS barrier wall will have minimal post-construction loading. Siltronic notes that the target strength will need to accommodate vehicular traffic. Additionally, it is not clear whether seismic stability was considered for this target strength. Siltronic notes that Arkema is proposing an upland IRAM that includes ISS columns to address monochlorobenzene dense nonaqueous-phase liquid at its facility. Arkema has recently submitted its pre-final design report for this IRAM and based on discussions with its geotechnical contractor, has selected a design target strength of 60 PSI. The results of Arkema's Phase I treatability study indicate this minimum target strength is achievable.[2] Columbia West notes that for cutoff walls, the standard target strength is between 50 and 200 psi and recommends a minimum target strength of 50 psi for the treatability study (see attachment).

Construction Schedule

This section lays out the proposed schedule for design following DEQ approvals but does not identify the preliminary schedule for construction. Siltronic understands that NWN is in early stages of planning the construction sequence, estimating durations, and working out the logistics of the proposed remedy. A schedule for construction, including sequence and durations, is not yet available, but will be provided in the future. Siltronic will need to have a detailed schedule to facilitate access, eliminate disruptions to its operations, and ensure the safety of its workers and infrastructure. Siltronic requests NWN provide a draft construction schedule in the revised BODR or next design deliverable, with increasing detail and refinement on sequence and duration in future design documents as more information becomes available. By providing a schedule early and providing refinements well before the final design, Siltronic will have more time to prepare for planned construction and can more easily provide NWN access to Siltronic's property when construction is ready to begin.

Additionally, it will be helpful for Siltronic to understand how the upland work ties into the riverbank ISS. Siltronic understands the riverbank ISS-augered columns will need to be completed before the upland ISS barrier wall. Siltronic assumes that the in-water remedial elements that tie into upland work will be provided in the schedule, as well.

Field Pilot Study

Siltronic notes that a field pilot study has not been proposed in the IRAM BODR. Siltronic has previously recommended a field pilot study to evaluate the vibrational and geotechnical impacts of the equipment on Siltronic's property. Siltronic needs assurance through empirical demonstration that the construction activities will not cause adverse effects to its manufacturing operations or property and continues to believe that a field pilot study is the most comprehensive method to demonstrate this. If a field pilot study is not conducted, early phases of IRAM construction should include an early quality assurance/quality control (QA/QC) period to test the equipment, gather data

[2] ERM. 2025. In Situ Stabilization Pre-Final Design Report, Arkema Inc. Facility, Portland Oregon. Prepared For Legacy Site Services LLC, agent for Arkema Inc. June 16.

regarding the vibrational and geotechnical effects of each type of equipment, and adjust the construction methodologies as appropriate. In the absence of a field pilot study, future design deliverables should also identify contingency measures that NWN can implement if early construction phases demonstrate vibration levels or geotechnical effects that would significantly negatively impact Siltronic's operations. Siltronic is currently conducting a study of baseline vibration measurements (discussed further below) that can be used by NWN, in conjunction with earlier vibration studies, to evaluate vibration data generated during a field pilot study or early phase of IRAM construction.

If no field pilot study is conducted Siltronic recommends that future design deliverables provide additional information about a QA/QC phase of construction and how existing data will be used to evaluate vibrational and stability impacts, as well as methods to avoid and/or mitigate impacts during construction.

Vibration Monitoring

Siltronic's primary concern with any remedy proposed on its property is impacts that could negatively affect the precision requirements for its silicon wafer products. Vibrations induced during remedy implementation could interfere with wafer production and must be avoided to the greatest extent possible. Siltronic has completed its vibration monitoring to establish a robust baseline data set that can be used to inform evaluation of vibration concerns during remedial design and implementation, and a report is forthcoming and will be shared with NWN once completed. Siltronic will require NWN to adhere to the established vibration baseline when construction proceeds. Siltronic understands that NWN is reviewing previous vibrational studies to translate vibrations across different lithologies within the upland project area, including reviewing data gathered during the 2009 sheet pile wall evaluation on Siltronic's property and the installation of pilings around the liquified natural gas area on the Gasco Property. Siltronic appreciates NWN conducting this evaluation and recommends that any approach to evaluation of vibration data developed by NWN be documented in future design deliverables. Siltronic looks forward to both parties' vibration consultants working together to address this issue.

Siltronic Outfall 001

Siltronic's primary outfall (Outfall 001) is located within the proposed IRAM construction area. Outfall 001 discharges stormwater from some of Siltronic's paved areas and the Fab 1 roof, as well as treated inorganic wastewater from Siltronic's processes, both of which are permitted discharges under National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. 101128 and NPDES Stormwater General Permit 1200-Z, respectively. Outfall 001 is not listed in Section 4.2 Permitting, nor is it listed on Table 5-1, Obstructions Inventory. Siltronic understands that NWN is evaluating options to temporarily redirect Siltronic's discharges from this outfall without impeding Siltronic's operations. The BODR should be updated to indicate that Outfall 001 will be impacted during construction of the IRAM, and include discussion of the two existing NPDES permits and the implications the proposed remedy has for the permitted discharges.

Closing

We appreciate the opportunity to comment on this document. Please contact us should you have any questions.

Sincerely,

Maul Foster & Alongi, Inc.

Audrey Hackett
Senior Environmental Scientist

Courtney Savoie, RG
Senior Hydrogeologist

Attachments

Limitations

Re: NW Natural Gasco Site, Interim Removal Action Measure Basis of Design Report, Review of Geotechnical Related Issues. Columbia West Engineering., Inc., June 11, 2025.

cc: Elizabeth Bingold, Siltronic Corporation
Samantha Hopman, Siltronic Corporation
Myron Burr, Restoration Strategies, LLC
David Rabbino, Jordan Ramis
Bob Wyatt, NW Natural
Patty Dost, Pearl Legal Group PC
Halah Voges, Anchor QEA
Matt Davis, Anchor QEA
Ryan Barth, Anchor QEA
Jen Mott, Anchor QEA
Rob Ede, Ede Environmental, LLC
Mike Crystal Sevenson Environmental Services, Inc.
Dan Hafley, Oregon Department of Environmental Quality
Amber Lutey, Oregon Department of Environmental Quality
Hunter Young, U.S. Environmental Protection Agency

Limitations

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the use of segregated portions of this report.

Attachment

Re: NW Natural Gasco Site, Interim Removal Action Measure Basis of Design Report, Review of Geotechnical Related Issues. Columbia West Engineering., Inc., June 11, 2025

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June 11, 2025

Maul Foster Alongi
2815 2nd Avenue, Suite 540
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Attn: Audrey Hackett

Re: NW Natural Gasco Site
Interim Removal Action Measure Basis of Design Report
Review of Geotechnical Related Issues
CWE Project No. 23232

On behalf of Maul Foster Alongi and the Siltronic Corporation, Columbia West Engineering, Inc. (Columbia West) reviewed the May 9, 2025 Interim Removal Action Measure Basis of Design Report (IRAM BODR) prepared by Anchor QEA for NW Natural. Our review was limited to geotechnical-related issues. Specifically, we reviewed Sections 5.1.3.8, 5.2.3.4, and 5.3.3.8; pertinent portions of Appendix D regarding target strength for the in situ stabilization and solidification (ISS) columns; and a pertinent portion of Appendix E related to geotechnical exploration.

SECTION 5 - FUTURE REMEDIAL DESIGN TECHNICAL EVALUATIONS

5.1.3.8 GEOTECHNICAL ANALYSIS – IRAM ISS BARRIER WALL

An analysis of geotechnical characteristics of the soil within the IRAM ISS barrier wall alignment will be performed to understand the minimum construction and long-term performance requirements of ISS-treated materials, particularly at depth. This includes analysis of bearing capacity, consolidation settlement, slope stability, liquefaction, and seismically induced ground deformations.

Bearing Capacity

Bearing capacity and settlement will be analyzed for temporary construction conditions, including the work platform and adjacent areas. Please indicate which mitigating measures will be implemented If the analysis concludes that the weight of the construction equipment exceeds the bearing capacity of the soil or if excessive settlement is predicted.

Liquefaction and Cyclic Softening

Liquefaction or cyclic softening are a concern if the wall bears on or extends through susceptible materials, such as the Upper Silt Unit or Upper and Lower Alluvium water bearing zone below groundwater. Evaluating the potential for liquefaction and/or cyclic softening and potential effects on the barrier wall will involve a sequence of phases, including assessing the susceptibility of the site soil and evaluating whether liquefaction is triggered or cyclic softening occurs under the anticipated site conditions when subject to the design seismic demand and, if so, estimating residual shear strength parameters as well as seismically induced ground deformations that could affect the wall's integrity and performance.

Please indicate which analytical methods will be used to assess liquefaction and compute deformations. Please list any mitigating measures if it is determined that liquefaction will negatively impact the IRAM ISS barrier wall. It is not stated that geotechnical laboratory testing will be conducted to determine the cyclic and residual strength of the soil. In our opinion, such testing will be useful in assessing the loss of soil strength under seismic conditions.

A contingency level earthquake will be used as the design seismic scenario. Please provide the return period for such an event and the associated design levels of ground shaking. Also, a design groundwater level should be provided.

Slope Stability and Seismically Induced Ground Deformations

Stability analysis will be conducted to assess new stress regimes, excavations, and seismic conditions. Minimum acceptable factors of safety should be provided. If it is determined slopes are unstable under seismic conditions, we understand that slope displacement will be computed. The design team should determine deflection tolerances and indicate whether any mitigating measures will be implemented if the tolerances are exceeded or if the analysis show the slopes are unstable or marginally stable. Recommendations for temporary and permanent slopes and dewatering should also be provided.

Anchor QEA states that if analysis indicates that seismically induced ground deformations may result in wall displacement and cracking, future design phases will include development of a post-seismic inspection and response plan. Consideration should be given to mitigating excessive ground deformations that could cause displacement and cracking.

5.2.3.4 GEOTECHNICAL ANALYSIS – NEARSHORE UPLAND ISS AREA OF INTEREST

Geotechnical analyses will be performed to evaluate the conditions influencing the design and construction of the nearshore upland ISS area of interest. This includes assessment of the nearshore upland ISS area of interest and will consider bearing capacity, settlement, slope stability, and potential seismic effects.

Bearing Capacity and Axial Strain

Bearing capacity of the existing ground and ISS monolith will be evaluated to ensure that the ground can adequately support the weight of the equipment without experiencing failure. The analysis will consider temporary construction equipment and long-term load associated with future development. Axial strain on the monolith will be assessed to evaluate the potential for cracking and downgraded performance. The design team should provide acceptable limits for bearing capacity, tolerance for strains, and mitigating measured if the limits are exceeded.

Liquefaction and Cyclic Softening

Please indicate which analytical methods will be used to assess liquefaction and list any mitigating measures if it is determined that liquefaction will negatively impact the upland ISS area of interest and monolith.

Columbia West's comments are as stated above in the "Liquefaction and Cyclic Softening" section under Section 5.1.3.8.

Slope Stability and Seismically Induced Ground Deformations

Slope stability analysis related to temporary slopes and potential modifications to groundwater conditions will be conducted through limited equilibrium methods. Minimum acceptable factors of safety should be provided. If it is determined slopes are unstable under seismic conditions, we understand that slope displacement will be computed. The design team should determine deflection tolerances and indicate whether any mitigating measures will be implemented if the tolerances are exceeded. Please list which analytical methods will be used to compute ground displacement. Recommendations for temporary and permanent slopes and dewatering should also be provided.

5.3.3.8 GEOTECHNICAL ANALYSIS – GROUNDWATER HC&C SYSTEM

The potential impacts of groundwater drawdown on consolidation settlement within the IRAM Project will be studied with focus on the Siltronic property where sensitive infrastructure exists. The purpose of the analysis is to ensure that potential changes in groundwater levels do not adversely affect the structural integrity of existing infrastructure.

Scenarios studied will include groundwater level reductions ranging from mild (4 to 5 feet) to more severe (10 feet). Please indicate how these scenarios were established and how they model field conditions.

A differential settlement of 2.5 inches over a distance 500 feet (0.042 percent) was selected as the settlement tolerance. This is acceptable for most structures. However, Siltronic has settlement-sensitive equipment, and this may exceed the tolerance of such equipment. Therefore, we recommend Siltronic have input on the settlement tolerance. We also recommend a tolerance for total settlement be established.

APPENDIX D

As part of the treatability study (TS), a range of ISS grout dosages will be mixed into homogenized soil samples in a program designed to achieve the performance objectives and design criteria identified in the IRAM BODR for ISS-treated soils. The TS testing program is intended to identify an optimized grout dosage that includes testing for various properties, including unconfined compressive strength (UCS.)

2.2.1 PHYSICAL PROPERTY TESTING OBJECTIVES AND EVALUATION CRITERIA

A preliminary strength target for treated soil will be reaching a nominal 20 pounds per square inch (psi) or greater to structurally support the minimal post-construction loading on top of the ISS treated materials. A UCS of 20 psi was selected because significant loading is not expected as part of future use of the site. It is not clear whether seismic stability was considered for the target strength; seismic considerations may require an increased strength to resist seismically induced forces and limit deflections. Typically, the target strength for cutoff walls is between 50 and 200 psi. Therefore, we recommend a target strength of at least 50 psi be used for the bench scale study.

3.5 PHASE II GROUT DOSAGE TESTING

Six TS rotosonic borings will be drilled to cover a range of representative conditions and determined to be representative of both the IRAM ISS barrier wall alignment and the nearshore upland ISS area of interest. Phase II of testing evaluates the effect of grout dosage on treated soil strength. It will identify a range of grout dosages to meet the preliminary TS strength; grout dosages of 3, 5, and 7 percent are planned. The cement water ratio will also be evaluated to optimize the treated soil consistency. We expect grout dosages and cement water ratios to achieve the target strength will be different for different soil types.

Soil conditions vary vertically, and different grout dosages may be required over the depth of the proposed barrier wall. How will the various soil types be identified over the depth of the barrier wall and how will grout dosage and cement water ratios be adjusted in the field to account for soil conditions that vary with depth?

APPENDIX E

2.0 SOIL BORINGS AND GEOTECHNICAL INVESTIGATION

A focused geotechnical investigation will be conducted to support the design and construction of the IRAM work platform and the IRAM ISS barrier wall. Five borings are planned along the IRAM ISS barrier wall for the geotechnical investigation. No details are provided on drilling methods, sampling methods, or geotechnical laboratory testing. We request that these details be provided for review.

♦ ♦ ♦

Please do not hesitate to contact us if you have questions or require additional information.

Sincerely,

Brett A Shipton, PE, GE
Principal Engineer

BAS:kat
Document ID: 23232-Revised IRAM BODR CWE Review - 061125.docx

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July 11, 2000
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