



Oregon

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May 13, 2024

Todd Slater
Legacy Site Services LLC
3553 West Chester Pike #413
Newton Square, PA 19073

via electronic delivery (email)

Subject: 2023 GWET System Effectiveness Evaluation
Arkema Facility, ECSI No. 398

Dear Mr. Slater:

The Oregon Department of Environmental Quality received the *GWET System Effectiveness Evaluation* (GWET SEE) dated March 29, 2024. The report was prepared by Environmental Resources Management (ERM) for Legacy Site Services LLC (Legacy). ERM submitted the GWET SEE to provide an update on the system, evaluate the extent of capture achieved, and propose actions to improve hydraulic capture.

The GWET system represents the primary method of groundwater contaminant source control at the Arkema site, a high priority project in the Portland Harbor Superfund Site. The system is a hydraulic containment system designed with the objective of preventing contaminated groundwater behind the slurry wall from migrating to the river. To achieve this objective, the wells and trenches must extract groundwater at rates greater than or equal to the groundwater flux through the alluvial water bearing zones lying immediately upgradient of the wall. The performance criteria for the barrier wall-groundwater extraction system is: 1) inward hydraulic gradients, and 2) an absence of mounding behind the wall. Although, neither of these performance criteria have been achieved the 2022 modifications are showing some limited indications of progress towards meeting these performance criteria.

DEQ has the following comments on the GWET SEE.

- 1) DEQ has previously provided comments on chloride concentrations and increasing concentrations in riverside wells (PA-19D and PA-30D). In addition, DEQ continues to watch increasing chlorobenzene concentrations in well PA-30D and perchlorate concentrations in well MWA-56D. DEQ will continue to evaluate concentrations trends over the next year while additional operation refinements are implemented.
- 2) **Section 9, Recommendations.** The last bullet that states “As outlined in Section 8 above, the annual groundwater monitoring data evaluation concluded that increasing concentrations identified are sporadic and overall conclusions are consistent with previous evaluations, which indicated that mounding behind the GWBW is not causing

significant migration of COCs.” is not supported by the data presented earlier in the SEE that indicate concentrations of chloride, chlorobenzene, and perchlorate are increasing in select areas outside the GWBW.

EPA and partners have reviewed the GWET SEE. EPA and the Five Tribes provided comments to DEQ on this report. These comments are attached for your reference.

Please contact me at 503-860-3943 or by email at Katie.Daugherty@deq.oregon.gov if you have any questions.

Sincerely,



Katie Daugherty, R.G.
Project Manager
Cleanup Program
Northwest Region

Attachments: Five Tribes Memo dated April 30, 2024
EPA Memo dated May 7, 2024

ecc David Lacey, DEQ
Brendan Robinson, ERM
Josh Hancock, ERM
Sarah Seekins, ERM




REGION 10
SEATTLE, WA 98101

May 7, 2024

MEMORANDUM

SUBJECT: Comments on the GWET System Effectiveness Evaluation
Arkema Inc. Facility, Portland, Oregon
ECSI # 398
March 29, 2024

FROM: Laura Hanna, RG, Remedial Project Manager 
Superfund and Emergency Management Division, EPA

TO: Katie Daughtery, RG, Project Manager
NWR Cleanup, Oregon Department of Environmental Quality

The following are the U.S. Environmental Protection Agency's (EPA's) comments on the document titled *GWET System Effectiveness Evaluation, Arkema Inc. Facility, Portland, OR* (Report). The Report was prepared by Environmental Resources Management, Inc. (ERM) for Legacy Site Services LLC. The Former Arkema Inc. Facility (site) is located at 6400 NW Front Avenue in Portland, Oregon and listed as Environmental Cleanup Site Information (ECSI) #398. The site is located adjacent to the Willamette River upland of the River Mile 7 West (RM7W) remedial design project area within the Portland Harbor Superfund Site (PHSS). The Report focuses on the groundwater upland source contaminant transport pathway.

The Report provides an update on the current performance of the Groundwater Source Control Measure (GW SCM), discusses corrective actions implemented to improve the performance of the GW SCM, evaluates the extent of capture currently achieved by the GW SCM, and proposes actions to improve hydraulic capture. EPA's comments are categorized as: "Primary," which identify concerns that must be resolved to achieve the objective, or "To Be Considered," which, if addressed or resolved, would reduce uncertainty, improve confidence in the document's conclusions, and/or best support the objectives.

Primary Comments

1. **General comment on hydraulic capture based on groundwater elevation evaluation line of evidence.** Given that the Report presents an evaluation of hydraulic capture behind the

groundwater barrier wall, EPA expects relevant figures and information that support the evaluation and conclusions to be provided in the main body of the text. Instead, this document refers the reader to Appendix A that contains over 400 pages of summary technical memos which requires the reviewer to locate and evaluate the information pertinent to what is being presented in the Report. With the current format approach, EPA can only tentatively accept the conclusions stated in the Report with regards to hydraulic capture based on the groundwater elevation evaluation line of evidence. Future Reports should present relevant figures and information supporting the narrative, evaluation, and conclusions in the main body of the document.

To Be Considered

1. **Section 4.1.1 GWET Well Extraction Rates and Relationships with Seasonal Conditions, pages 12 through 13, Tables 1a and 1b and Figure 3b:** The text should explain the purpose of presenting average operational monthly recovery well extraction rates (Table 1b and Figure 3b). EPA notes that the project groundwater flow model indicates an average monthly extraction rate of 60 gallons per minute is necessary to achieved capture zone objectives, so the comparison of this modeled extraction rate is relevant to the average monthly recovery well extraction rates presented in Table 1a. It is unclear what the purpose is for developing and presenting the data in Table 1b/Figure 3b. EPA suggests Table 1b/Figure 3b be removed from the Report to avoid confusion if a purpose cannot be articulated for an operational average flow rate.
2. **Section 7.3 Statistical Data Evaluation Methodology, page 20:** Only data from a “historical” period (i.e., 2007 to 2010) and a “current” period (i.e., 2019 to 2023) have been used in the used in the evaluation, which included a Mann-Kendall test for trends over the total “study” period of 2007 to 2023. It is unclear whether data from 2010 to 2019 do not exist or if those data have been excluded for some other reason. Attempting to detect trends over a 17-year period with an 8-year data gap (i.e., 2011 to 2018) in the middle is inadvisable. If no data for this period exist, or if events during this period (e.g., construction of barrier wall in 2012, startup of pump and treat system in 2014) resulted in non-monotonic trends, then an alternative statistical test should be employed. For example, if a Mann-Kendall test applied to the current period for a well fails to detect a trend, then a generalized Wilcoxon test (Helsel 2012, page 171) could be used to evaluate if the measurements from the two periods are significantly different (note that expanding the historical period to include more than four measurements would probably be advisable to achieve adequate statistical power.) The statistical evaluation currently includes a comparison based on orders-of-magnitude, but a generalized Wilcoxon test would be able to detect smaller differences while also accounting for censored information caused by non-detect concentration measurements.
3. **Appendix C Mann-Kendall Scatterplots and Trend Analysis:** The Appendix B tables indicate that the number of samples for the historical period (i.e., 2007-2010) is four for sampling locations with data, but the scatterplots in Appendix C only show two datapoints. Clarify why four datapoints are not shown in the scatterplots for the historical period.

References

Helsel, Dennis R. 2012. Statistics for Censored Environmental Data Using Minitab and R. John Wiley & Sons.

cc: David Lacey, DEQ
Katie Young, CDM Smith

MEMORANDUM | April 30, 2024

TO Katie Daugherty and David Lacey, Oregon Department of Environmental Quality (DEQ)

FROM Peter Shanahan, HydroAnalysis LLC (HALLC); Jennifer Hart and Gail Fricano, Industrial Economics, Inc. (IEc)

SUBJECT Five Tribe review of “GWET System Effectiveness Evaluation, Arkema Inc. Facility,” dated March 29, 2024

This memorandum, submitted on behalf of the Five Tribes,¹ reviews the *GWET* [Groundwater Extraction and Treatment] *System Effectiveness Evaluation* (2023 GWET SEE Report) prepared by Environmental Resource Management, Inc. (ERM) on behalf of Legacy Site Services, LLC (LSS) (ERM 2024).

Substantive Comments

1. Section 4.1.2 of the 2023 GWET SEE Report indicates that “the TCZOs [Target Capture Zone Objectives] are not being fully achieved as of the end of the reporting period.” Section 6.4 describes various planned actions but states “More time at elevated extraction rates is necessary to evaluate whether GWET objectives are being met systemwide.” ERM (2023), the 2022 GWET SEE Report, reached a similar conclusion: “Target Capture Zone Objectives are unlikely to be achieved until Q3 or Q4 of 2023. As the new extraction trenches come online and higher pumping rates are consistently achieved, compliance with Target Capture Zone Objectives will continue to be evaluated...” Based on our review of the 2023 GWET SEE Report, we conclude that the upgraded system, like the version before it, is undersized and not performing as designed. A variety of measures have been carried out and are proposed to remedy this situation; however, we are concerned that these minor adjustments will not achieve TCZOs. We recommend DEQ require LSS conduct an exhaustive evaluation as to whether the existing system can achieve TCZOs, and if not, what type of system should replace it.
2. Section 3.2 indicates that many of the pressure transducers (12 out of 54 piezometers) were inoperative for a month or more during 2023. The report states, “Transducers are typically inspected within 1 week of an issue being identified and typically repaired within 1 week to 1 month depending on whether a transducer replacement is required or not.” Although not explicitly stated, the text implies that several weeks are needed to order and obtain a replacement transducer. Since transducers seem to fail with regularity, we recommend that spare transducers be purchased so that defective transducers can be replaced more expeditiously.

¹ The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

3. Table 1a indicates that of the four recovery wells (RW), three (RW-14, -22, -25) were out of service due to equipment issues for all of May, June, and July. We recommend this extended outage be discussed and explained in Section 3.3 of the report.
 4. Table 1a also shows that during the month of April seven of the fourteen trench extraction wells (EW) (EW-06, -08, -09, -10, -11, -12, -14) were out of service and an additional two extraction wells were below capacity (EW-02, -05). We recommend that this problematic period be discussed and explained in Section 3.3 of the report.
 5. Section 4.1.1 describes operational difficulties due to “excessive friction loss at higher flows in the 3-inch conveyance line.” This implies that the conveyance line, a holdover from the system pre-upgrade, is under-designed for the current system despite design calculations showing it would be adequate (ERM 2022). Section 6.1 states that “an event in January 2024 is planned to connect EWs in Trenches 5, 6, and 7 to the currently out-of-use conveyance line for Intermediate Zone based RWs.” We recommend that the report indicate the size (diameter) of this conveyance line and provide calculations that show the increase in conveyance capacity. Friction coefficients used previously (ERM 2022) should be adjusted based on the performance of the existing conveyance line. Also, the SEE report is dated March 2024, which is after the so-called “planned event.” We recommend that events that have occurred be reported, at least parenthetically, even if they occurred outside of the reporting period.
 6. Section 6.2 lists numerous system shutdowns due to “solids handling issues,” but without much specificity as to the nature of the problems other than their locale in the treatment system. We recommend more details be provided. We also recommend a more complete explanation of the system problems in general. Section 6.2 ascribes treatment-system problems to “variable solids and flowrates coming from new EWs.” Variability seems unlikely to be the sole source of these problems. Rather, the descriptions in the text imply the system simply lacks adequate capacity for the new higher flows. If so, this represents a serious and systematic deficiency in the GWET system.
 7. Section 6.4 indicates that “Solids handling was resolved in early 2023 through chemical trials, cleaning pressure filters, and replacing media in July 2023.” This statement seems to be contradicted by the frequency of shutdowns listed in Section 6.2 that occurred after July 2023. We recommend LSS provide additional detail to explain why the maintenance performed in the first half of 2023 did not reduce the frequency of shutdowns in the second half of 2023. We also recommend that the list in Section 6.2 differentiate routine maintenance events from non-routine maintenance events.
 8. Appendix C, page 3 of 47, reveals a distinct seasonal pattern in the concentration of chloride at shallow well MWA-63, which is located just beyond the eastern end of the barrier wall (i.e., on the river side of the wall). The data suggest a seasonal release of chloride to the river and may reveal important aspects of GWET system behavior. We recommend the concentration patterns at this well be discussed in Section 7.4.2.
 9. The analysis of chloride in Section 7.4.2 includes a statement that trends at GCC5 and Proximal Wells “indicat[e] that the GWBW [groundwater barrier wall] is effectively preventing chloride migration towards the river.” We recommend that this statement be qualified by adding “in this part of the site.”
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10. The analysis of perchlorate in Section 7.4.2 explains the trend of consistently increasing concentrations at deep well MWA-56D (see Appendix C, page 18 of 47) to be “likely from a proximal source on the exterior side of GCC4.” This seems speculative. We recommend the report discuss what activities occurred or were likely to have occurred in this area that would give rise to a source of perchlorate, how such a source could give rise to increasing rather than steady concentration trends, and whether concentrations in the shallow and intermediate zones support the hypothesis there is a local source.
11. We recommend the statement from Section 4.1.2 that “TCZOs are not being fully achieved as of the end of the reporting period” be included in Section 8.1 as it is a significant conclusion from the 2023 GWET SEE results.
12. We recommend striking the first bullet item in Section 8.2 as the conclusion that equipment failures and malfunctions were resolved is not supported by the continued transducer failure rates reported in Section 3.2.
13. We recommend Section 8.2 include a statement that the upgrades to the GWET system have yet to achieve the forecasted 60 gallons per minute extraction rate on a sustained basis owing to system inadequacies and malfunctions.
14. This report contains many grammatical and typographical errors. We recommend greater attention to quality assurance and quality control.

Editorial Comments

15. Tables 1a and 1b report “Average Monthly Extraction Rates” and “Average Operational Monthly Extraction Rates.” We recommend that these terms be defined in a footnote to each table.
16. Page 11 states “In accordance with the PMP [Performance Monitoring Plan], groundwater elevations are being monitored using the transducers and monthly manual groundwater elevation gauging.” This phrasing leaves ambiguous how many of the 54 piezometers are monitored using pressure transducers, how many are monitored manually, or whether all are monitored both ways. We recommend this be clarified.
17. Page 11 states “cones of depression are apparent around each groundwater extraction trench.” Inspection of contour plots in Appendix A shows this is not actually true for all months and all trenches.
18. Page 13 includes this vague description of future upgrades: “reconfiguring the conveyance line connections to EW trenches 5, 6, and 7.” We recommend a clearer description—for example, “connecting EW trenches 5, 6, and 7 to an alternative discharge line.”

References

- Environmental Resource Management, Inc. (ERM). 2022. Final Design Report, Arkema Inc. Facility, Portland, Oregon. May 22.
- Environmental Resource Management, Inc. (ERM). 2023. GWET System Effectiveness Evaluation, Arkema Inc. Facility, Portland, Oregon. April 12.

Environmental Resource Management, Inc. (ERM). 2024. GWET System Effectiveness Evaluation,
Arkema Inc. Facility, Portland, Oregon. March 29.