



June 26, 2024

Ms. Leigh Barr
New Mexico Energy, Minerals & Natural Resources Department
Oil Conservation Division, Environmental Bureau
LeighP.Barr@emnrd.nm.gov

Re: Request to Reduce Dissolved Metals Analysis for the Facility-Wide Groundwater Monitoring Program, HF Sinclair Navajo Refining LLC, Artesia Refinery, Discharge Permit GW-028

Dear Ms. Barr:

HF Sinclair Navajo Refining LLC (HFSNR) is submitting this letter and attached supporting technical memorandum to request a reduction of dissolved metals analysis for the facility-wide groundwater monitoring program at the HFSNR Artesia Refinery (Refinery) in Artesia, New Mexico. Both unfiltered and filtered groundwater samples have been collected for analysis of total and dissolved metals, respectively, since at least 2007. HFSNR is requesting to cease collection of filtered samples for dissolved metals at all wells except those specified in the November 2020 Stage 1 Abatement Plan (AP) Report and April 2024 Stage 2 AP for the former reverse osmosis (RO) reject fields (wells MW-29, MW-40, MW-55, MW-56, MW-114 through MW-119, MW-125, MW-140 through MW-144, RW-18A, and two new wells that will be installed upon the New Mexico Oil Conservation Division [OCD] approval of the Stage 2 AP).

The attached memorandum prepared by TRC Environmental Corporation (TRC) demonstrates that this requested modification will not reduce the effectiveness of the facility-wide groundwater monitoring program. Analysis of unfiltered samples for total metal concentrations is a more conservative monitoring approach than analysis of filtered samples for dissolved metal concentrations because it ensures mobile metal species are not removed by filtration and better estimates total metal contaminant loading in groundwater. A statistical comparison of total and dissolved metal concentrations in groundwater samples collected over 17 years at the Refinery confirms the mean total concentrations are greater than the mean dissolved concentration for each metal. Facility-wide groundwater corrective action decisions at the Refinery are already based on total metal concentrations, where the total results are compared to available dissolved Water Quality Control Commission (WQCC) standards that are also equivalent to available total Maximum Contaminant Levels (MCLs).

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This request is being submitted to the OCD separate from the annual update to the Facility-Wide Groundwater Monitoring Program (FWGMWP), which is submitted to both the New Mexico on Environment Department (NMED) and the OCD to fulfill requirements of both the NMED-issued Post-Closure Care Permit (PCC Permit) and the OCD-issued Discharge Permit GW-028, because NMED does not require dissolved metals analysis. Should OCD approve this request, the FWGMWP will be updated accordingly.

If you should have any questions or comments regarding this request, please feel free to contact Teresa Alba at (575) 746-5391 or Michael Holder at (575) 308-1115.

Sincerely,

A handwritten signature in blue ink that reads "Case Hinkins".

Case Hinkins
Environmental Manager
HF Sinclair Navajo Refining LLC

cc: OCD: R. Romero
 NMED: N. Dhawan, L Tsinnajinnie, M. Suzuki
 HF Sinclair: M. Holder; T. Alba
 TRC: J. Speer, D. Helbert, C. Smith



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Date: June 26, 2024

To: Teresa Alba, Environmental Supervisor, HF Sinclair Navajo Refining LLC
Michael Holder, Environmental Specialist, HF Sinclair Corporation

From: Marianne Link, Project Manager, TRC Environmental Corporation (TRC)
Julie Speer, Program Manager, TRC
Rebecca Paalanen, TRC

Project: 570710.0000.0000 Phase 1

Subject: Evaluation of the Artesia Refinery Facility-Wide Groundwater Monitoring Program to Support a Reduction of Dissolved Metals Analysis

This memorandum summarizes the results of an evaluation of the facility-wide groundwater monitoring analytical program at the HF Sinclair Navajo Refining LLC (HFSNR) Artesia Refinery (Refinery) to support a request for the reduction of dissolved metal analysis in the facility-wide analytical program. The evaluation included:

- A review of the groundwater metals data collected as part of the facility-wide groundwater monitoring program, the regulatory standards to which the metals data are compared, and how the metals data are currently used in evaluating facility-wide groundwater monitoring results and corrective action decision-making at the Refinery.
- A statistical comparison of the groundwater metals data collected to date at the Refinery to confirm the total metal laboratory results are greater than dissolved metal laboratory results, as is expected based on the theoretical definition of total concentrations (i.e., the total concentration is the sum of dissolved and insoluble metals concentrations).

The evaluation demonstrates laboratory analysis of total metal concentrations in groundwater at the Refinery is a more conservative and appropriate monitoring approach for the facility-wide program than analysis of dissolved metal concentrations. Therefore, reducing or removing dissolved metal analysis from the facility-wide groundwater monitoring program will not reduce the program's effectiveness in monitoring the presence and extent of metals in exceedance of critical groundwater screening levels (CGWSLs) at the Refinery. TRC recommends removing dissolved metals from the facility-wide groundwater analytical program at all wells except those specified in the November 2020 Stage 1 Abatement Plan (AP) Report (Wood 2020) and April 2024 Stage 2 AP (WSP 2024) for the former reverse osmosis (RO) reject fields (RO Reject Fields).

Background

The Refinery is located at 501 East Main Street in Artesia, New Mexico. The Refinery is subject to 1) a Post-Closure Care Permit (PCC Permit) issued by the New Mexico Environment Department (NMED) in October 2003 and later modified in December 2010 (NMED 2010); and 2) the renewed Discharge Permit GW-028 (DP GW-028) issued by OCD on August 16, 2022 (OCD 2022). The PCC Permit requires HFSNR to conduct facility-wide groundwater monitoring, with the purpose of evaluating the presence, nature, and extent of hazardous and regulated constituents during the post-closure period pursuant to Section 20.4.1.500 of the New Mexico Administrative



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Code (NMAC) and the Water Quality Control Commission (WQCC) standards included in 20.6.2.3103 NMAC. The DP GW-028 also requires HFSNR to conduct facility-wide groundwater monitoring for applicable constituents listed in 20.6.2.3103 NMAC.

HFSNR has conducted facility-wide groundwater monitoring in accordance with an approved Facility-Wide Groundwater Monitoring Work Plan (FWGMWP) since 2007. The FWGMWP is updated on an annual basis, and the 2023 FWGMWP (TRC 2023) is the current FWGMWP that was approved (with modifications) by NMED on February 6, 2024 (NMED 2024). The 2024 FWGMWP will be submitted to OCD and NMED by June 30, 2024. Currently, HFSNR collects both filtered and unfiltered groundwater samples to meet the requirements of both the NMED (PCC Permit) and the OCD (DP GW-028). NMED requires the analysis of total metals (unfiltered samples), consistent with United States Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA) and Superfund guidance documents (EPA 1992; Puls and Barcelona 1989). OCD requires the analysis of dissolved metals.

Facility-Wide Groundwater Metals Data

In accordance with the 2023 FWGMWP, and since at least the 2016 FWGMWP, groundwater samples collected during both the first and second semi-annual groundwater events are analyzed for total metals, while dissolved metals are only analyzed during the first semi-annual groundwater event. Metals are analyzed by Methods 6010/6020 or 7470 for arsenic, barium, chromium, iron, lead, manganese, and selenium; and boron, cadmium, cobalt, mercury, nickel, uranium, and vanadium are additionally analyzed in select wells. Groundwater metal analytical data collected in 2023, and during at least the three prior sampling events, were most recently provided in Appendix B/Table B-3 of the *2023 Annual Groundwater Monitoring Report* (TRC 2024). The total metal results are also summarized in Table 4B of the *2023 Annual Groundwater Monitoring Report*.

Arsenic is the only metal to be considered a target constituent of concern (COC) at the Refinery, and total arsenic concentrations in groundwater over time in each well are presented on time-series plots provided in Appendix C of the *2023 Annual Groundwater Monitoring Report*. As shown on those concentration plots, total arsenic concentrations are stable over time across the Refinery. Total and dissolved concentrations of other (non-target COC) metals were also stable during 2023 and at least the three prior sampling events, with minor isolated exceptions, as discussed in the *2023 Annual Groundwater Monitoring Report*.

Regulatory Standards and Drivers

Both total and dissolved metals concentrations are compared to the CGWSLs, which are the lower of the WQCC standards from 20.6.2.3103 NMAC or EPA maximum contaminant level (MCLs) for drinking water, except for vanadium which is the NMED Tap Water Screening Level because there is no established WQCC standard or MCL for vanadium. The available MCLs (which are based on total metal concentrations) are equivalent to the WQCC standards from 20.6.2.3103 NMAC (which are based on dissolved metal concentrations except for mercury). There are MCLs established for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and uranium. There are no MCLs established for boron, cobalt, iron, manganese, and nickel.

Despite collecting and analyzing groundwater samples for both total and dissolved metals, facility-wide groundwater monitoring program and corrective action decisions are based on total metal results (compared to dissolved WQCC standards that are equivalent to available MCLs based on total results). The rationale for basing facility-wide corrective action decisions on total metals data is based on EPA's position that field filtration of samples for metals analysis may not provide accurate information concerning the mobility of metal contaminants, as described in EPA



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guidance documents for RCRA and Superfund sites (EPA 1992; Puls and Barcelona 1989). In *RCRA Ground-Water Monitoring: Draft Technical Guidance*, EPA states it “generally does not recommend ground-water samples that will be used to determine if there is statistically significant evidence of ground-water contamination be filtered in the field” for several reasons, including the fact that metals can migrate in groundwater with colloidal particles that will not pass through a standard 0.45-micron filter (EPA 1992). In *Superfund Groundwater Issue: Ground Water Sampling for Metals Analyses*, EPA also concluded that use of a 0.45-micron filter (for dissolved metal analysis) was not useful, appropriate or reproducible in providing information on metals mobility since some mobile species are likely removed by filtration before chemical analysis as precipitated phases or colloids (Puls and Barcelona 1989). EPA concluded that if the purpose of the sampling is to determine possible mobile contaminant species, the unfiltered/total samples should be given priority.

Statistical Analysis of Total and Dissolved Metals Data

A statistical analysis of dissolved and total concentrations of metals was conducted to confirm total concentration data is sufficient to characterize groundwater and support corrective action decisions at the Refinery. A series of comparisons were made to determine if the mean (or average) of the dissolved data was statistically lower than the mean of the total concentration data. Comparisons were made for the following metals: arsenic, barium, boron, cadmium, chromium, cobalt, iron, lead, manganese, nickel, selenium, uranium, and vanadium. Only data points for which there were pairs of data collected in the same sampling event were used for this analysis. Data was collected between 2007 and April 2024. A summary of the data used in the evaluation is provided in Table 1.

A Wilcoxon Rank Sum test was used to compare means, as the data was not normally distributed and a paired samples design was employed. A one-sided test was opted for with the null hypothesis $\mu_{\text{Dissolved}} \geq \mu_{\text{Total}}$ and alternative hypothesis $\mu_{\text{Dissolved}} < \mu_{\text{Total}}$, as theoretically, total concentrations can be defined by the equation:

$$\mu_{\text{Total}} = \mu_{\text{Dissolved}} + \mu_{\text{insoluble}}$$

where, μ_{Total} = total metal concentration

$\mu_{\text{Dissolved}}$ = dissolved metal concentration

$\mu_{\text{insoluble}}$ = insoluble (or particulate) metal concentration

A significance level (α) of 0.05 was used (or 95% confidence level). Results of the statistical comparison are summarized in Table 1.

The sample means for total concentrations of arsenic, barium, chromium, cobalt, iron, lead, and manganese were statistically significantly elevated as compared to the dissolved concentrations (with p values ranging from 0.00000 to 0.01788, where a smaller p value provides stronger evidence against the null hypothesis). While the means for total boron, cadmium, nickel, selenium, uranium, and vanadium were not statistically significantly elevated above those of dissolved, the arithmetic mean for total concentrations was greater than that of dissolved for all of these metals. Of note, there were markedly less datapoints collected for boron, cadmium, nickel, uranium, and vanadium, which may indicate that this smaller sample size is not sufficiently powered to detect a difference between groups. Cadmium, nickel, and vanadium concentrations (both total and dissolved) have also either not historically exceeded their respective CGWSL or have not exceeded since 2016.



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Table 1. Dissolved versus Total Metals Data Summary

Analyte	Total Samples	Average ¹ Total Concentration (mg/L)	Average ¹ Dissolved Concentration (mg/L)	w Statistic	p value
Arsenic	1985	0.01846	0.01585	1894356	0.00782
Barium	1987	0.25078	0.22198	1859377	0.00063
Boron	273	0.71855	0.71106	37244	0.43710
Cadmium	273	0.00014	0.00013	36764	0.32820
Chromium	1987	0.00524	0.00213	1688295	0.00000
Cobalt	273	0.00094	0.00067	32163	0.00168
Iron	1987	1.36735	0.71970	1333721	0.00000
Lead	1987	0.00140	0.00081	1682260	0.00000
Manganese	1987	0.72325	0.69160	1900079	0.01788
Nickel	436	0.00578	0.00503	92493	0.21130
Selenium	1986	0.00672	0.00557	1939018	0.10730
Uranium	273	0.02545	0.02517	36920	0.42590
Vanadium	436	0.01090	0.01018	92693	0.22720

¹ Arithmetic mean
mg/L – milligrams per liter

The statistical comparison confirms the arithmetic mean of all total metal concentrations are greater than that of dissolved metal concentrations. Further, total concentrations of seven (7) of the 13 metals, including target COC arsenic, are statistically significantly greater than dissolved concentrations.

Conclusions and Recommendations

The analysis of total metals is the most conservative approach for evaluating the presence, nature, and extent of metal constituents in groundwater and is the appropriate basis for groundwater corrective action decision-making for the Refinery, as follows:

- The statistical analysis conducted using 17 years of groundwater data for 13 metals demonstrates that:
 - The mean total data is consistently higher than the mean dissolved data for each metal.
 - Total mean concentrations of seven (7) of the 13 metals, including target COC arsenic, are statistically significantly greater than dissolved mean concentrations.
- Analysis of total metals concentrations ensures mobile species are not removed by filtration before chemical analysis and better estimates total metal contaminant loading in the groundwater system.
- Total metals concentrations are compared to CGWSLs which are the WQCC standards (except for vanadium) based on dissolved analysis that are consistent with existing MCLs based on total analysis. The MCL for target COC arsenic is equivalent to the WQCC standard.

Based on these conclusions, and considering that total and dissolved groundwater concentrations are stable over time, it should be acceptable to revise the FWGMWP to remove dissolved metals



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analyses from the monitoring program at all wells except those located within and surrounding the former RO Reject Fields in accordance with the Stage 1 AP Report and Stage 2 AP. This change will not reduce the protectiveness of the groundwater monitoring program at the Refinery and will allow for completion of abatement activities at the former RO Reject Fields.

References

- EPA 1992. RCRA Ground-Water Monitoring: Draft Technical Guidance. EPA/530/R93/001. November 1992.
- NMED 2010. Navajo Refining Company, Artesia Refinery, Post-Closure Care Permit. December 2010.
- NMED 2024. Approval with Modifications, 2023 Facility-Wide Groundwater Monitoring Work Plan. February 6, 2024.
- TRC 2023. 2023 Facility-Wide Groundwater Monitoring Work Plan – HF Sinclair Navajo Refining LLC, Artesia Refinery. June 2023.
- TRC 2024. 2023 Annual Groundwater Monitoring Work Plan – HF Sinclair Navajo Refining LLC, Artesia Refinery. February 2024.
- OCD 2022. Discharge Permit GW-028 for HollyFrontier Navajo Refining, LLC Artesia Refinery. August 16, 2022.
- Puls and Barcelona 1989. Ground Water Sampling for Metals Analyses. U.S. EPA Superfund Ground Water Issue, EPA/540/4-89/001. March 1989.
- Wood 2020. Reverse Osmosis Reject Discharge Fields Stage 1 Abatement – Final Report. November 19, 2020.
- WSP 2024. Stage 2 Abatement Plan – Former Reverse Osmosis Reject Discharge Fields. April 16, 2024.

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CONDITIONS
 Action 358892

CONDITIONS

Operator: HF Sinclair Navajo Refining LLC ATTN: GENERAL COUNSEL Dallas, TX 75201	OGRID: 15694
	Action Number: 358892
	Action Type: [UF-DP] Discharge Permit (DISCHARGE PERMIT)

CONDITIONS

Created By	Condition	Condition Date
joel.stone	None	7/2/2024