

TECHNICAL MEMORANDUM

To: Nevada Environmental Response Trust

Cc: Nevada Division of Environmental Protection
United States Environmental Protection Agency

From: Katie Hendrickson

Date: April 26, 2021

Subject: Hydrogen-Based Gas Permeable Membrane Pilot Study Monthly Progress Report

At the direction of the Nevada Environmental Response Trust (NERT or Trust), Tetra Tech, Inc. (Tetra Tech) has prepared this memorandum that summarizes Tetra Tech's progress made during March 2021 toward successfully implementing the Hydrogen-Based Gas Permeable Membrane Pilot Study.

Task Progress Update: March 2021

Task M26 – Hydrogen-Based Gas Permeable Membrane Pilot Study

- Current Status
 - Test Scenario 2, which uses a blend of water from the AWF and IWF after chromium pre-treatment, began on February 17, 2021 and continued through March 2021.
 - Operational samples show the perchlorate concentrations from the lag reactor have been below the detection limit (<5 ppb) since March 4, 2021 while influent perchlorate concentrations have ranged from 79,200 ppb to 111,000 ppb indicating over 99.99% removal of perchlorate.
 - Steady state performance samples were collected on March 9, March 16, March 23, and March 30, 2021. The available results are shown on the attached table (some lab results are pending and highlighted in gray). Some key observations include:
 - Influent perchlorate concentrations ranged from 79,400 ppb to 90,400 ppb.
 - The perchlorate concentration for the March 9, 2021 sample from the lag reactor was 19.6 ppb, slightly above the 18 ppb criteria. However, the lab noted this result may be biased high and stated “The sample matrix interfered with the ability to make any accurate determination; spike value is high. Additionally, a split sample was collected and the split sample result for perchlorate was below the detection limit (<5 ppb) and the perchlorate concentration for a sample from the post reactor tank effluent was below detection limits (<0.3 ppb).
 - Perchlorate concentrations for samples from the lag reactor on March 16, 2021 and March 23, 2021 were 9.5 ppb and 16.9 ppb, respectively.

- The perchlorate concentration from the lag reactor on March 30, 2021 was 22.6 ppb. A split sample was collected and the split sample result for perchlorate was below the detection limit (<5 ppb) and the perchlorate concentration for a sample from the post reactor tank effluent was below detection limits (<0.3 ppb).
- Perchlorate concentrations for samples from the post reactor tank effluent ranged from below detection limits (<0.3 ppb) to 1.39 ppb for all performance sample results received thus far.
- Chlorate and nitrate concentrations for samples from the lag reactor and post reactor column were below detection limits for all results received so far.
- The Scenario 2 performance results are presented in Table 1. Additionally, Figure 1 displays the perchlorate operational and performance sample results from Scenario 2.
- Schedule and Progress Updates
 - Scenario 2 is anticipated to run for up to 12 weeks.
- Health and Safety
 - There were no health and safety incidents related to Task M26 during March 2021. Safety measures continue to be implemented to minimize potential exposure to COVID-19, including the use of face coverings, gloves, and hand sanitizer, as well as protocols for monitoring temperatures, minimizing the number of people on site at one time, and evaluating tasks to increase physical distance between personnel.

CERTIFICATION

Hydrogen-Based Gas Permeable Membrane Pilot Study Monthly Progress Report

Nevada Environmental Response Trust Site
(Former Tronox LLC Site)
Henderson, Nevada

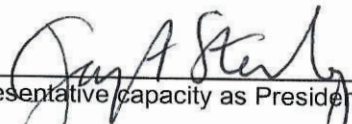
Nevada Environmental Response Trust (NERT) Representative Certification

I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of NERT. Based on my own involvement and/or my inquiry of the person or persons who manage the systems(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Signature:

 _____, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

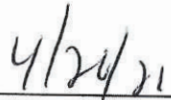
Not Individually, but Solely
as President of the Trustee

Name: Jay A. Steinberg, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

Title: Solely as President and not individually

Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

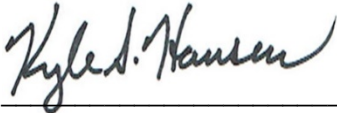
Date:

 _____

CERTIFICATION

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been prepared in a manner consistent with the current standards of the profession, and to the best of my knowledge, comply with all applicable federal, state, and local statutes, regulations, and ordinances. I hereby certify that all laboratory analytical data was generated by a laboratory certified by the NDEP for each constituent and media presented herein.

Description of Services Provided: Prepared Hydrogen-Based Gas Permeable Pilot Study Monthly Progress Report.



April 26, 2021

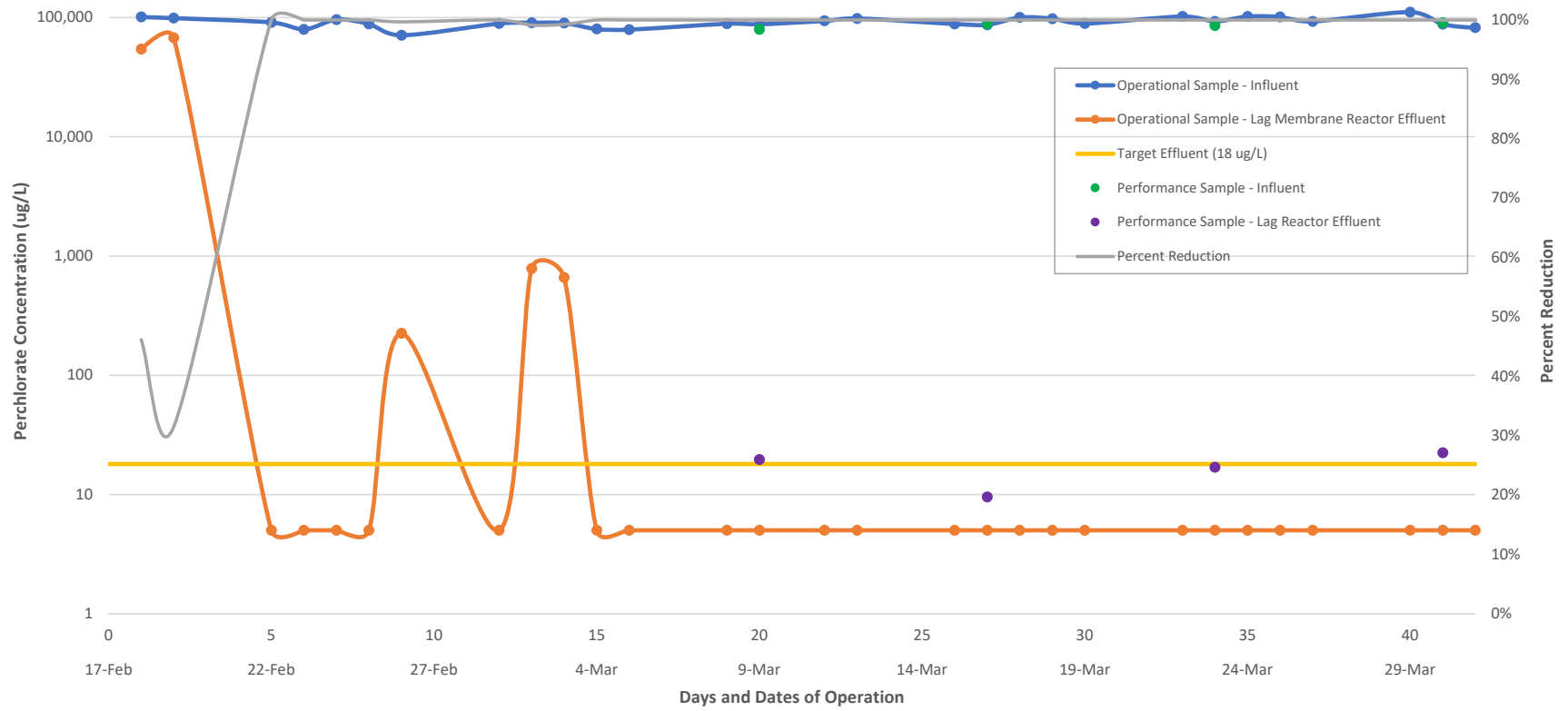
Kyle Hansen, CEM
Field Operations Manager/Geologist
Tetra Tech, Inc.

Date

Nevada CEM Certificate Number: 2167
Nevada CEM Expiration Date: September 18, 2022

Figures

Figure 1. Scenario 2 - Perchlorate Concentrations and % Reduction



Tables

Table 1
Scenario 2 Performance Monitoring Data
Hydrogen-Gas Based Permeable Membrane Pilot Study

Date	Influent Water										
	Flow	T	pH	Perchlorate	Chlorate	Sulfate	Nitrate -N	Total Cr ¹	Cr VI ¹	TDS	TSS
	gpm	°C	s.u.	ppb	ppb	ppm	ppm	ppb	ppb	ppm	ppm
3/9/2021	0.75	20.1	7.72	79,400	173,000	1,930	10.0	NA	NA	7,180	<2.5
3/16/2021	0.75	20.7	7.51	88,100	163,000	1,860	9.36 J	NA	NA	7,200	<2.5
3/23/2021	0.75	20.3	7.92	85,600	178,000	1,800	9.43	NA	NA	7,600	<2.78
3/30/2021	0.75	21.3	7.45	90,400	179,000	1,880	9	NA	NA	7,140	<2.5

Date	Biological Reactors																														
	Perchlorate (ppb)			Chlorate (ppb)			Nitrate (ppm)			Sulfate (ppm)			Total Cr (ppb) ¹		Cr VI (ppb) ¹		TSS (ppm)			pH			T (°F)			ORP			Pressure (psig)		
	Lead	Middle	Lag	Lead	Middle	Lag	Lead	Middle	Lag	Lead	Middle	Lag	Lag	Lag	Lead	Middle	Lag	Lead	Middle	Lag	Lead	Middle	Lag	Lead	Middle	Lag	Lead	Middle	Lag		
3/9/2021	79,200	1,750	19.6 J+	59,500	816	<24	<0.240	<0.240	<0.240	1,950	1,930	1,920	NA	NA	<2.5	<2.5	<2.5	7.45	7.53	7.45	73.6	75.9	78.0	11	-252	-441	10.6	5.3	9.2		
3/16/2021	73,800	885	9.51	50,100	164	<24	0.79	<0.240	<0.240	1,900	1,820	1,750	NA	NA	<2.5	3.1	3.7	7.19	7.25	7.33	71.8	72.3	74.1	265	-233	-391	9.9	6.6	10.2		
3/23/2021	80,800	661	16.9	51,900	<24	<24	<0.480	<0.480	<0.480	1,880	1,500	1,480	NA	NA	<2.8	4.04	3.8	7.37	7.31	7.31	74.1	78.2	78.2	54	-324	-358	9.5	7.1	10.2		
3/30/2021	96,800	1,630	22.3	78,700	581	<24	1.21	<0.480	<4.80	1,780	1,870	1,750	NA	NA	2.86	2.63	3.6	7.21	6.83	7.35	79.3	83.8	84.9	388	-327	-358	9.6	8.3	9.9		

Date	Post Reactor Tank Effluent							
	Perchlorate	Chlorate	Nitrate - N	Sulfate	Total Cr ¹	Cr VI ¹	TDS	TSS
	ppb	ppb	ppm	ppm	ppb	ppb	ppm	ppm
3/9/2021	<0.3	<24	<0.048	1,910	NA	NA	7,340	<2.5
3/16/2021	<0.3	<24	<0.048	1,810	NA	NA	7,080	6.5
3/23/2021	1.39	<24	<0.48	1,760	NA	NA	7,370	4.49
3/30/2021	<0.3	<24	<0.48	1,810	NA	NA	7,080	<2.5

¹ The chromium analysis will only be performed during Scenario #3.

NA = Not analyzed.

J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

J+ = The result is an estimated quantity, but the result may be biased high.