TETRA TECH

TECHNICAL MEMORANDUM

To:	**Nevada Environmental Response Trust**
Cc:	Nevada Division of Environmental Protection United States Environmental Protection Agency
From:	Katie Hendrickson
Date:	August 31, 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 to summarize Tetra Tech's progress during July 2021 toward successfully implementing the Hydrogen-Based Gas Permeable Membrane Pilot Study.

Task Progress Update: July 2021

Task M26 – Hydrogen-Based Gas Permeable Membrane Pilot Study

- Current Status
    - Scenario 3, which uses a blend of water from the AWF and the IWF prior to chromium pre-treatment, began on May 18, 2021 and continued through July 2021.
    - The pilot system influent water temperature exceeded 100 degrees F multiple times during June and July 2021. Several corrective measures were implemented as described in the June Progress Report. Since July 14, 2021 the influent water temperature has been below 100 degrees F.
    - Operational samples after July 14, 2021 show the perchlorate concentrations from the lag membrane reactor were below the detection limit (5 ppb) as shown on Figure 1.
    - Performance samples were collected on July 8, 2021 (prior to influent water temperature correction) and on July 20, 2021 and July 27, 2021. Some key observations from the performance samples collected in July are as follows:
        - Influent perchlorate concentrations ranged from 94,500 to 95,800 ppb.
        - Perchlorate concentrations from the lag membrane reactor were 43.2 on July 8, less than 0.3 ppb on July 20 and 0.612 ppb on July 27.
        - Influent hexavalent chromium concentrations ranged from 344 to 514 ppb and hexavalent chromium concentrations from the lag membrane reactor were less than 0.15 ppb.

Tetra Tech, Inc.
150 S. 4th Street, Unit A, Henderson, NV 89015
Tel 702-854-2295 tetratech.com

        - The above results indicate the system is meeting the pilot test objectives of reducing perchlorate to less than the current perchlorate discharge limit for the FBR system and that hexavalent chromium can be effectively reduced to trivalent chromium in the reactors.

- Schedule and Progress Updates
    - Scenario 3 is anticipated to run for a total of up to 12 weeks and assuming the performance data remains favorable, Scenario 3 would conclude on August 10, 2021 . Decommissioning of the pilot system is planned for immediately after Scenario 3 is complete.
- Health and Safety
    - There were no health and safety incidents related to Task M26 during July 2021.

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

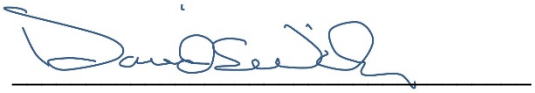
Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Date: 8/31/21

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.



August 31, 2021

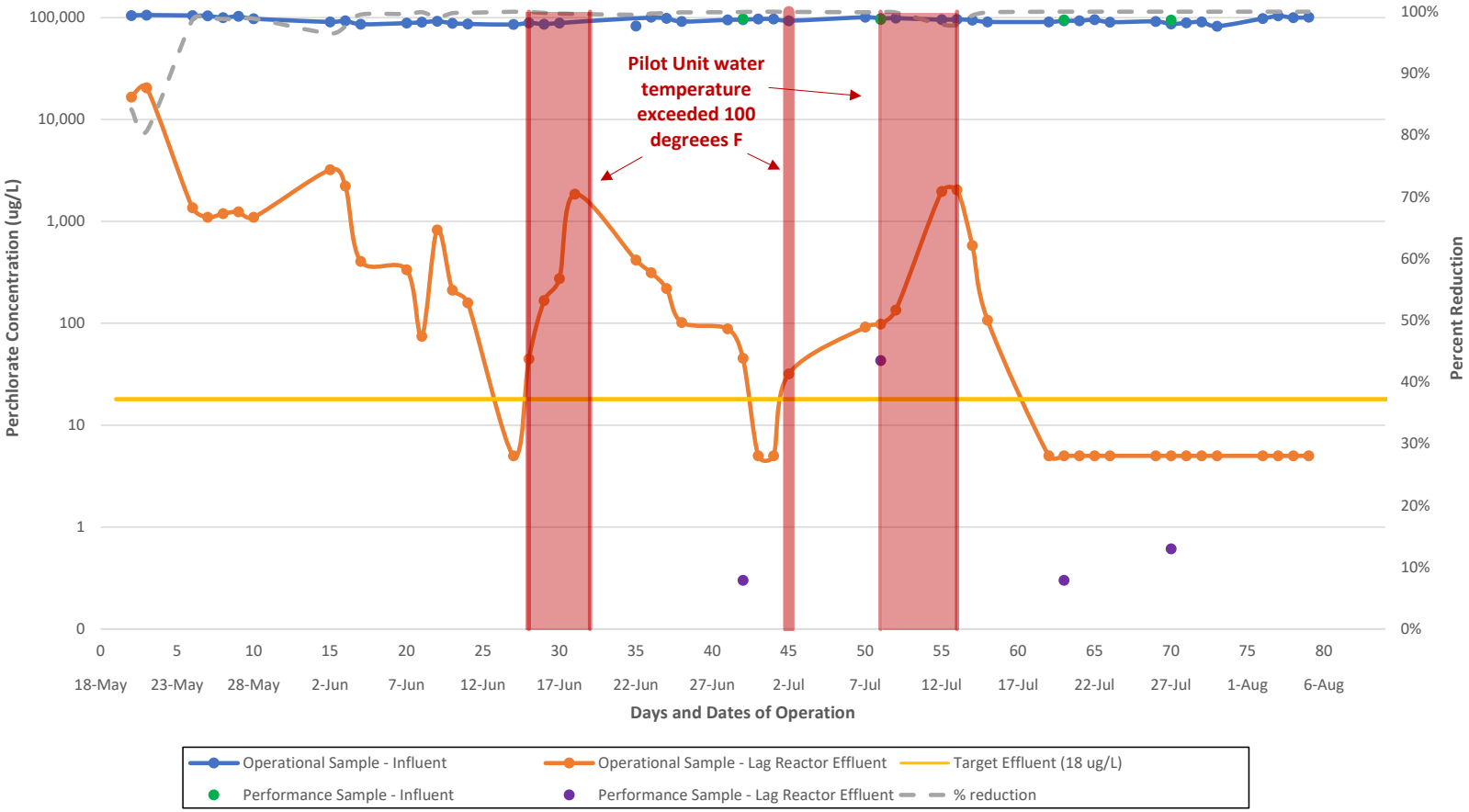
David S. Wilson, CEM
Principal Engineer
Tetra Tech, Inc.

Date

Nevada CEM Certificate Number: 2385
Nevada CEM Expiration Date: September 19, 2022

Figures

Figure 1. Scenario 3 Acclimation and Steady State - Perchlorate Concentrations and % Reduction



Tables

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Table 1
Scenario 3 Performance Sampling
Hydrogen-Gas Based Permeable Membrane Pilot Study

Week and Date	Influent Water									
	Flow	T	pH	Perchlorate	Chlorate	Nitrate-N	Total Cr [1]	Cr VI [1]	TDS	TSS
	gpm	°F	s.u.	ppb	ppb	ppm	ppb	ppb	ppm	ppm
7/8/2021	0.75	95.9	7.35	95,800	180,000	12.2	493	514	8,140	<2.5
7/20/2021	0.75	93	7.75	94,900	210,000	12.9	425	450	7,660	<2.5
7/27/2021	0.75	84	7.90	94,500	210,000	11.6	431J	344	7,440	<2.5

Week and Date	Biological Reactors																								
	Perchlorate (ppb)			Chlorate (ppb)			Nitrate (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	Lag	Lag	Lead	Middle	Lag	Lead	Middle	Lag	Lead	Middle	Lag	Lead	Middle	Lag	Lead	Middle	Lag
7/8/2021	45,700	1,290	43.2	12,000	<24	<24	<0.048	<0.048	<0.048	15.9	<0.15	<2.5	<2.5	<2.5	7.4	7.3	7.3	99.9	100.2	100.2	-120	-392	-405	7.0	5.1	7.8
7/20/2021	42,800	<0.3	<0.3	16,100	<24	<24	<0.48	<0.48	<0.48	11.7	<0.15	6.7J	2.9	<2.5	7.31	7.29	7.4	96.8	97.9	95.7	18	-365	-398	8.6	5.2	7.8
7/27/2021	38,700	823	0.612J	27,100	<24	<24	<0.48	<0.48	<0.48	12.2	<0.15	7.7	2.9	<5	7.30	7.31	7.41	89.4	93.4	93.2	129	-323	-418	12.8	5.7	8.3

Week and Date	Post Reactor Tank Effluent								Treated Water Holding Tank					Cartridge Filter Effluent								
	Perchlorate	Chlorate	Nitrate - N	Total Cr	Cr VI	TSS	T	pH	Total Cr (ppb) [1]	Cr VI (ppb) [1]	TSS	T	pH	Perchlorate	Chlorate	Nitrate -N	Total Cr	Cr VI	TDS	TSS	T	pH
	ppb	ppb	ppm	ppb	ppb	ppm	°F	s.u.	ppb	ppb	ppm	°F	s.u.	ppb	ppb	ppm	ppb	ppb	ppm	ppm	°F	s.u.
7/8/2021	54.9	<24	<0.48	14.9	<0.15	2.7	NA	NA	15.9	<0.15	7.3	NA	NA	11.4	<24	<0.48	20.9	<0.15	8,320	3.7	NA	NA
7/20/2021	<0.3	<24	<0.48	10	<0.15	<2.5	93.4	7.63	10.2	<0.15	4.3	91.6	7.42	<0.3	<24	<0.48	10.5	<0.15	7,440	8.67	92.5	7.41
7/27/2021	1.33J	<24	<0.48	12.3	<0.15	3.5	89.2	7.65	12.3	<0.15J	5.7	86.7	7.96	0.336J	<24	<0.48	12.8	<0.15	7,600	8.6	86.4	8.03

gpm	gallons per minute
T	temperature
°F	degrees Fahrenheit
s.u.	standard unit
ppb	parts per billion
ppm	parts per million
Total Cr	Total Chromium
Cr VI	hexavalent chromium
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
NA	Not Analyzed

J = Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
J+ = The result is an estimated quantity, but the result may be biased high.
J- = The result is an estimated quantity, but the result may be biased low.