

# TECHNICAL MEMORANDUM

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**To:** Nevada Environmental Response Trust

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

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**From:** Katie Hendrickson

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**Date:** October 4, 2021

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

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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 August 2021 toward successfully implementing the Hydrogen-Based Gas Permeable Membrane Pilot Study.

## Task Progress Update: August 2021

### Task M26 – Hydrogen-Based Gas Permeable Membrane Pilot Study

- Current Status
  - Scenario 3, which uses a blend of water from the Athens Well Field and the Interceptor Well Field prior to chromium pre-treatment, began on May 18, 2021 and continued through August 9, 2021.
  - Operational samples during August show the perchlorate concentrations from the lag membrane reactor were below the detection limit (5 ppb) as shown on Figure 1 with one exception on August 6 where the perchlorate concentration in the lag membrane reactor was 797 ppb. There were no system performance issues on that day and the result is believed to be lab or field error as perchlorate concentrations in lag reactor samples collected the day before and three days later were below the detection limit.
  - Performance samples were collected on August 3, 2021, August 5, 2021 (chromium only) and August 9, 2021. Some key observations from the performance samples collected in August are as follows:
    - Influent perchlorate concentrations were 80,600 and 94,500 ppb.
    - Perchlorate concentrations from the lag membrane reactor were 1.85 and 2.07 ppb.
    - Influent hexavalent chromium concentrations ranged from 381 to 453 ppb and hexavalent chromium concentrations from the lag membrane reactor were less than 0.15 ppb.
    - 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
  - Decommissioning of the pilot system is in progress.
- Health and Safety
  - There were no health and safety incidents related to Task M26 during August 2021.

## CERTIFICATION

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### 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

Not Individually, but **Solely**  
as President of the Trustee

**Signature:**  \_\_\_\_\_, 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

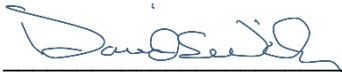
**Date:** 10/9/21

## CERTIFICATION

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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.



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

October 4, 2021

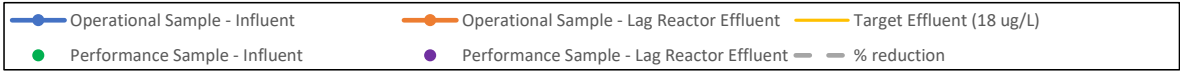
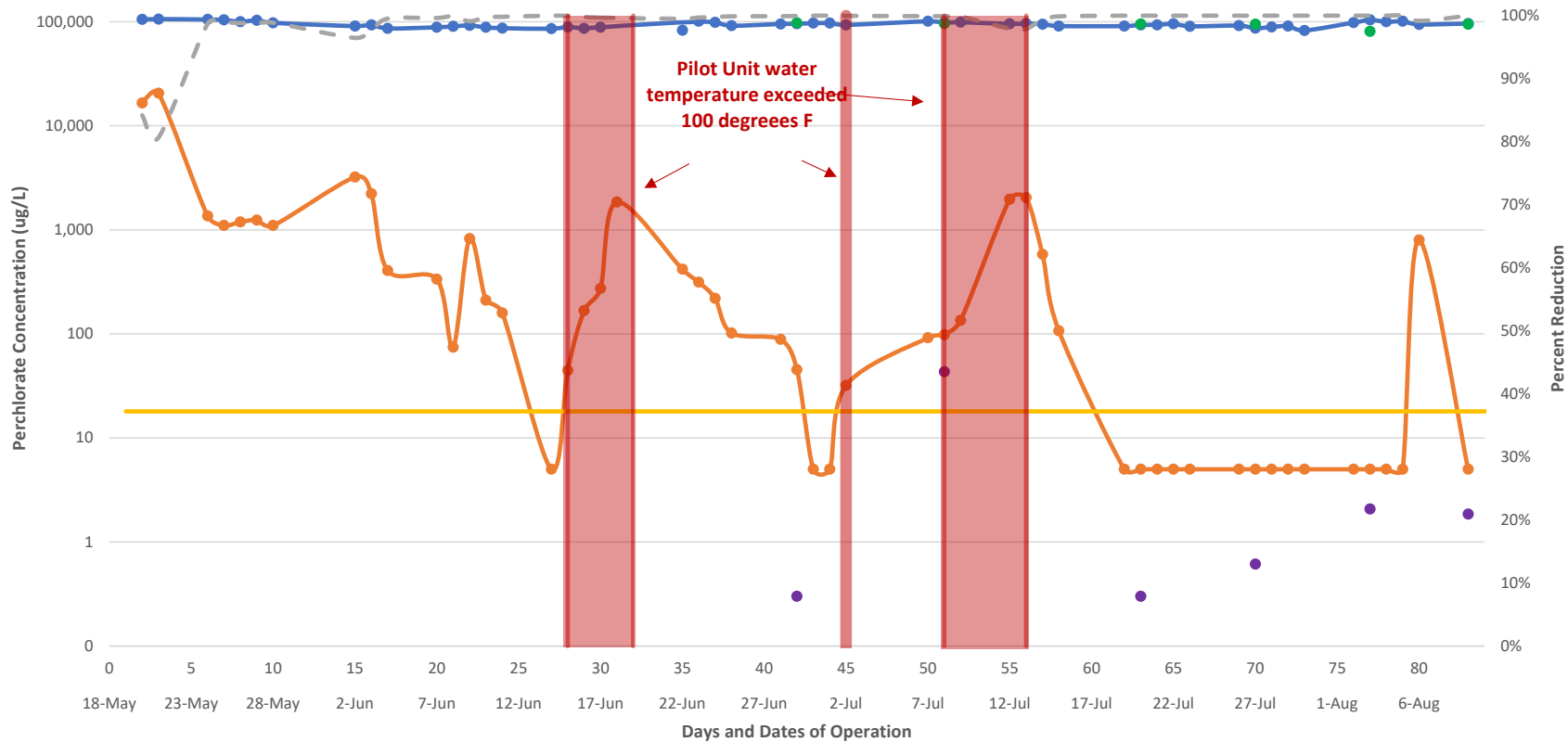
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Date

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

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

Week and Date	Influent Water									
	Flow gpm	T °F	pH s.u.	Perchlorate ppb	Chlorate ppb	Nitrate-N ppm	Total Cr ppb	Cr VI ppb	TDS ppm	TSS ppm
8/3/2021	0.75	80.1	8.04	80,600	215,000	13.2	381	351	7,660	<2.5
8/5/2021	0.75	72.1	7.82	NA	NA	NA	453	320	NA	2.6
8/9/2021	0.75	80.4	7.33	94,500	204,000	13.6	394	273	7,800	8.6

Week and Date	Biological Reactors																									
	Perchlorate (ppb)			Chlorate (ppb)			Nitrate (ppm)			Total Cr	Cr VI	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
8/3/2021	31,400	9,350	2.07	26,600	1,310	<24	0.8	<0.48	<0.48	7.16	<0.15	<2.5	<2.5	<2.5	7.29	7.3	7.42	90.1	94.3	93.6	25	-169	-378	15.0	5.5	8.8
8/5/2021	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.10 J	<0.15	<2.5	<2.5	<2.5	7.30	7.3	7.4	85.8	91.9	93.4	45	-155	NA	17.0	5.7	8.6
8/9/2021	34,100	11,300	1.85	21,700	1,670	<24	<0.48	<0.48	<0.48	5.19	<0.15	3.2	4.1	3.8	7.30	7.31	7.4	91.8	94.5	94.8	52	-162	-403	20.4	5.6	8.8

Week and Date	Post Reactor Tank Effluent									Treated Water Holding Tank					Cartridge Filter Effluent								
	Perchlorate ppb	Chlorate ppb	Nitrate - N ppm	Total Cr ppb	Cr VI ppb	TSS ppm	T °F	pH s.u.	Total Cr ppb	Cr VI ppb	TSS ppm	T °F	pH s.u.	Perchlorate ppb	Chlorate ppb	Nitrate - N ppm	Total Cr ppb	Cr VI ppb	TDS ppm	TSS ppm	T °F	pH s.u.	
8/3/2021	0.535 J-	<24	<0.48	6.72 J	<0.15	<2.5	86.5	7.84	8.16 J	<0.15	3.5	86.0	8.03	0.541	<24	<0.48	7.87 J	<0.15	7,760	<2.5	86.7	8.01	
8/5/2021	NA	NA	NA	4.88 J	<0.15	<2.5	89.1	7.5	5.26 J	<0.15	<2.5	86.4	8.11	NA	NA	NA	4.60 J	<0.15	NA	<2.5	86.9	8.03	
8/9/2021	<0.3	<24	<0.48	5.35	<0.15	5.3	NA	NA	6.31	0.334	4.3	NA	NA	<0.3	<24	<0.48	6.14	0.381	7,580	14.8	NA	NA	

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.