

# 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:** March 29, 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 that summarizes Tetra Tech's progress made during February 2021 toward successfully implementing the Hydrogen-Based Gas Permeable Membrane Pilot Study.

## Task Progress Update: February 2021

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

- Current Status
  - Test Scenario #1B, which involves treatment of the existing FBR influent obtained from the FBR equalization tank, began on November 24, 2020 and continued through February 11, 2020.
  - Additional performance samples for Scenario 1B were collected on February 2, 2021. The influent perchlorate concentrations was 45,000 ppb and effluent perchlorate concentration from the lag reactor was 0.85 ppb, which is over a 99.99% reduction. The influent and effluent nitrate concentrations were 7.7 ppm and below detection limits (<0.014 ppm), respectively. The influent and effluent chlorate concentrations were 100,000 ppb and 20 ppb, respectively. The Scenario 1B performance results are shown in Table 1 and Figure 1 displays the perchlorate operational and performance sample results from Scenario 1B.
  - The Pilot System cleaning was performed February 11 through February 17, 2021.
  - Pilot System operations for Scenario #2, which uses a blend of water from the AWF and IWF after chromium pre-treatment, was started on February 17, 2021 and system acclimation is ongoing.
- Schedule and Progress Updates
  - Scenario 2 is anticipated to run for up to 12 weeks. Once steady state is reached, performance samples will be collected.
- Health and Safety
  - There were no health and safety incidents related to Task M26 during February 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

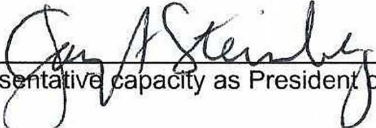
**Nevada Environmental Response Trust Site  
(Former Tronox LLC Site)  
Henderson, Nevada**

#### **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

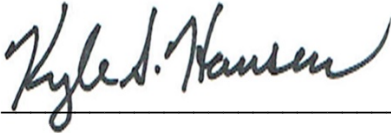
**Date:** 3/29/21

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

March 29, 2021

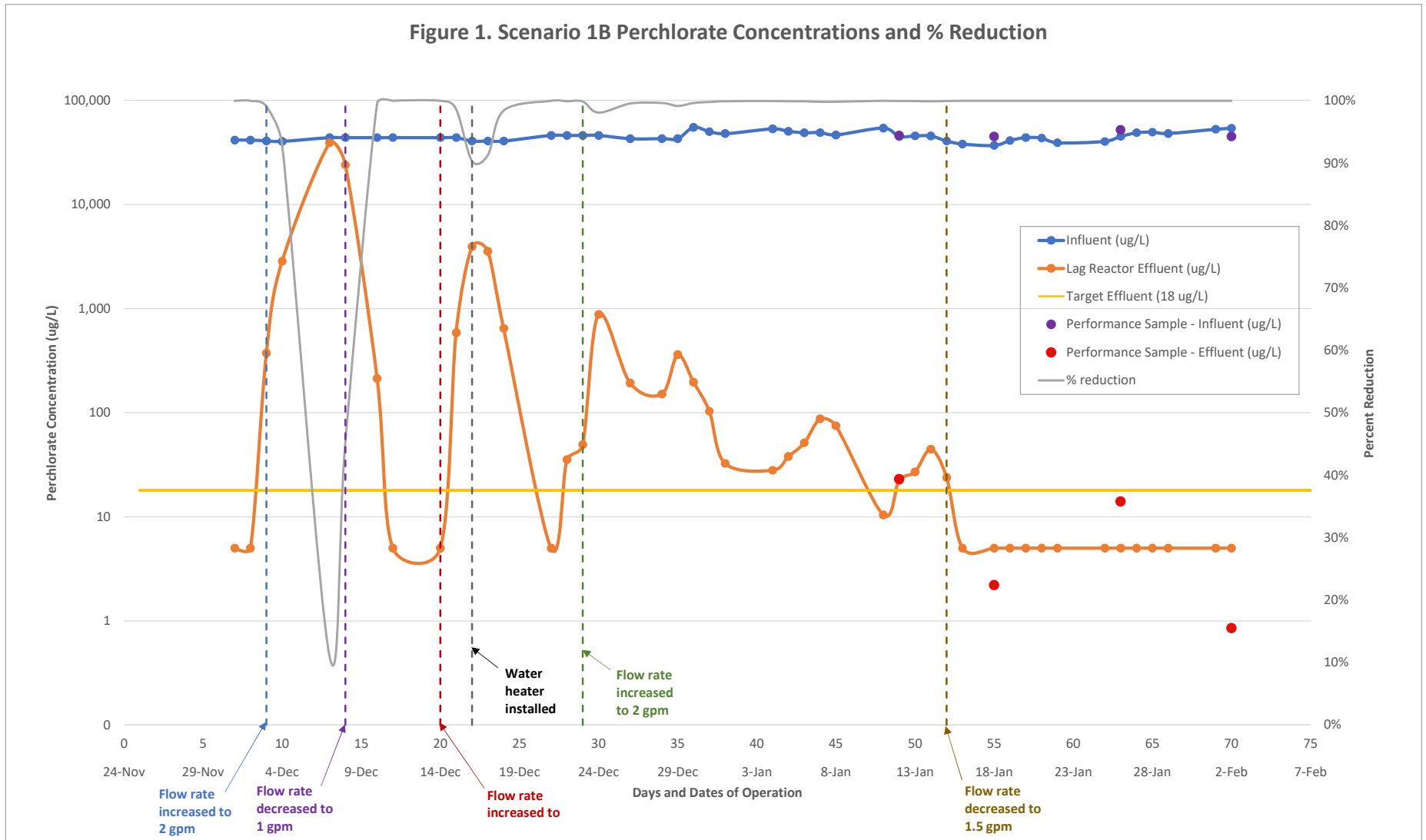
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Date

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

## Figures

Figure 1. Scenario 1B Perchlorate Concentrations and % Reduction



## Tables

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

| Date      | Influent Water |      |      |             |          |            |                       |                    |       |     |
|-----------|----------------|------|------|-------------|----------|------------|-----------------------|--------------------|-------|-----|
|           | Flow           | T    | pH   | Perchlorate | Chlorate | Nitrate -N | Total Cr <sup>1</sup> | Cr VI <sup>1</sup> | TDS   | TSS |
|           | gpm            | °C   | s.u. | ppb         | ppb      | ppm        | ppb                   | ppb                | ppm   | ppm |
| 1/12/2021 | 2.0            | 20.3 | 7.67 | 46,000      | 88,000   | 6.6        | NA                    | NA                 | NA    | 13  |
| 1/18/2021 | 1.5            | 22.9 | 7.62 | 45,000      | 110,000  | 6.3        | NA                    | NA                 | 4,800 | 5.5 |
| 1/26/2021 | 1.5            | 20.0 | 7.78 | 52,000      | 110,000  | 6.8        | NA                    | NA                 | 4,400 | 12  |
| 2/2/2021  | 1.5            | 22.7 | 7.79 | 45,000      | 100,000  | 7.7        | NA                    | NA                 | 4,900 | 13  |

| Date      | Biological Reactors |        |      |                |        |     |               |        |        |                             |                          |           |        |     |      |        |      |        |        |      |      |        |      |                 |        |      |
|-----------|---------------------|--------|------|----------------|--------|-----|---------------|--------|--------|-----------------------------|--------------------------|-----------|--------|-----|------|--------|------|--------|--------|------|------|--------|------|-----------------|--------|------|
|           | Perchlorate (ppb)   |        |      | Chlorate (ppb) |        |     | Nitrate (ppm) |        |        | Total Cr (ppb) <sup>1</sup> | Cr VI (ppb) <sup>1</sup> | 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  |
| 1/12/2021 | 31,000              | 620    | 25   | 14,000         | 140    | 72J | 0.21          | <0.014 | <0.014 | NA                          | NA                       | 5.0       | 8.0    | 8.0 | 8.00 | 8.00   | 7.85 | 73.2   | 72.5   | 73.0 | -365 | -394   | -376 | 13.4            | 11.2   | 18.8 |
| 1/18/2021 | 4,800               | 100    | 2.1  | 2,000          | 64J+   | 74  | <0.014        | <0.014 | <0.014 | NA                          | NA                       | 5.0       | 8.5    | 13  | 8.00 | 7.99   | 7.83 | 78.4   | 77.7   | 78.6 | -299 | -432   | -470 | 19.6            | 12.1   | 19.0 |
| 1/26/2021 | 32,000              | 53,000 | 14   | 32,000         | 73,000 | 53  | 0.99          | 10     | <0.014 | NA                          | NA                       | 8.0       | 8.5    | 10  | 7.99 | 8.01   | 7.73 | 73.0   | 73.2   | 73.2 | 124  | -411   | -440 | 20.1            | 16.2   | 18.7 |
| 2/2/2021  | 33,000              | 680    | 0.62 | 28,000         | 120    | 20  | 0.14          | <0.014 | <0.014 | NA                          | NA                       | 13.0      | 6.5    | 5.5 | 7.99 | 8.01   | 7.58 | 80.6   | 81.5   | 82.5 | 6    | -422   | -456 | 27.6            | 16.0   | 18.6 |

| Date      | Post Reactor Tank Effluent |          |             |                       |                    |     |
|-----------|----------------------------|----------|-------------|-----------------------|--------------------|-----|
|           | Perchlorate                | Chlorate | Nitrate - N | Total Cr <sup>1</sup> | Cr VI <sup>1</sup> | TSS |
|           | ppb                        | ppb      | ppm         | ppb                   | ppb                | ppm |
| 1/12/2021 | 23                         | 69J      | <0.014      | NA                    | NA                 | 9.5 |
| 1/18/2021 | 2.2                        | 76       | <0.014      | NA                    | NA                 | 7.0 |
| 1/26/2021 | 8.7                        | 58       | <0.014      | NA                    | NA                 | 15  |
| 2/2/2021  | 0.85                       | 45       | <0.014      | NA                    | NA                 | 13  |

<sup>1</sup>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.

J- = Laboratory result inconsistent with other process samples and split sample results. Results from split samples collected from the Middle Reactor on 1/26/21 are as follows:

Perchlorate = 514 ppb

Chlorate = <200 ppb

Nitrate = <0.5 ppm