TETRA TECH

TECHNICAL MEMORANDUM

To:	**Nevada Environmental Response Trust**
Cc:	Nevada Division of Environmental Protection United States Environmental Protection Agency
From:	Carl Lenker and Eric Klink
Date:	March 12, 2020
Subject:	**Unit 4 Source Area In-Situ Bioremediation Treatability 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 January 2020 toward successfully implementing the Unit 4 Source Area In-Situ Bioremediation Treatability Study.

Task Progress Update: January 2020

Task M21 – Unit 4 Source Area In-Situ Bioremediation (ISB) Treatability Study

- Task Leader – Arul Ayyaswami
- Current Status
    - The University of Nevada – Las Vegas (UNLV) continued microcosm and column testing in accordance with the Unit 4 Source Area In-Situ Bioremediation Treatability Study Bench-Scale Work Plan and Treatability Study Modification No. 1. The following is a brief summary of the bench-scale study results to date:
        - UNLV continued microcosm testing with a combination of molasses, molasses with acetate, mixed microbial cultures, and soil and groundwater collected from boring and well locations near the Unit 4 Building. On January 14, 2020, (day 509 of the microcosm testing), UNLV sampled the remaining microcosms. The following is a summary of these results:
            - In microcosms containing initial TDS concentrations of approximately 15,000 mg/L and molasses, the average perchlorate concentration was 1,095 mg/L (1,200 mg/L in the primary microcosm and 990 mg/L in the replicate microcosm). This compares to the average perchlorate concentration of 1,050 mg/L (1,100 mg/L in the primary microcosm and 1,000 mg/L in the replicate microcosm) for the previous samples from these microcosms.
            - In microcosms containing initial TDS concentrations of approximately 21,000 mg/L and molasses, the average perchlorate concentration was 651 mg/L (1.7 mg/L in the primary microcosm and 1,300 mg/L in the replicate microcosm). This compares

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to the average perchlorate concentration of 708 mg/L (16 mg/L in the primary microcosm and 1,400 mg/L in the replicate microcosm) for the previous samples from these microcosms.

- Perchlorate concentrations have not signficantly degraded in any of the microcosms containing molassess and acetate.

- UNLV continued column testing during this reporting period with two intermediate columns (columns packed with a mixture of sand and soil collected from 75 to 85 feet bgs) and two deep columns (columns packed with a mixture of sand and soil collected from 95 to 105 feet bgs). On November 25, 2019, UNLV began feeding undiluted groundwater to the columns to evaluate the effect of higher TDS on the biodegradation. The following is a summary of the available results from November 25, 2019 through January 24, 2020:
  - Hexavalent chromium continued to be degraded in both the intermediate and deep columns with hexavalent concentrations reducing from an influent concentration of up to 100 mg/L to an effluent concentration below 0.1 mg/L in all columns.
  - Nitrate degraded from approximately 40 mg/L to 20 mg/L in the intermediate columns and from 140 mg/L to less than 1 mg/L in the deep columns.
  - Chlorate degraded from approximately 2,500 mg/L to 1,200 mg/L in the intermediate columns and from approximately 11,000 mg/L to 6,000 mg/L in the deep columns.
  - Perchlorate did not degrade in the intermediate columns and degraded from approximately 1,800 mg/L to 1,200 mg/L in the deep columns.
  - It is believed that partial degradation of chlorate and perchlorate in the columns is due to the higher concentrations of contaminant fed to the columns without a change in flowrates and contact time. On January 25, 2020, the feed flowrates were reduced for all of the columns to allow additional contact time. The results will be included in future progress reports.

- Schedule and Progress Updates
  - The following activities are scheduled to be conducted in February 2020:
    - Continued UNLV microcosm and column testing in accordance with the Unit 4 Source Area In-Situ Bioremediation Treatability Study Bench-Scale Work Plan and Treatability Study Modification No. 1. UNLV plans to collect the last microcosm sample on February 25, 2020 and then will analyze the remaining soil and liquid present in the microcosms for bacteria and contaminants.
    - Development of the Unit 4 Source Area In-Situ Bioremediation Treatability Study Work Plan Addendum for Phase 2 that is currently anticipated to be submitted in the Third Quarter of 2020.
- Health and Safety
  - There were no health and safety incidents related to Task M21 during January 2020.

CERTIFICATION

Unit 4 Source Area Bioremediation Treatability 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 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

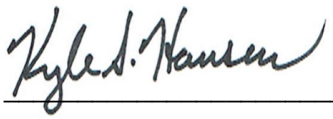
Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Date: 3/12/2020

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 Unit 4 Source Area Bioremediation Treatability Study Monthly Progress Report.



March 12, 2020

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

Date

Nevada CEM Certificate Number: 2167
Nevada CEM Expiration Date: September 18, 2020