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:	January 24, 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 December 2019 toward successfully implementing the Unit 4 Source Area In-Situ Bioremediation Treatability Study.

Task Progress Update: December 2019

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. No new data are available to report for the microcosm testing during this reporting period. An additional sampling event is planned for January 2020 and there may be sufficient volume of liquid in the remaining microcosms to collect one additional sample after the January 2020 sample.
        - 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). The columns have been running for over 293 days. On November 25, 2019, UNLV began feeding undiluted groundwater to the columns to evaluate the effect of higher TDS on the biodegradation.
            - 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.

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- Nitrate continued to be degraded in the intermediate columns with nitrate concentrations reducing from an influent concentration of 40 mg/L to effluent concentrations of approximately 2.5 mg/L in one intermediate column and below 1 mg/L in the second intermediate column. In the deep columns, nitrate concentrations reduced from an influent concentration of approximately 140 mg/L to effluent concentrations between 50 and 75 mg/L.
- Chlorate was significantly degraded in both intermediate columns and one deep column following the change in the influent feed water to undilitued groundwater. In the intermediate columns, chlorate concentrations decreased from an influent concentration of approximately 2,500 mg/L to effluent concentrations between 400 and 900 mg/L. In the deep columns, chlorate concentrations decreased from an influent concentration of approximately 11,000 mg/L to an effluent concentration of 4,250 mg/L in one column, with no signficant decrease in concentration observed yet in the second column.
- No significant perchlorate reduction was observed in the intermediate and deep columns in the first 15 days following the change in the influent feed water to undiluted groundwater.
- Chloroform was also measured during the column testing to evaluate chloroform degradation. In the intermediate columns, chloroform concentrations decreased from an influent concentration of approximately 40 µg/L to effluent concentrations between 0.5 and 3.5 µg/L. In the deep columns, chloroform concentrations decreased from influent concentrations between 2,500 and 4,800 µg/L to effluent concentrations between 22 and 150 µg/L.

- Schedule and Progress Updates
  - The following activities are scheduled to be conducted in January 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. The bench-scale studies are currently anticipated to be completed in March 2020, with final data and reporting from UNLV in April 2020.
    - 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 second quarter of 2020. The submittal timeline of the Addendum will be dependant on the duration of the microcosm and column studies.
- Health and Safety
  - There were no health and safety incidents related to Task M21 during December 2019.

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

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

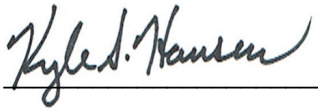
Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Date: 1/24/2020

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.



January 24, 2020

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

Date

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