

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 2, 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 November 2019 toward successfully implementing the Unit 4 Source Area In-Situ Bioremediation Treatability Study.

Task Progress Update: November 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. The groundwater was diluted to three different total dissolved solids (TDS) concentrations (approximately 15,000 mg/L, 18,000 mg/L, and 21,000 mg/L) to evaluate the effect of TDS on the degradation of the chemicals of potential concern (COPCs).
 - **Molasses Microcosm Results:** On November 5, 2019 (day 439 of the microcosm testing), UNLV sampled the microcosms containing initial TDS concentrations of approximately 21,000 mg/L and 15,000 mg/L to determine whether perchlorate had been further degraded. In microcosms containing initial TDS concentrations of approximately 21,000 mg/L, the perchlorate concentration slightly reduced from 18 mg/L to 16 mg/L in one microcosm and from 1,700 mg/L to 1,400 mg/L in the replicate microcosm compared to the results from the previous sampling event in September 2019. In microcosms containing an initial TDS concentration of approximately 15,000 mg/L, the perchlorate concentrations reduced from

approximately 1,100 mg/L to 1,050 mg/L compared to the results from the previous sampling event in September 2019.

- **Molasses and Acetate Microcosm Results:** Perchlorate concentrations have not significantly degraded in any of the microcosms after 439 days.
- 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 240 days using a feed solution containing groundwater collected from the intermediate and deep zones from the Unit 4 Source Area both with and without a carbon substrate solution and mixed microbial cultures. The groundwater was diluted at a 1:3 ratio of groundwater to stabilized Lake Mead water resulting in a feed solution with a TDS concentration between 2,000 and 3,000 mg/L for the intermediate columns and 4,000 to 6,000 mg/L for the deep columns. At day 240, perchlorate concentrations were below detection limits in the intermediate columns and one of the deep columns. Because biodegradation was observed for the COPCs in the columns using the diluted groundwater, UNLV started feeding undiluted groundwater to the columns on November 25, 2019 to evaluate the effect of higher TDS on the biodegradation. The TDS concentrations of the feeds to the columns are approximately 6,600 mg/L for the intermediate columns and 22,000 mg/L for the deep columns. Additional data for the column tests will be presented in subsequent monthly progress reports.
- Schedule and Progress Updates
 - The following activities are scheduled to be conducted in December 2019:
 - 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.
 - Development of the Unit 4 Source Area In-Situ Bioremediation Treatability Study Work Plan Addendum for Phase 2 at the completion of laboratory testing, provided the data support moving forward with a field test. 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 November 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

Signature: Jay A. Steinberg, not individually but solely as President, 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: 11/2/20

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.



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

January 2, 2020

Date

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