TETRA TECH

TECHNICAL MEMORANDUM

To:	Nevada Environmental Response Trust
Cc:	Nevada Division of Environmental Protection United States Environmental Protection Agency
From:	Dan Pastor and Dana Grady
Date:	January 26, 2018
Subject:	**Seep Well Field Area Bioremediation Treatability Study Progress Update**

At the direction of the Nevada Environmental Response Trust (NERT or Trust), Tetra Tech, Inc. (Tetra Tech) has prepared this memorandum which summarizes Tetra Tech's progress during December 2017 toward successfully implementing the Seep Well Field (SWF) Area Bioremediation Treatability Study.

Task Progress Update: December 2017

Task M11 – Seep Well Field Area Bioremediation Treatability Study (SWFTS)

- Task Leader – Dana Grady/Dan Pastor
- Current Status
    - All bench-scale testing by the University of Nevada, Las Vegas (UNLV) has been completed. UNLV submitted a draft report to Tetra Tech in December that summarizes this testing, results, and conclusions, and this report is currently under review. The bench-scale study will be summarized in the forthcoming Seep Well Field Area Bioremediation Treatability Study Results Report, which will be submitted upon completion of the treatability study. The results report will also include the complete UNLV report as an appendix.
    - The final results of the effluent chemical oxidant demand from the UNLV bench-scale column tests indicate that concentrations ranged from 500 milligrams per liter (mg/L) to 1,000 mg/L, which equates to approximately 125 mg/L to 250 mg/L of total organic carbon (TOC) for the emulsified vegetable oil substrate under evaluation. This range is very similar to the highest TOC concentrations (100 mg/L to 180 mg/L) that were measured in the treatability study monitoring wells located nearest the injection wells.
    - Groundwater sampling was performed the week of December 11 – December 15.
    - Slug testing was performed the week of December 18 – 22 on select injection and monitoring wells.

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  - Results from the ongoing effectiveness monitoring program continued to indicate sustained decreases in perchlorate and chlorate concentrations in groundwater in the first 9 weeks following completion of the first injection event (August/September 2017). The results of the Week 13 groundwater sampling event (the December monthly event) indicate that perchlorate concentrations in downgradient wells have gradually begun to increase, though concentrations in several wells are still at 50 percent or less than their baseline concentrations. Two key monitoring wells, located between the injection transects, had slight increases in perchlorate concentrations after having previously achieved non-detect concentrations. However, the perchlorate concentrations in these wells are still at least 90 percent less than their baseline concentrations. This is likely due to diminishing organic carbon availability and is indicative of the need for carbon replenishment. Based on TOC measurements in injection and monitoring wells, Tetra Tech has determined that a targeted supplemental injection event will be performed in January 2018.
  - The second round of Bio-Traps® was removed from the wells on November 29 for advanced microbial analysis to monitor the microbial response following the first injection event. Initial analysis and comparison to baseline values in the same wells indicate an order of magnitude increase in microbial population following carbon substrate injections from approximately 10^4 per bead to 10^5 per bead in most wells. Additionally, Proteobacteria, which are one of the largest groups of bacteria and represent a wide variety of both aerobe and anaerobes, had proportions that were generally over 50 percent at the start of the study and remained over 50 percent in the most recent sample collection. Proportions of firmicutes, which are of interest because they include anaerobic fermenting bacteria that produce the hydrogen necessary for perchlorate reduction, increased in the injection wells from 0 percent to approximately 10 percent. At the same time, there was very little increase in the proportion of bacteria groups that are associated with sulfate reducers, which is important because of the large quantity of sulfate present in groundwater and the desire to prevent large-scale microbial sulfate-reduction. Detailed results of the microbial data will be summarized in the Seep Well Field Area Bioremediation Treatability Study Results Report.

- Schedule and Progress Updates
  - This task remains on schedule.
  - The second injection event is scheduled to begin on January 22, 2018.
  - No groundwater sampling will be conducted in January due to injections being performed. Monthly groundwater sampling will resume in February following completion of the second injection event.
- Health and Safety
  - There were no safety incidents related to Task M11 during December 2017.

CERTIFICATION

Seep Well Field Area Bioremediation Treatability Study Progress Update

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

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: 1/28/18

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 Seep Well Field Area Bioremediation Treatability Study Progress Update, Nevada Environmental Response Trust Site, Henderson, Nevada

January 26, 2018

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

Date

Nevada CEM Certificate Number: 2167
Nevada CEM Expiration Date: September 18, 2018