MEMO

Date **September 11, 2019**
To **Nevada Environmental Response Trust**
From **John Pekala, Scott Warner, and Chris Ritchie**
Copy to **Nevada Division of Environmental Protection**
United States Environmental Protection Agency
Subject **In-Situ Bioelectrochemical Laboratory-Scale Treatability Study Monthly Progress Report**

TASK PROGRESS UPDATE: JULY 2019

At the direction of the Nevada Environmental Response Trust (NERT or Trust), Ramboll US Corporation (Ramboll) has prepared this memorandum which summarizes Ramboll's progress during July 2019 toward successfully implementing the In-Situ Bioelectrochemical Laboratory-Scale Treatability Study for the remediation of perchlorate in water.

TASK M24 – IN-SITU BIOELECTROCHEMICAL LABORATORY-SCALE TREATABILITY STUDY

- Task Leaders – Scott Warner / Chris Ritchie
- Current Status
  - Microcosm Batch Testing: The second round of microcosms outlined in the March 2019 progress update continued through July. Microcosm samples are scheduled to be analyzed in August, and associated data will be provided in subsequent progress reports.
  - Column Testing: The second stage of column testing outlined in the April 2019 progress update continued through July. The soil columns, which were supplemented with vitamin B12 on May 15, 2019 and molybdate on June 11, 2019, continued to be monitored in July. For the column undergoing indirect electrochemical treatment, whereby hydrogen is the only electron donor, perchlorate removal activity appears to have been stimulated in July, though variability in the effluent perchlorate concentrations warrants further monitoring into August to establish reproducible results. Since the addition of the vitamin B12 and molybdate, no significant decrease in perchlorate effluent concentrations has been observed in the two other columns (one column undergoing simulated direct electrochemical treatment and one column undergoing no electron donor addition); monitoring will continue into August.
  - Sand Tank Testing: The sand tank continued to operate as a flow-through system throughout the month of July. During operation of the sand tank at a two-week residence time (i.e., time that influent water remains in the tank system), analytical results continued to indicate complete perchlorate reduction, as described in the June progress update. Evaluation of secondary reactants from this treatment process indicated that approximately 90% of dissolved hydrogen is consumed within the first 6 inches of the sand tank, suggesting rapid electron donor uptake which corresponds to the rapid perchlorate removal observed in this interval. Additionally, at the two-week residence time, there appeared to be residual dissolved hydrogen generally throughout

the sand tank regardless of depth, suggesting potential downward hydrogen diffusion from the headspace into the soil. Based on the successful perchlorate removal observed for the two-week residence time, the flow rate of the tank was increased to further assess perchlorate removal kinetics, thereby lowering the residence time to one week. Preliminary results for samples collected one week after the flow rate increase indicated at least 90% reduction of perchlorate concentrations from 50 mg/L in the influent to 4 mg/L in the effluent. These initial results may not yet represent steady-state conditions; therefore, monitoring of the sand tank will continue into August. Objectives during August will be to verify perchlorate reduction rates at the one-week residence time and evaluate the associated presence and distribution of secondary reactants from the treatment process.

- Schedule and Progress Updates
  - Bench-scale testing has been extended to further evaluate microcosms, columns, and the sand tank and is expected to continue through September 2019. A report summarizing the results of the laboratory testing program is anticipated to be submitted to NDEP in fourth quarter 2019.
  - A modification to the treatability study work plan (Treatability/Pilot Study Modification No. 11) is currently being prepared to obtain site-specific design parameters through a focused assessment of Site microbial conditions and implementation of a small-scale bioelectrochemical field test based in part on the initial successful results from the sand tank testing. This modification will contain a summary of bench-scale testing done to-date to support an incremental stage small-scale field test.
  - Pending completion of bench-scale testing and the small-scale field test, a report will be prepared to present NERT's conclusions on the technology. At that time, a work plan addendum proposing a more comprehensive field test may be prepared if supported by the results.
- Health and Safety
  - There were no safety incidents during July 2019.

In-Situ Bioelectrochemical Laboratory-Scale 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 system(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, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Signature: VICE-PRESIDENT NERT, ON BEHALF OF

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: 9/10/19

In-Situ Bioelectrochemical Laboratory-Scale Treatability Study Progress Update

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

Responsible Certified Environmental Manager (CEM) for this project

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 provided 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.

September 11, 2019

John M. Pekala, PG
Principal

Date

Certified Environmental Manager
Ramboll US Corporation
CEM Certificate Number: 2347
CEM Expiration Date: September 20, 2020