MEMO

Date	**June 3, 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: APRIL 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 April 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
  - Three experimental flow through soil columns continued to operate to assess perchlorate and competing electron acceptor (i.e. nitrate, nitrite, and chlorate) removal. The columns were operated under the following electron donor conditions: 1) no electron donor to act as the control, 2) electrochemically-produced hydrogen and acetate to simulate a direct treatment and 3) hydrogen only to simulate an indirect treatment. As discussed previously, the first stage of column testing was completed in March 2019. The site soil flow-through columns were re-started for a second stage of testing in April 2019 with the following modifications:
    - Synthetic groundwater was formulated with a higher perchlorate concentration relative to other competing electron acceptors: perchlorate = 36 mg/L; chlorate = 1.6; nitrate = 1.5 mg/L; and nitrite = 1.3 mg/L. The flow conditions are similar to flow conditions of the first stage column investigations conducted from October 2018 to March 2019.
    - Columns were bioaugmented with two species of *Dechloromonas* (namely, the known perchlorate reducers *D. aromatica* and *D. agitata*). Influent and effluent samples are being monitored for perchlorate and chlorate removal. At the time of this update, there remains an apparent lag in perchlorate and chlorate removal in both the direct (acetate and H2 as electron donors) and indirect (H2 as electron donor) electrochemical treatment columns. This is not unexpected as the pure cultures of *Dechloromonas* were not acclimated to the column conditions prior to being introduced. The operation and monitoring of the columns is ongoing.

- The second round of microcosms outlined in the March 2019 report are still operating. Initial results show that, similar to the columns, there is an apparent lag in perchlorate reduction regardless of electron donor presence and whether site soils were bioaugmented with the *Dechloromonas* strains. The microcosms will continue to be monitored with data provided in subsequent progress reports as data are available.
- While column testing and microcosm testing are still ongoing, the sand tank prototype testing phase has commenced to evaluate distribution/delivery effects and dynamic effects in a two-dimensional system and to help our understanding of the performance of the columns. The sand tank design is complete (see schematic in Figure 1). Sand tank construction and instrumentation (e.g., sampling ports, ORP electrodes) were initiated and nearly completed by the end of April. Site soils (collected from immediately south of Galleria Road in the ZVI treatability study area) were sieved to prevent plugging of sample ports. The site soils fill about half of the sand tank; clean sand will be mixed with the site soil to reach the final tank solids volume. Once flow is initiated in the sand tank, data will be collected and reported in future progress reports.

- Schedule and Progress Updates

  As discussed in the March 2019 update, bench-scale testing is expected to continue into June 2019. A bench-scale treatability study report is anticipated to be submitted in Q3 2019. A work plan addendum proposing a field test will be provided as an attachment.

- Health and Safety
  - There were no safety incidents during April 2019.

ATTACHMENTS

Figure 1: Schematic of sand tank design and operation in a re-circulation mode.

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 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 of the 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: 6-3-19

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

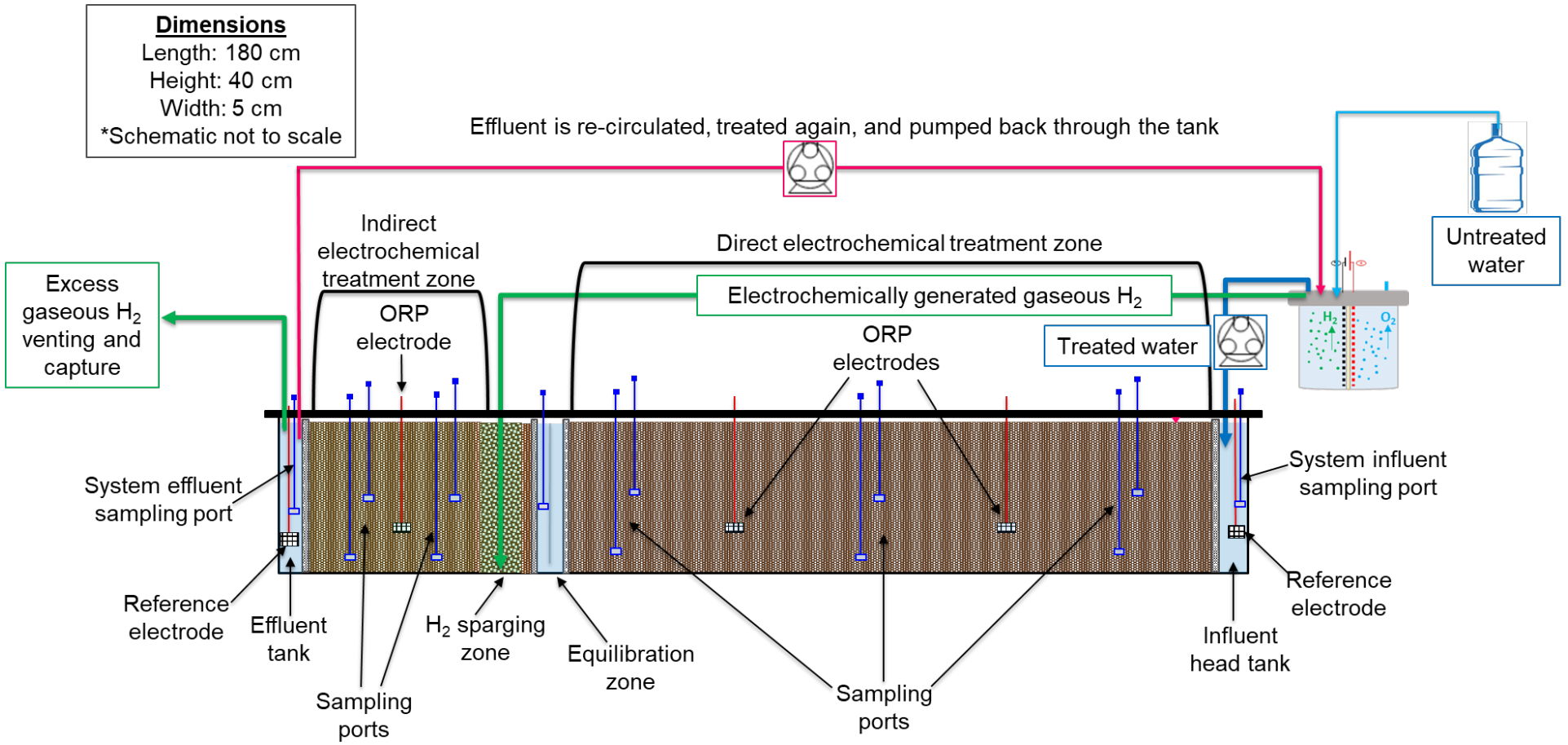
I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession, and to the best of my knowledge, comply with all applicable federal, state, and local statutes, regulations, and ordinances.

June 3, 2019

John M. Pekala, PG
Principal

Date

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



RAMBOLL

Schematic of sand tank design and operation in a re-circulation mode. Note that the placement of treatment zones or location of sampling ports and other instrumentation is an approximation.

Figure 1

Drafter: RZ | Date: 05/17/19 | Contract Number: 1690011200-052 | Approved: | Revised: