

# MEMO

Date **May 9, 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 **Galleria Drive ZVI-Enhanced Bioremediation Treatability Study Monthly Progress Report**

## TASK PROGRESS UPDATE: MARCH 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 March 2019 toward successfully implementing the Galleria Drive Zero-Valent Iron (ZVI)-Enhanced Bioremediation Treatability Study.

## TASK M18 – GALLERIA DRIVE ZVI-ENHANCED BIOREMEDIATION TREATABILITY STUDY.

- Task Leaders – Scott Warner / Chris Ritchie
- Current Status
  - Phase 1 of the treatability study is on-going. The pre-design field investigation is complete; bench-scale testing is in progress and described more in the following sections. Bench-scale testing is anticipated to conclude in May 2019. Phase 2 (design and implementation of a field test) is anticipated to be proposed in late Q2 of early Q3 2019 as part of a forthcoming Work Plan Addendum.
  - As previously reported, the ion chromatograph (IC) has been experiencing difficulties in running samples. Perchlorate data are delayed due to analytical instrument issues; troubleshooting is underway.
  - Column testing is on-going; experimental columns are described in the table below.

Summary of Column Tests				
Column ID	Test Conditions	Length	Start Date	Status
A1	ZVI only (abiotic)	2 feet	October 2018	Completed
B1	ZVI + nutrients	2 feet	October 2018	Operating with increased flowrate
A2	ZVI + nutrients	5 feet	November 2018	Operating with increased flowrate

Summary of Column Tests				
Column ID	Test Conditions	Length	Start Date	Status
B2	ZVI + carbon + nutrients	5 feet	November 2018	Operating with increased flowrate
Pc	Peroxychem commercial ZVI + carbon + nutrients	5 feet	November 2018	Operating with increased flowrate
Notes: 1. The "nutrients" are diammonium phosphate (DAP) and vitamin B-12. DAP has a formula of (NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub> and is a common nutrient for biomass. 2. The "carbon" is supplied as Emulsified Oil Substrate (EOS) in column B2 and as an integrated solid carbon substrate in column Pc.				

- As previously reported, samples were taken from column A1 and column A2 in January 2019 to evaluate the presence of perchlorate and nitrate degrading genes. The results revealed that the column A2 contained  $3.09 \times 10^2$  copies of the perchlorate reduction gene (pcrA gene), indicating low levels of perchlorate reducing bacteria. Column A1 did not contain detectable concentrations of the perchlorate reduction gene, but did have detectable concentrations of nitrate reduction genes. Following this evaluation, the column A1 feed was supplemented with nutrients (DAP, vitamin B12) to foster microbial growth and thereby perchlorate degradation. The column was allowed to run for approximately one month post-amendment and then stopped after running 145 days total. Perchlorate and chlorate reduction data are waiting to be run on the IC. Column A1 is currently being dissected and sampled (Figure 1); samples will be analyzed for post-amendment perchlorate removal and the potential growth of perchlorate-reducing bacteria.
- Initially, the column Pc was effective at removing contaminants but decreased contaminant removal was observed after approximately 25 days. This was assumed to be caused by exhaustion of the Peroxychem material in the column; however, additional testing has shown that there was an issue with flow through the column. After replacing the tubing and clearing the clogged material, the column began operating again. Initial results indicate nitrate removal, though perchlorate and chlorate removal data are waiting for analysis.
- In order to determine the minimum hydraulic residence time that will allow for the degradation of all contaminants, the flow rate of the columns was increased twice in March 2019. Initial results indicate the columns are able to adapt to the increased flow rates but samples are still being analyzed. Flowrates will continually be increased until the limiting flowrates are determined and then the columns will be stopped. Further discussion and results will be outlined in upcoming progress reports.
- Hydrogen generation by ZVI was tested in a batch apparatus. Samples containing 30g ZVI/L of granular ZVI (Connelly GPM ETI-CC 1004) are being assessed for hydrogen production. Another sample, with half the granular ZVI/L concentration (15g) is simultaneously being tested. Results will be presented in future progress reports.
- The Trust continues to evaluate the applicability of this technology as additional data become available.

- Schedule and Progress Updates
  - Field work related to the pre-design field investigation as specified in the work plan is complete. Additional deeper investigation was conducted in January and February in accordance with Treatability/Pilot Study Modification No. 5 dated November 5, 2018 (approved by NDEP on November 14, 2018). Preliminary findings from the deeper investigation are expected to be provided in the April and May updates.
  - Column testing is expected to be completed in May. The testing of hydrogen generation from ZVI will continue through May.
  - A work plan addendum is anticipated to be submitted in Q3 2019 provided that the data continue to support moving forward with a field test.
- Health and Safety
  - There were no safety incidents during March 2019.

## **ATTACHMENTS**

Figure 1: Column A1 has been stopped and dissected. The column is currently being sampled for chemical and microbial analysis.



## Galleria Drive ZVI-Enhanced 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:** Jay A Steinberg **Not Individually, but Solely as President of the Trustee**, 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:** 5/9/19

## Galleria Drive ZVI-Enhanced Bioremediation 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 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 Galleria Drive ZVI-Enhanced Bioremediation Treatability Study Progress Update, Nevada Environmental Response Trust Site, Henderson, Nevada



5/9/2019

**John M. Pekala, PG**  
**Principal**

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

Date



**Column A1 has been stopped and dissected. The column is currently being sampled for chemical and microbial analysis.**

Figure

**1**