NEVADA DIVISION OF
ENVIRONMENTAL
PROTECTION

STATE OF NEVADA
Department of Conservation & Natural Resources
Steve Sisolak, *Governor*
Bradley Crowell, *Director*
Greg Lovato, *Administrator*

July 9, 2020

Jay A. Steinberg
Nevada Environmental Response Trust
35 East Wacker Drive, Suite 690
Chicago, IL 60601

Re: **Tronox LLC (TRX) Facility**
Nevada Environmental Response Trust (Trust) Property
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection (NDEP) Response to: *Seep Well Field Area Bioremediation Treatability Study – 2019 Annual Progress Report*

Dated: May 22, 2020

Dear Mr. Steinberg,

The NDEP has received and reviewed the Trust's above-identified Deliverable and provides comments in Attachment A. A revised Deliverable should be submitted by **09/10/2020** based on the comments found in Attachment A. The Trust should additionally provide an annotated response-to-comments letter as part of the revised Deliverable.

Please contact the undersigned with any questions at wdong@ndep.nv.gov or 702-486-2850 x252.

Sincerely,

Dong Weiquan

Weiquan Dong, P.E.
Bureau of Industrial Site Cleanup
NDEP-Las Vegas City Office

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Todd Tietjen, SNWA

Attachment

1. The Deliverable does not have fatal flaw.

2. The EVO Pro mass injected by well has been significantly varying from well to well and specific well from Event 1 to Event 4, which are related to the injection rate and the time duration. What are criteria used to determine how much EVO Pro mass is needed and appropriate for each injection well during each injection event?

3. Several downgradient monitoring wells (e.g. SWFTS-MW25, SWFTS-MW23, SWFTS-MW24, SWFTS-MW03, SWFTS-MW09A and PC-94) from the injection wells didn't respond to the Injection Events 2, 3 and 4 as they responded Injection Event 1. Please explain and investigate why perchlorate concentration of these monitoring wells has been staggered after Injection Event 1.

4. Specific Comment #1 Section 2.1, Page 3
   How was the amount of distribution water used determined? If the EOS dilution water and the distribution water are added, the percentage of EOS Pro in the water is 5 percent and since EOS Pro is already only 60 percent vegetable oil, this means that the EVO added was fairly dilute.

5. Specific Comment #2 Section 2.1, Page 3
   Glycerin was added to the injectate solution to serve as an immediate source of carbon to drive the groundwater anaerobic rapidly and reduce acclimation time at the start of the study in first injection but it was not added in the second injection. Glycerin was added at a concentration of about 2 percent of the volume of the EOS Pro in both Injection Events 4 and 5. EOS Pro already contains approximately 4 percent rapidly biodegradable substrate (glycerol according to the SDS) and the groundwater at the site should be close to anaerobic condition; therefore, what is the reason that this small amount of glycerin is added to the mixture?

6. Specific Comment #3 Section 2.3
   Were there any monitoring parameters that were used to determine when another injection of EVO would take place? What determined the injection frequency shown in Table 1?

7. Specific Comment #4 Section 3.3, Page 9
   Injection wells SWFTS-IW13B and SWFTS-IW19 were the wells that it was not possible to inject into during the fourth injection event, but well SWFTS-IW19 did accept the injection after the well maintenance activities. The analysis of the solids collected from these wells were similar to each other but different from the other wells and presumably

is indicative of material that clogs the well rather than just accumulating. What is the explanation for the fact that the well maintenance activities were able to restore function to well SWFTS-IW19 but not SWFTS-IW13B, and what future maintenance could be performed on well SWFTS-IW13B to restore this well?

8. Specific Comment #5 Section 3.3, Page 9
   Why did the biomass, oleate materials, and calcium salts accumulate in wells SWFTS-IW13B and SWFTS-IW19 only? Is it possible that these wells received less distribution water owing to the positioning of the manifolds, or did groundwater flow cause the injected material to flow in the direction of these wells, or were these two wells overdosed with EVO Pro due to inappropriate mixing during the injection?

9. Specific Comment #6 Section 3.3, Page 9
   This information is very interesting. A summary table of types of materials accumulating as related to well injection rates and EVO Pro mass could be drawn from this and would be a valuable addition.

10. Specific Comment #7 Section 3.4.4
    Some success has been shown in using ethyl lactate to dissolve oleate clogging EVO wells. Will the use of an organic material such as ethyl lactate to dissolve the organic material clogging the well be considered in order to return well SWFTS-IW19 to functionality?

11. Specific Comment #6 Section 4.2.1.1
    Are there any plans to investigate the poor response of well SWFTS-MW15 to the EVO injections or to install another injection well to target this area?

12. Specific Comment #7 Section 4.2.1.1
    Does the difference in screened interval between wells PC 91 and PC 92 account for the steady decrease in perchlorate observed at PC 91 as compared to the fluctuations observed at PC 92?

13. Specific Comment #8 Section 4.2.3
    As discussed in this section, nitrate removal and perchlorate removal appear to be highly correlated. However, in wells SWFTS-MW19 and SWFTS-MW23, nitrate levels appear to be naturally low (low at baseline event). However, significant perchlorate biodegradation has not been observed in these locations. Has any hypothesis on this been formed?

14. Specific Comment #9 Section 4.2.4

An increase in total organic carbon (TOC) is typically desired for anaerobic remediation. The United States Environmental Protection Agency (USEPA) (1998) suggests that a TOC greater than 20 milligrams per liter (mg/L) is favorable for anaerobic remediation. This recommendation pertains to chlorinated solvents, and it is true that perchlorate reduction takes place under less reducing condition; however, some increase in TOC may enhance perchlorate remediation. Has any thought been given to increasing the EVO dose to try to increase TOC concentration and to control biofouling in the treatment area?

The absence of volatile fatty acids in any wells except SWFTS-MW14 and SWFTS-MW16 (low levels) is also an indication of insufficient carbon in the treatment area.

15. Specific Comment #10 Section 4.2.5
    The lack of sustained reductions in oxidation reduction potential (ORP) and increases in methane and ferrous iron suggest that long lasting anaerobic conditions have not been established other than in wells MW 14 and MW 16. This is another indication that an increased EVO dose may be warranted. Has any thought been given to increasing the EVO dose to try to enhance and sustain anaerobic conditions in the treatment area?

16. Specific Comment #11 Section 4.2.6
    The sentence "The Bio Trap® collected from downgradient well SWFTS-MW09B had the highest proportion of General (Nsats) at 62.22 percent during the reporting period" should be edited to explain that Nsats are normal saturated fatty acids that are found in all organisms, and, therefore, the prevalence of these types of fatty acids and absence of other fatty acids that may indicate more diverse organisms indicates that the bacteria population may be less diverse in this area.

17. Specific Comment #12, Section 4.2.6
    This section discusses the higher concentration of eukaryotes in the sample from well SWFTS MW14 and states that this is sometimes an indication of inefficient destruction of contaminants but that this is not the case at well SWFTS-MW14 as good removal of perchlorate has been observed at this well. What then, if anything, is the significance of the relatively high population of eukaryotes in this well?

18. Specific Comment #13, Section 4.2.6
    Was any consideration given to trying a biotrap "baited" with perchlorate in well SWFTS-MW14 or SWFTS-MW16 to learn more about the population which is degrading the perchlorate? It seems unlikely that this population was captured on the biotraps given the low perchlorate concentration at SWFTS-MW14 at the time when the biotraps were deployed and the lack of perchlorate biodegradation in the other biotrap wells.

19. Specific Comment #14, Section 5.2

    The cost effectiveness of the injection of less substrate is discussed; however, the injection of a higher concentration of substrate at a lower frequency may achieve greater cost savings and enhance the biodegradation of perchlorate.

20. Reference

    USEPA. 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater. Cincinnati, OH: National Risk Management Research Laboratory, Office of Research and Development, USEPA. EPA/600/R 98/128