NEVADA DIVISION OF
ENVIRONMENTAL
PROTECTION

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

March 27, 2019

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: *Hydrogen-Based Gas Permeable Membrane Technology, Pilot Test Work Plan*

Dated: February 15, 2019

Dear Mr. Steinberg,

The NDEP has received and reviewed the Trust's above-identified Deliverable and finds that the document is acceptable with the following comments noted for the Administrative Record:

1. **General Comment**: The O&M Manual needs to be submitted before starting the system.

2. **General Comment**: The work plan does not have detail information about the technology background with the references. The work plan should also provide more information such as the chemistry of influent and effluent water and the sludge generated for the five APT pilot studies mentioned. NDEP asks this information to be presented with the study result report.

3. **Section 2.1, MBfR Process**: This section states that a potential advantage of using hydrogen as electron donor versus ethanol for perchlorate reduction is that the denitrification biomass synthesis "equations indicate that for every gram of nitrate nitrogen that is reduced using ethanol as the electron donor approximately 0.42 grams of biomass is generated; however, when hydrogen is used as the electron donor only 0.23 grams of biomass is generated for one gram of nitrate nitrogen being reduced. Therefore, a system using hydrogen as electron donor would theoretically generate 50% less waste biomass than a system using ethanol". Based on the biomass generation mass estimates provided, the percent reduction of 50 percent has been derived by rounding to the nearest tens place. The text should be revised to be more accurate so that the percent reduction number is 45% (rounded to the nearest ones place).

   In addition, please provide a summary of the scientific justification (including citations) for this statement, "the mechanism for perchlorate reduction are believed to be similar" to denitrification in the study result report.

4. **Section 2.1, MBfR Process**: This section states that "the H_2 passing through the membrane is used to reduce the oxidized contaminant, which could provide better process stability compared to FBR systems that use sand or activated carbon as media for biomass growth when appropriately scaled". Please provide further explanation of the potential benefits from improved process stability in the study result report.

5. **Section 2.1, MBfR Process**: This section states that "In addition to reducing perchlorate and chlorate, a potential secondary benefit of the MBfR technology is that it may also reduce hexavalent chromium (Cr^{+6}) to trivalent chromium (Cr^{+3}). Following chemical reduction in the bioreactor, the trivalent chromium could be precipitated and removed from the water stream. Evaluating the treatment efficiency of hexavalent chromium will be a secondary objective of the pilot test." Please provide scientific justification (including citations) for why this may be possible in the study result report.

6. **Section 2.2, Description and General Operation of the Pilot Unit**: This section states that "the sloughed biofilm will be collected, measured and evaluated as part of this study". Provide further details about the measurement process in the O&M manual and the study result report.

7. **Section 2.2, Description and General Operation of the Pilot Unit**: This section states that "treated water from the effluent storage tank is expected to contain very low concentrations of perchlorate, chlorate, and nitrate, therefore, it will be periodically discharged to the GW-11 Pond for subsequent treatment in the FBR plant. Plans to direct the treated water to the GW-11 pond have been discussed with Envirogen Technologies Incorporated (ETI), the Groundwater Extraction and Treatment System (GWETS) operator, and they have no concerns with processing this water through the FBRs, nor do they have any concerns regarding GWETS compliance with its NDPES permit as a result of processing this treated water". If one of the pilot study objectives is to "demonstrate the ability of the APT MBfR technology to reduce various influent concentrations of perchlorate to less than 18 ppb, the current perchlorate discharge limit for the FBR system, and evaluate its ability to achieve even lower concentrations", then why is it expected that the treated water generated from the MBfR pilot study will need subsequent treatment in the FBR plant. Please provide justification for this statement in the study result report.

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

Sincerely,

Dong Weiq

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NDEP-Las Vegas City Office

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