May 9, 2014

Mr. Weiquan Dong, PE
Bureau of Corrective Actions, Special Projects Branch
Nevada Division of Environmental Protection
2030 E. Flamingo Rd., Suite 230
Las Vegas, Nevada 89119

Re: Treatability Study Work Plan, In-Situ Soil Flushing Pilot, Revision 2, Nevada Environmental Response Trust Site, Henderson Nevada, May 9, 2014 (NDEP Facility ID #H-000539)

Dear Mr. Dong,

Please find enclosed the *Treatability Study Work Plan, In-Situ Soil Flushing Pilot, Revision 2*, dated May 9, 2014 (the "Work Plan") for the Nevada Environmental Response Trust (Trust) Site in Henderson, Nevada. This report was prepared by ENVIRON International Corporation (ENVIRON) on behalf of the Trust. This Work Plan was revised in response to comments received from the Nevada Division of Environmental Protection (NDEP) on March 18, 2014. An annotated response to NDEP's comments is attached to this letter.

Please contact John Pekala at (602) 734-7710 or Allan DeLorme at (510) 420-2565 if you have any comments or questions concerning this report.

Sincerely,

John M. Pekala, PG
Senior Manager
CEM #2347, expires 9/20/2014

Allan J. DeLorme, PE
Principal

Attachment

cc: BMI Compliance Coordinator, NDEP, BCA, Las Vegas
NDEP c/o Brian Giroux, McGinley and Associates, Reno

ec: James Dotchin, NDEP
Greg Lovato, NDEP
Nevada Environmental Response Trust
Tanya O'Neill, Foley & Lardner LLP
Joe McGinley, McGinley and Associate

Attachment

Responses to NDEP Comments Dated March 18, 2014
Treatability Study Work Plan, In-Situ Soil Flushing Pilot, Revision 1,
Nevada Environmental Response Trust Site, Henderson, Nevada

Responses to NDEP Comments Dated March 18, 2014
Treatability Study Work Plan, In-Situ Soil Flushing Pilot, Revision 1,
Nevada Environmental Response Trust Site, Henderson, Nevada

NDEP Comment	Response
1. Section 1.2 Purpose and Objectives, page 2. Perchlorate mass within the groundwater plume was estimated and presented within the Remedial Investigation/Feasibility Study (RI/FS); however, no estimate appears to have been developed for the on-site soils. No data is presented that the proposed site is located in terms of perchlorate mass remaining in the soil column.	The following text has been added to the second paragraph of Section 1.2 in the Work Plan (Revision 2): "ENVIRON has estimated that approximately 1,300 tons of perchlorate are present in on-site vadose zone soils following the 2011 remedial action. This mass estimate was calculated using GIS software and the Thiessen Polygon method over multiple depth intervals to interpolate the post-remediation soil sample results." Section 3 of the Work Plan (ENVIRON, December 27, 2013) presents the rationale used to select the pilot study location. While the concentrations of perchlorate in vadose zone soils are an important consideration, a number of other factors including proximity to utilities, access, proximity to operating portions of the Site, etc. were also considered in choosing the pilot study location. In addition to the discussion presented in Section 3 of the Work Plan, the concentrations of perchlorate from available soil sampling results are presented in Figure 3 and an estimate of the mass within the pilot study area is provided in Appendix D of the Work Plan.
2. Section 2 Work Performed by Others, page 5, 2nd paragraph. There is a footnote that indicates that there were anomalies in the previous work by Prima. There is no indication of the degree of the anomalies and the effect on the conclusions. However, the subject Work Plan continues to reference and use the conclusions herein.	The subject footnote in Section 2 (Work Performed by Others) has been revised as follows: "The 99% percent removal is based on the results of sampling the soil in the columns pre- and post-flushing. Prima also looked at mass removed using the leachate sampling results, which indicated that only 33% and 67% percent of perchlorate was removed from the columns tested, based on perchlorate analytical results of pre-flushing soil samples. Although the Prima report does not identify a reason for this discrepancy in the estimated mass removed, potential causes include non-uniform distribution of perchlorate in the soil columns, ineffective homogenization of the soil in the soil columns, or biodegradation within the soil columns that was not accounted for during testing. These anomalies do not in themselves alter the overall conclusion that soil flushing is effective at removal of perchlorate from vadose zone soils and that further evaluation through pilot testing is needed."

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3. Section 3 Candidate Installation Location, page 6, 1st bullet. Soil comparison to a BCL is not an appropriate metric for evaluating the soil leaching to groundwater pathway.	ENVIRON acknowledges that a direct contact BCL is not the appropriate metric for evaluating the soil leaching to groundwater pathway. In the context of the discussion of Section 3, the BCL was simply referenced as a convenient metric to help identify areas of the Site where perchlorate concentrations are elevated and was not intended to be used as a metric for evaluating the soil leaching to groundwater pathway.
4. Section 4.1 Local Geology, page 7, 1st paragraph. Site has been defined as the "NERT Site." A search of the All Wells database there are 709 wells installed by NERT. Please provide a reference for the 1,100 well counts mentioned herein.	Please note that this number (1,100) refers to the approximate number of both wells and soil borings that have been installed, and was presented to give general context to the extent of investigation activities that have been performed at and in the vicinity of the Site.
5. Section 5.2 Laboratory Column Testing, page 9, last paragraph on page. What are the redox characteristics of the GWETS water as opposed to the stabilized Lake Mead water?	At the time of writing the Work Plan, no redox data were available for the GWETS effluent, and although dissolved oxygen (D.O.) results are reported, analysis for D.O. was performed by an external laboratory with results reported outside holding times. Following treatment in the fluidized bed reactor (FBR) water from the GWETS goes through a dissolved air floatation process (DAF) where this water is aerated. As discussed in Section 5.2 of the Work Plan (Revision 1), samples of each flushing liquid will be collected from sample ports on the GWETS effluent and Lake Mead water lines at the Site, and analyzed for various parameters including dissolved oxygen (DO), conductivity, oxidation reduction potential (ORP) and redox pairs.
6. 5.2 Laboratory Column Testing, page 10, penultimate paragraph on page. The Deliverable states that "The progress of the wetting front will be monitored daily until break through. Once the flushing liquid breaks through at the bottom of the column, a sample will be collected and analyzed for the constituents listed in Table 1." The Work Plan states that the column tests will follow ASTM D4874-95; however, the ASTM reference states that the column is run in an upflow mode. Please explain the contradiction.	ASTM D4874-95 will be used as guidance in the design and construction of the columns as described in the last sentence of the second paragraph of page 10 of the Work Plan. Similar to the testing performed by Prima, ENVIRON is proposing to operate the columns in downward flow mode as this will more accurately simulate the operation of the proposed field-scale pilot system.
7. Section 6.1.1, Flushing Volume, page 12. The logic used to jump from 4 volumes to 8 volumes is not clear.	A gross volume estimate of soil flushing volumes was provided in the Work Plan for planning purposes and to facilitate the discussion and development of the preliminary design of the in-situ pilot presented. Although 99% of the mass of perchlorate was estimated by Prima to be removed after about 2 pores volumes, flushing of soils in-situ is

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	expected to require higher volumes of flushing liquid than that observed in the laboratory due to the effects of heterogeneities in soil structure, anisotropies of hydraulic properties, and the greater depth of contamination. For planning purposes, ENVIRON has conservatively estimated a minimum of 4 pore volumes and as many as 8 pore volumes will be required to achieve similar levels of perchlorate removal in-situ. The last two sentences in the second paragraph of Section 6.1.1 have been revised in the Work Plan (Revision 2) as follows: "Based on review of these considerations reported in literature and the varying soil structures observed in available boring logs from the Site, a minimum of 4 pore volumes and, conservatively, as many as 8 pore volumes have been estimated to achieve similar levels of perchlorate removal in-situ."
8. Section 6.1.2, Hydraulic Loading, page 13. Green-Ampt equation should be capitalized and referenced.	The name of the Green-Ampt equation has been capitalized in Section 6.1.2 and the following citation has been added to Section 10 (References) of the Work Plan (Revision 2): "Green, W. H., and G. A. Ampt 1911. Studies on soil physics, J. Agric. Sci., 4(1), 1 –24."
9. Section 6.1.4 Potential Impacts to the GWTS, page 13, 2nd paragraph of the section. Please provide the data and calculations to support the estimated mass of perchlorate.	The estimated mass of perchlorate present in the pilot study area was calculated using a maximum reported perchlorate concentration of 3,130 mg/kg, a soil bulk density of 1.725 g/cc obtained from the Prima column study report (Prima, 2010), and the volume of vadose zone soils of 270,000 cubic feet of the pilot area. The perchlorate concentration of 3,130 mg/kg from soil boring RSAM-5 was reported by Prima as the maximum concentration of perchlorate in the soils used for the column testing. Shallow soils where the Prima samples were collected to construct their columns were subsequently removed during the 2011 remedial activities. As illustrated in Figure 3 in the Work Plan (Revision 1), post-removal perchlorate concentrations in soils of the planned location of the pilot study area range from 204 to 2,620 mg/kg based on sampling results from borings RSAM5 and SA15. To be conservative and account for

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	the observed variability in the previous results, ENVIRON used the maximum concentration of 3,130 mg/kg reported by Prima in its calculations of perchlorate mass. The volume of vadose zone in the candidate pilot area is estimated to be 270,000 cubic feet, using flushing surface area of 10,000 square feet and an average vadose zone depth of 27 feet.. While the actual depth of the vadose zone may be closer to 20 feet, based on the post excavation ground surface and recent water level measurements, the depth of 27 feet was used as a conservative estimate. Appendix D of Work Plan (Revision 2) has been updated to include a description of calculations presented to estimate the mass of perchlorate flushed during operation of the in-situ pilot study.
10. Section 6.1.4 Potential Impacts to the GWTS, page 13, 2nd paragraph of the section. The Work Plan states that "ENVIRON notes that this assumption is likely to significantly overestimate that rate at which perchlorate will leach from soils in the pilot system due to the issues discussed in Section 6.1.1 above." The reference to Section 6.1.1 should be Section 2.0, page 5.	The typographical error has been corrected in the Work Plan (Revision 2) as follows: "ENVIRON notes that this assumption is likely to significantly overestimate the rate at which perchlorate will leach from soils in the pilot system due to the issues discussed in Section 2.0 above."
11. Section 6.3 Permitting, page 16. What is the contingency plan for permitting if the pilot test runs past 180 days? What will trigger the need to apply for a major or minor permit modification, allowing for the timer required by NDEP for permit processing?	As communicated by the NDEP BWPC contact for Groundwater Discharge Permits, a temporary discharge permit can be resubmitted if the actual discharge duration extends beyond the 180 day period. ENVIRON will coordinate with the NDEP BWPC over the course of the pilot study to maintain the necessary permit. Based on this clarification from NDEP BWPC, a modification to the existing permit would not be required. It is noted that for full-scale operation of soil flushing at the Site, the addition of a new source of groundwater discharge to an existing permit would be considered a major modification requiring submittal of an application and public comment period. The estimated time frame for completing a major modification is approximately 4 months. The text of the 1st paragraph of Section 6.3 has been revised in the Work Plan (Revision 2) as follows:

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	"Extension of the test for a longer time period will require application for a new temporary Groundwater Discharge Permit at least 30 days prior to expiration of the "existing" temporary Groundwater Discharge Permit."
12. Appendix B. ENVIRON Standard Operating Procedures. The SOPs do not follow EPA QA/G-6, April 2007, EPA/600/B-07/001, Office of Environmental Information. The NDEP previously specified that the BMI Companies were to follow the EPA guidance.	Appendix B. ENVIRON SOPs have been revised in the Work Plan (Revision 2) to conform with the format prescribed in USEPA QA/G-6 (April 2007, EPA/600/B-07/001).
13. Appendix C Groundwater Mounding Estimates. Table 1. QAL Soil Matrix Data at Similar Depths to the Proposed Soil Flushing Pilot. Please indicate basis for the porosity determination as reported herein, e.g., volumetric or gravimetric.	The porosity used in the calculations is based on data obtained from Table 3-4 of the 2010 Northgate Capture Zone Evaluation Report. The porosity was determined on a volumetric basis. The source of the data presented in Appendix C (Groundwater Mounding Estimates) has been added as a footnote to the table in the Work Plan (Revision 2).
14. Appendix D IWF Perchlorate Removal Calcs. The calculated perchlorate mass loading is proportional to the thickness of groundwater mixing zone. Please justify why the 2 meter of the thickness of groundwater mixing zone was used.	The 2 meter thickness was selected using the July 1996 USEPA soil screening guidance, EPA540/R-96/018, Equation 12: Estimation of Mixing Zone Depth. The purpose of the evaluation presented in Section 6.1.4 and Appendix D (Perchlorate Mass Loading Rate Estimates) was to assess the potential impact of operation of the in-situ soil flushing pilot on the GWETS. To this end, a worst-case scenario of perchlorate flushing to the GWETS was considered by using conservative inputs to the calculations presented in Appendix D. The 2 meter mixing thickness is conservative given the dimensions of the proposed pilot study area, and results in a higher estimated breakthrough concentration at the Interceptor Well Field.