NEVADA DIVISION OF
ENVIRONMENTAL
PROTECTION

STATE OF NEVADA
Department of Conservation & Natural Resources
Steve Sisolak, *Governor*
James R. Lawrence, *Acting Director*
Greg Lovato, *Administrator*

November 3, 2022

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: *The annotated response-to-comments (RTCs)-Baseline Health Risk Assessment Report for OU-1 Soil Gas and Groundwater*

Dated: June 24, 2022

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 **11/03/2023** 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 702-668-3929.

Sincerely,

Dong Weiquan

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

WD:cp

EC:
Jeffrey Kinder, Deputy Administrator NDEP
Frederick Perdomo, Deputy Administrator NDEP
James Dotchin, NDEP BISC Las Vegas
Carlton Parker, NDEP BISC Las Vegas
Alan Pineda, NDEP BISC Las Vegas
Andrew Barnes, Geosyntec
Andrew Steinberg, Nevada Environmental Response Trust
Anna Springsteen, Neptune & Company Inc.
Betty Kuo Brinton, Metropolitan Water District of Southern California

Brian Waggle, Hargis + Associates
Brian Loffman, Nevada Environmental Response Trust
Brian Rakvica, Syngenta
Carol Nagai, Metropolitan Water District of Southern California
Chris Ritchie, Ramboll
Christine Klimek, City of Henderson
Chuck Elmendorf, Stauffer Management Company, LLC
Dan Pastor, P.E. TetraTech
Dan Petersen, Ramboll
Dane Grimshaw, Olin
Daniel Chan, SNWA
Darren Croteau, Terraphase Engineering, Inc.
Dave Share, Olin
Dave Johnson, LVVWD
Derek Amidon, TetraTech
Ebrahim Juma, Clean Water Team
Ed Modiano, de maximis, inc.
Eric Fordham, GeoPentech
Gary Carter, Endeavour
Jay A. Steinberg, Nevada Environmental Response Trust
Jeff Gibson, Endeavour
Jill Teraoka, Metropolitan Water District of Southern California
Joanne Otani, The Fehling Group
Joe Kelly, Montrose Chemical Corporation of CA
Joe Leedy, Clean Water Team
John Edgcomb, Edgcomb Law Group
John-Paul Rossi, Stauffer Management Company LLC
John Solvie, Clark County Water Quality
Karen Gastineau, Broadbent & Associates
Kathrine Callaway, Cap-AZ
Kelly McIntosh, GEI Consultants
Kirk Stowers, Broadbent & Associates
Kirsten Lockhart, Neptune & Company Inc.
Kim Kuwabara, Ramboll
Kurt Fehling, The Fehling Group
Laura Dye, CRC
Lee Farris, BRC
Marcia Scully, Metropolitan Water District of Southern California
Maria Lopez, Metropolitan Water District of Southern California
Mark Duffy, U.S. Environmental Protection Agency, Region 9
Mark Paris, Landwell
Mauricio Santos, Metropolitan Water District of Southern California
Melanie Hanks, Olin
Michael J. Bogle, Womble Carlyle Sandridge & Rice, LLP
Michael Long, Hargis +
Mickey Chaudhuri, Metropolitan Water District of Southern California
Nicholas Pogoncheff, PES Environmental, Inc.
Nicole Moutoux, U.S. Environmental Protection Agency, Region 9
Orestes Morfin, CA
Paul Black, Neptune & Company
Peter Jacobson, Syngenta
Ranajit Sahu, BRC
Rebecca Sugerman, U.S. Environmental Protection Agency, Region 9
Richard Pfarrer, TIMET
Rick Kellogg, BRC
R9LandSubmit@EPA.gov

Roy Thun, GHD
Steve Clough, Nevada Environmental Response Trust
Steven Anderson, LVVWD
Steve Armann, U.S. Environmental Protection Agency, Region 9
Tanya O'Neill, Foley & Lardner L
Todd Tietjen, SNWA
William Frier, U.S. Environmental Protection Agency, Region 9

Attachment A

NDEP 1st Comments	NERT's Response	NDEP's 2nd Comments
Executive Summary, p. ES-2. 1st full paragraph, last sentence. Please clarify by expanding the sentence. As written, this sentence leaves the reader hanging.	The sentence cited in the comment states "It should be noted that the cancer risk and noncancer hazard estimated in this BHRA do not represent absolute estimates in OU-1, since generic and conservative assumptions were used when values specific to the Operations Area were not available, which are likely to overestimate actual exposures and calculated risks." To clarify, we can add a sentence after the cited text to Revision 1 of the Baseline Health Risk Assessment Report for OU-1 Soil Gas and Groundwater ("Revised Report") as follows: "The actual health risks associated with exposure through the vapor intrusion pathway from soil gas and shallow groundwater within the Operations Area of OU-1 for the on-Site workers are expected to be lower than the risk estimates reported in this BHRA".	Response is accepted, pending review of the revised report.
Section 4.2.3 and associated Figures. – The temporal bar plots in general show little data. What they mostly show is a comparison of two wells in the OSSM-derived plume area compared to one well in an area of much lower concentration in the NERT-derived plume area. Please include more soil gas wells for temporal description of activity over time on the east side of OU-1 or explain why these wells were left out (such as those included later in the correlation plots, RISG-23, and RISG-82). It might be that even at shallow depths there were no samples from the 2008 Phase B investigation, but please make this or other reasoning more explicit in this section. It may also be helpful to include a comparable Table 4-3 for soil gas locations. Please also explain why the temporal trends at RISG-14 might be meaningful with respect to the	Soil gas data is available from 2008 (Phase B investigation completed by Tronox) and 2019 (Phase 2 and Phase 3 RI). The 2008 soil gas samples were collected at 5 feet below ground surface (ft bgs). For the temporal trend analysis, Ramboll evaluated all three 2008 locations that were within 50 feet from a 2019 sampling location and located within the chlorinated volatile organic compounds (VOCs) groundwater plumes. In order to include more soil gas locations in the temporal trend analysis of the Revised Report, Ramboll can change the inclusion criteria and include any 2008 locations that are located within approximately 100 feet of a 2019 sampling location. This will result in eight additional soil gas locations in the temporal trend analysis, including RISG-82 on the east side of OU-1. The impact of increasing the distance between the 2008 and 2019 soil gas locations	Response is accepted, pending review of the revised report.

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potential source of chloroform on the east side of OU-1.	will be discussed in the Uncertainty Analysis of the Revised Report. In addition, a new table summarizing soil gas sample locations can be added to the Revised Report that provides information comparable to existing Table 4-3 'Shallow Groundwater Wells Included in the BHRA Data Set'. With respect to the comment related to RISG-14, the temporal trend at this location is meaningful because RISG-14 is within the chloroform plume at the Unit 4 Building, a source of chloroform in soil gas. While there are other soil gas locations within the Unit 4 Building footprint, these other locations do not have results available from nearby Phase B locations that could be used to evaluate the temporal trend between 2008 and 2019. The chloroform results at RISG-14 are similar in magnitude to the results from the locations within the Unit 4 Building footing. Thus, the results from RISG-14 (and Phase B location SG69) can be used to evaluate how the source of chloroform at the Unit 4 Building is changing over time. The chloroform concentrations at RISG-14/SG69 were significantly lower in 2019 than in 2008 indicating that there is a decreasing temporal concentration trend at the Unit 4 Building. The text in Section 4.2.3 of the Revised Report can be modified to provide additional clarification of why the temporal trends at RISG-14 might be meaningful with respect to chloroform contamination associated with former operations at the Unit 4 Building.	
Section 4.2.3, Shallow Groundwater. First, it was helpful to see both figures 4-12a (at the same scale as figure 4-11) and 4-12b (at a scale relevant to only the data presented). However, it is unclear why samples taken from wells upgradient of the former Beta Ditch would be	The purpose of this groundwater temporal trend evaluation was to analyze the temporal trend of chloroform in the area with the highest chloroform concentrations and potential health risks. Thus, the groundwater temporal analysis focused on locations in the area with chloroform concentrations over 1,000 µg/L within the chlorinated VOC groundwater plumes in OU-1.	Response is accepted, pending review of the revised report.

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excluded. It is also not clear why temporal trends for wells with concentrations over 1,000 µg/L are the only ones of interest. Chloroform exists on OU-1 upgradient of the former Beta Ditch and east, and possibly separated from the groundwater plume originating from OSSM (Figure 3-2) at levels lower than 1,000 µg/L but above the screening level of 70 µg/L. These concentration levels rule out looking temporally at any wells also used in section 4.2.4. Please make it clearer why temporal trends were of interest for only these concentration levels. It removes a large portion of wells on OU-1 unrelated to the OSSM plume, which makes up a small spatial portion of OU-1. Also, it is not clear why some spatial contouring has not been done to support any arguments made. These could include spatial- temporal plots that would allow more data to be brought into the analysis.	In order to evaluate temporal trends in areas with lower chloroform concentrations, additional locations can be integrated into Section 4.2.3 of the Revised Report including locations upgradient of the former Beta Ditch and within the chlorinated VOC groundwater plumes. This temporal trend analysis would focus on groundwater locations with chloroform concentrations over 150 µg/L, which is the minimum risk-based target concentration (RBTC) for chloroform among all scenarios. It is anticipated that approximately 20 wells could be added to this analysis. In addition, spatial plots with a continuous concentration scale consistent with recommendations in Neptune's memo on NERT spatial plots dated February 18, 2022 will be prepared and included in the Revised Report for the chemicals that were detected at a concentration greater than 10% of the lowest RBTC for vapor intrusion.	
<u>Section 4.2.4.</u> The correlation analysis is not compelling. It is driven by a couple of high concentrations. Have any diagnostics of the regression analysis been performed to confirm the correlation analysis? It appears that the correlation analysis is driven by one or two influential points.	It is the opinion of Ramboll that the correlation analysis plots presented in Figures 4-13 and 4-14 clearly show that: 1) higher chloroform concentrations in soil gas are associated with higher chloroform concentrations in shallow groundwater, and 2) the correlations are driven by one or two high concentrations. Accordingly, we do not believe there is a need to present regression diagnostics since this is already evident in the presentation of the results. Thus, while acknowledging the limited number of samples included in the correlation analysis, we believe the data is sufficient for this purpose and are generally consistent with the CSM which concluded that the chloroform in soil gas is from groundwater within the groundwater VOC plumes. Section 4.2.4 of the Revised Report can be modified to justify the conclusion and acknowledge the uncertainty in the correlation analysis.	As noted in the response, the correlations are driven by one or two high concentrations. This violates the basic assumptions of a linear regression analysis – that is, that the residuals should be normally distributed around zero. This is clearly not the case here. Consequently, the regression analysis cannot be relied upon. Otherwise, statements could be made that the two highest concentrations in GW are from the same locations as the two highest concentrations in soil gas – for the other 4 data points, there is no correlation. Are there any other data that can be brought to bear on this? Even in the log-based scatter plot, the low 4 values show no relationship, and the (weaker) relationship indicated (weaker than non-log) is still driven by the 2 high values. Perhaps a more appropriate argument should be one that simply addresses

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		the very high concentrations are collocated and the 4 lower concentrations are collocated. Not much more than that is supported by the data and the subsequent statistical analysis.
Section 4.2.5, p. 4-11, 1st full paragraph. In the third overall paragraph of this section there is text that suggests the benzene, chlorobenzene, dichlorobenzenes, and carbon tetrachloride found on OU-1 are primarily limited to the western portion of the study area, where the OSSM groundwater plume is located on OU-1. These analytes are said to correlate with chloroform and to also not have been used on OU-1 according to known documents. However, the report also states that chloroform was not reported to be used on OU- 1, yet there is a chloroform plume related to the Unit 4 building. Please provide or reference figures of groundwater plumes for these chemicals to support this statement, and please provide the correlation analysis	Section 4.2.5 of the Revised Report will be revised to clarify the relationship between benzene, chlorobenzene, dichlorobenzenes, carbon tetrachloride, and chloroform in OSSM's DNAPL plume, and how that relationship is not present in the NERT plume related to the Unit 4 building. Relevant sections from the discussion presented in Section 9.4.5 of the NERT RI Report for OU-1 and OU-2 and reference to the plume figures (Figures 7-65a, 7-68a, 7-69a, 7-71a, 7-72a, and 7-73a) will be added to support the discussion. The discussion in Section 4.2.5 will also be updated with any applicable comments from NDEP on the RI Report.	Response is accepted, pending review of the revised report.
Executive Summary Figures ES-4 and ES-5. On Figures ES-4 and ES-5, the area around RISG-14 contains more samples at 15 ft bgs than at 5 ft bgs. Why the difference in sampling density in this location?	As discussed in Section 3.1.2, Phase 2 Remedial Investigation, as part of the NERT Remedial Investigation, four samples (RISG-16, RISG-17, RISG- 18, and RISG-19) were located beneath the existing basement slab in the center of the Unit 4 Building. Due to depth of the basement slab, shallower soil gas samples could not be collected in these locations. A footnote can be added to the Executive Summary to emphasize this point.	Response is accepted, pending review of the revised report.
Executive Summary, p. ES-6. For clarity, the closing sentence of the Executive Summary on page ES-6 should include the phrase "of the vapor intrusion pathway" before the phrase "is not warranted". This recommendation	The last sentence in the Executive Summary in the Revised Report will be modified to include "of the vapor intrusion pathway" as suggested.	Response is accepted, pending review of the revised report.

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should not be construed as agreement from NDEP with the resulting phrase. The recommendation is intended to make clear to other readers that the BHRA only evaluates the vapor intrusion pathway.		
Section 2.3, p. 2-3. The last paragraph on page 2-3 refers to narrow paleochannels. It would be helpful to update relevant figures with the location of these paleochannels relative to the soil gas and groundwater sample locations.	A figure showing the general geology underneath OU-1 with the location of these paleochannels can be added to Section 2 of the Revised Report. The location of these paleochannels can also be added to soil gas and groundwater sampling location figures (i.e., Figures 3-1 and 3-2) in the Revised Report.	Response is accepted, pending review of the revised report.
Section 4.2.3. Much of section 4.2 is devoted to chloroform. Yet the opening paragraph of section 5.1 states that there are 34-66 COPCs depending on matrix and depth. Additionally, table 7-4 lists chlorobenzene as a driver of HI. Please reiterate again at the beginning of section 4.2.3 why chloroform is the only analyte examined temporally.	As discussed in Sections 5.4.1 and 5.4.2, chloroform is the primary cancer risk and noncancer HI driver at soil gas locations and the primary cancer risk driver at groundwater locations within OU-1. Besides chloroform, no other COPC had an estimated excess lifetime cancer risk greater than 1×10^{-6}. Although chlorobenzene is a primary contributor to the noncancer HI at groundwater locations, all noncancer HIs were below the NDEP target HI of one, and therefore, chloroform is the only analyte examined temporally. Clarifying text will be added to Section 4.2.3 of the Revised Report.	Response is accepted, pending review of the revised report.
Section 4.2.4. Please explain why the highest area of highest concentration within the chloroform plume on the east side of OU-1 had no soil gas samples.	As indicated in Phase 2 RI Modification No. 9 that was approved by NDEP on June 21, 2018, there was one proposed soil gas sample (RISG-23) in this area. However, this location was on the northern berm of the Central Retention Basin and had to be relocated. Due to the ongoing treatability studies immediately adjacent to the planned location and inaccessibility from steep grades, the soil gas location proposed in the Phase 2 RI Modification No. 9 was relocated to the southwest of the proposed location. The risks from vapor intrusion were evaluated using a combination of soil gas and	Please add summary text similar to the response to this RTC to the report explaining why planned sampling within the highest area of concentration on OU-1 not related to OSSM and referencing the modification.

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	groundwater data. As it is the opinion of Ramboll that the groundwater concentrations in this area are well characterized, we also believe the risks are well characterized. Therefore, no changes will be made to the Revised Report.	
Section 4.2.4. In the first line of text on page 4- 10, please change 'concertation' to 'concentration'.	The Revised Report will be updated accordingly.	Response is accepted, pending review of the revised report.
Section 4.2.5. In the fourth paragraph of this section correlations in Figures 4-13 and 4-14, it is understood that the source of soil gas VOCs is likely chloroform in groundwater, and it does support the CSM, however what is shown in Figures 4-13 and 4-14 is driven largely by the two very high concentrations in the OSSM plume, representing potentially a different source than the operations area itself and representing a very small spatial area of the Operations Area. The correlations may not be representative of most of OU-1. Please discuss uncertainties with these correlations with respect to the entire operations area. This is discussed briefly in the first bullet point of section 4.2.4, but please reiterate some of that discussion here or at minimum provide some thoughts regarding the correlation being driven by two data points on the far western side of the Operations Area and that absent these two points the relationship between chloroform and soil gas is much more variable across the rest of OU-1. Note that correlation analysis is a special case of regression analysis (a simple linear regression), and regression diagnostics should be considered before presenting results of a correlation when it is	As stated in the response to Comment #4, we believe the correlation analysis plots clearly demonstrate that the correlations are driven by one or two high concentrations, therefore we do not believe there is a need to present regression diagnostics. Section 4.2.5 of the Revised Report can also be revised consistent with our response to Comment #4 affecting Section 4.2.4.	Please see response to Comment #4. Otherwise, please provide text in section 4.2.5 that includes a discussion similar to that in 4.2.4 and includes some discussion of the correlations being driven partly by samples on the western side of OU-1 that NERT may not represent chloroform derived from OU-1 operations, as planned in the above response. Some discussion between NDEP and NERT might be needed to resolve and fully understand this correlation issue.

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clear that the apparent effect is driven by a few "influential points" or "outliers".		
Table 4-5. This table has several cells with "#value!" and "/FALSE". Please address accordingly.	Table 4.5 will be updated as required in the Revised Report.	Response is accepted, pending review of the revised report.
Section 5.2.2. Provide representative BIOVAPOR and Johnson & Ettinger modeling spreadsheets for chloroform and benzene for the various scenarios and simulated depths. In addition, the uncertainty in the BIOVAPOR and Johnson & Ettinger modeling results should be qualitatively or quantitively discussed.	The Johnson & Ettinger modeling spreadsheets for all VOCs modeled and BIOVAPOR modeling spreadsheets for benzene for the various scenarios and simulated depths were included in Appendix G. Due to size of the files, these were provided electronically. Text will be added to the Table of Contents for Appendix G to clarify where these are located. Representative modeling spreadsheets in PDF format will also be added for chloroform and benzene. The uncertainty in the BIOVAPOR and Johnson & Ettinger modeling results is qualitatively discussed in Section 6, Uncertainty Analysis, under Section 6.2.2.3 Fate and Transport Modeling.	Response is accepted.
Figure 5-5. The transfer factors in Table 5-5 are more than 10 orders-of- magnitude less than those for the other COPCs and suggest that benzene will not be detected in indoor air under any circumstances. The low transfer factors for benzene are likely the result of the modeled degradation rates. It has been our experience that benzene is routinely detected in outdoor air (and indoor air) in most (if not all) urban/suburban areas suggesting that the modeled degradation rates may be incorrect or there are other sources (e.g., automobiles and trucks). Please comment in the Uncertainty Analysis.	It should be noted that the BIOVAPOR and Johnson & Ettinger models predict vapor migration from the subsurface to indoor air. The models do not take into account either the impact of existing indoor or ambient sources on indoor air concentrations. The Uncertainty Analysis section of the Revised Report will be expanded to include discussion of other sources of benzene in the ambient environment.	Response is accepted, pending review of the revised report.
Figure 3-1. This includes all spatial plots, but there is a	The divergence of the OSSM plume in this area is likely caused by the presence of a topographic high of	Response is accepted, pending review of the revised report.

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noticeable 'pinch' of the plume around wells MW-16, M-5A, RISG-80, and other locations in this area. This did not seem to be highlighted in the text. Please provide an interpretation or description of the underlying mechanism by which the OSSM plume is essentially 'splitting'.	the less permeable Upper Muddy Creek Formation near and north of M-5A, MW-16 (NERT), and RISG-80. This topographic high is illustrated on Figure 5-8 (Subsurface Cross-Section F- F') in the RI Report for OU-1 and OU-2. Sections 4.2.2 and 5.1 of the Revised Report will be expanded to incorporate additional discussion of the spatial distribution of the chloroform plume and the effects of the topographic high in this area. In addition, per the response to Comment 9 above and to further illustrate the influence of geology on contaminant transport, a figure showing the general geology underneath OU-1 with the location of the paleochannels will be added to Section 2 of the Revised Report.	
Section 5.1. This document attributes 6 COPCs entirely to the OSSM plume and references the Ramboll 2021a document for this, however that document is still under review. Please provide a brief explanation of why all of these are being attributed solely to the OSSM plume in this report.	Section 5.1 of the Revised Report will be modified to present a standalone justification for the referenced conclusion.	Response is accepted, pending review of the revised report.
Table E-1. The OU-1 Groundwater BHRA Data Set has a result of 0.000005 µg/L for formaldehyde in sample M-249-60-20171113 while the BMI has a result of 5 µg/L (converted from 0.005 mg/L in the EDD). Please check on this sample and verify the result reported in Table E-1.	Table E-1 of the Revised Report will be corrected as required. This impacts two formaldehyde samples, M-249-60-20171113 and M-251-60- 20171114. The impact on the total risk results at these two groundwater sample locations is negligible due the low detected levels of formaldehyde (5 µg/L compared to the indoor worker RBTC of 300,000 µg/L for formaldehyde).	Response is accepted, pending review of the revised report.