NEVADA DIVISION OF
ENVIRONMENTAL
PROTECTION

STATE OF NEVADA
Department of Conservation & Natural Resources
Brian Sandoval, Governor
Bradley Crowell, Director
David Emme, Administrator

January 12, 2017

Jay A. Steinberg
Nevada Environmental Response Trust
35 East Wacker Drive, Suite 1550
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: *Soil Gas Investigation and Health Risk Assessment for Parcels C, D, F, G, and H, Revision 1*

Dated: September 23, 2016

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 04/12/2017** 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

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Bureau of Industrial Site Cleanup
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Attachment A

General Comment:

1. Run the J&E model for the soils at the depth of 5 ft. and 10 ft., and the groundwater with the data available, respectively;
2. The input data for the J&E model must use the site specific data. If the site specific data is not available, NERT should choose using the default values of the dominant soil classifications for corresponding soil horizons at the site or collecting new data for the depth of 5 ft. and 10 ft.;
3. Do a 30-day exposure frequency for trench model analysis.

Specific Comment #1 **March 18, 2013 NERT HRA Work Plan, on page 2, Section 1.1 Overview, footnote #4 and Section 5.4.3**

This section states: "Potential risks associated with soils within the Study Area are currently being evaluated. The current draft of the soil HRA was submitted to NDEP on May 18, 2012 (Northgate 2012) and NDEP provided comments on the draft HRA on August 7, 2012. Responses to NDEP comments and revisions to the draft HRA are in preparation. Results from the final (NDEP-approved) HRA will be combined with the risk results for the vapor intrusion pathway to evaluate cumulative risk."

The current version of the report only addresses the vapor intrusion pathway and makes no statement with regard to next steps / path forward. It is understood that the path forward is dependent upon risk management decisions among stakeholders, however, the current report does not address the cumulative risk.

Specific Comment #2 **March 18, 2013 NERT HRA Work Plan, Figure 5**

Figure 5, the CSM, indicates that the downgradient receptor pathways for Indoor Worker and Resident are complete. Further, page 35, Section 5.2.1 Conceptual Site Model, last paragraph states:

> "In accordance with the 2010 and 2013 risk assessment work plans (Northgate and Exponent 2010a; ENVIRON 2013a), off-site receptors, visitors, and trespassers were not quantitatively evaluated in the HRA. The rationale for excluding these receptors and a qualitative in the HRA. The rationale for excluding these receptors and a qualitative discussion of their potential risks is presented in Section 6.4.

And on Page 47, Section 6.4, Exposure Assessment, fourth paragraph states:

> "In accordance with the NDEP-approved Health Risk Assessment Work Plan (Northgate and Exponent 2010a), off-site receptors were not quantitatively evaluated in the HRA. Inhalation of VOCs by on-site outdoor commercial/industrial workers serves as an upper-bound estimate of the potential exposures to VOCs by off-site receptors,..."

For reference and clarity of the administrative record, the Health Risk Assessment Work Plan (Northgate and Exponent 2010a) specifically states on page 8:

"…off-Site receptors will not be quantitatively evaluated in post-remediation risk assessments and a discussion will be included to provide rationale for this decision, and the associated uncertainties will be included in the uncertainty assessment."

The report lacks transparency as regards rationale and justification for not evaluating off-Site receptors as this justification is not brought forward into the HRA report. It should also be noted this plan states, "Based on the relative differences in the on-Site receptor particulate emission factor …. and the off-Site receptor particulate emission factor during construction,… versus other exposure factors that may be higher for the off-site receptor, the on-Site construction exposure will be greater than that of the off-Site receptors." Underline added for emphasis to draw attention to lack of technical justification for not evaluating the off-Site receptor. Recommend revision to this section to provide clear justification and technical rationale for why off-Site receptors are protected.

Specific Comment #3 Executive Summary

The construction worker receptor should be evaluated using a model accounting for vapor intrusion into a utility trench such as that from the Virginia Department of Environmental Quality (2016).[1]

Specific Comment #4 Section 1. Introduction, page 3.

The text states that "In addition, based on a review of figures showing a chloroform plume in shallow groundwater, NDEP noted that the 2008 Phase B investigation soil gas samples were collected from locations where VOC results would likely be biased low. Finally, NDEP commented that it may be reasonable to use the site-wide soil gas data reported in the 2010 Site-Wide Soil Gas HRA in conjunction with groundwater data to evaluate potential risks for the vapor intrusion pathway."

Section 1. Introduction, page 5. The text states that "Since completion of the soil gas sampling and Revision 0 of this HRA, USEPA issued the final version of its guidance Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (USEPA 2015a). Ramboll Environ has reviewed the guidance and found that the completed field work and HRA are generally consistent with the current guidance."

USEPA (2015) referenced herein states that "Modeling results for idealized scenarios show that, in homogeneous soil, soil gas concentrations tend to be greater beneath the building than at the same depth in adjacent open areas when the vapor source is underneath the building, even if the source is laterally extensive relative to the building footprint (e.g., broad plume of contaminated groundwater) (USEPA 2012b). Given these predictions and supporting field evidence (USEPA 2012a, see Figure 6; Luo et al. 2009; Patterson and Davis 2009, see Figure 1), individual exterior soil gas samples cannot generally be expected to accurately estimate sub-slab or indoor air concentrations. This potential limitation may be particularly valid for shallow soil gas samples collected exterior or adjacent to a building footprint...Deeper soil gas samples collected in the vadose zone immediately above the source of vapor contamination (i.e., 'near-source' soil gas samples; see Section 6.3.1) can reasonably be expected to be less susceptible to the diluting effects of ambient air, compared to shallow soil

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1 http://www.deq.virginia.gov/Programs/LandProtectionRevitalization/RemediationProgram/VoluntaryRemediationProgram/VRPRiskAssessmentGuidance/Guidance.aspx

gas samples. On this basis, deeper soil gas samples collected in the vadose zone immediately above the source of vapor contamination will tend to be more suitable than will be shallow soil gas samples for assessing vapor concentrations that may be in contact with the building's sub-slab." The USEPA (2015) as referenced in the Deliverable does not appear to support the use of shallow soil gas sample on open areas.

Specific Comment #5 Section 2.1.5 Parcel H, First Line, page 14

The text indicates the size of Parcel H is 24.5 acres. However, the J&E modeling done used a parcel size of 26.3. Please reconcile and correct J&E modeling accordingly (Table 12).

Specific Comment #6 Section 4.1.1 Soil Gas Data Set, Second Paragraph, page 22

The text indicates that there are 12 sampling locations from the 2008 investigation…shown on Figures 5 and 6. Consistent with the RTCs, for Parcel H, why not include the soil gas data from sample locations SG47, SG66 and SG67?

Specific Comment #7 Section 4.2.2.2 Parcels F, G, and H), page 32.

1. The text states that "However, as previously described (Section 2.3), chloroform was not detected in the 0 and 10 ft soil samples collected within Parcel F (7 of which were located within LOU 63, although downgradient of SG34), but was detected at concentrations of 200 and 410 µg/kg in two of the 20 and 30 ft soil samples collected within Parcel F, suggesting a groundwater source." Please show this data in graphic and/or tabular form.
2. The text states that "For the outlier pair, for which the soil gas concentration was higher than predicted, available shallow soil samples (at 0 and 10 ft bgs) did not provide evidence of a surface source, with chloroform detected only in deep soil samples at 20 and 30 ft bgs." The correlation shown in Figure 8 does not support the predicted concentration assumed herein. Given that USEPA (2015) referenced in the states that "Modeling results for idealized scenarios show that, in homogeneous soil, soil gas concentrations tend to be greater beneath the building than at the same depth in adjacent open areas...individual exterior soil gas samples cannot generally be expected to accurately estimate sub-slab or indoor air concentrations... This potential limitation may be particularly valid for shallow soil gas samples collected exterior or adjacent to a building footprint..." Please explain the apparent low bias in shallow soil gas as shown in these two paragraphs in Section 4.2.2.2.

Specific Comment #8 Section 4.2.3 Spatial Analysis of VOCs in Soil Gas, page 32

In general, it appears that this exercise also supports the tenet of groundwater as the source yet several exceptions are noted. For example, no discussion is offered concerning significant contribution of carbon tetrachloride in Parcel G soil gas samples E-SG-8 and SG47. However, shallow groundwater data (Table 8) in Parcel G monitoring well TR-8 reports nondetect or very low estimated concentrations. Please update this section to provide a more robust interpretation of the data.

Specific Comment #9 Section 5.2.3.2 Fate and Transport Modeling, page 36.

The text states that "For the receptors evaluated in this HRA (future on-site workers), transfer factors for soil gas to indoor air and outdoor air were derived based on migration of soil gas from 5 ft bgs into a commercial slab-on-grade building and into ambient air." The J&E model documentation states that the advective zone of influence for soil gas flow is limited to

soil immediately adjacent to the building foundation. The foundation acts as a barrier to atmospheric cycles resulting in higher sub-foundation soil gas concentrations than measured in the absence of a building. Computer simulations by Massmann and Farrier (1992) supports the concept that "fresh air may migrate several meters into the subsurface during a barometric pressure cycle." Three-dimensional modeling by Abreu, et.al. (2008) indicated that for shallow sources on undeveloped land the best sampling depth was between 4 to 5 meters of depth and for deep sources samples should be collected from a maximum depth of 5.5 meters.

Reference to Table 12 and Table 14. The J&E soil gas model was for shallow 5-foot deep soil gas samples; however, the soil physical properties were for soil samples from 9 to 15 feet deep with an average of 10 feet deep. The mean volumetric water content was 0.154 (unitless) and the total porosity was 0.366 (unitless). If comparable shallow soil samples are not available on the NERT site then J&E default values for loamy sand (volumetric water content 0.076 and total porosity was 0.39) should be used in the model.

Specific Comment #10 Section 6.3, page 46

The report states "California's default air exchange rate of 1 air change per hour (Cal/EPA 2011) was used in the absence of a default rate from USEPA. A conservative height of 10 ft was assumed, although many commercial buildings have higher first floor ceilings." The CalEPA default commercial building height (8 feet) should be used.

Specific Comment #11 Section 6.3 Exposure Concentrations, page 50.

The text states that "Lastly, it is expected that the soil gas samples will provide a more accurate risk characterization because soil gas samples are collected closer to the point of exposure." It is accurate to say that the shallow soil gas sample is closer to the point of exposure; however, it is inaccurate to say that a shallow soil gas sample is equivalent to a sub-slab or deep soil gas sample. Shallow soil gas samples over undeveloped land are not equivalent to either sub-slab soil gas (USEPA, 2015; USEPA, 2004) or soil gas samples from undeveloped land (Massmann and Farrier, 1992; Abreu, et.al., 2008). Given the probable low bias from shallow soil gas in undeveloped (open) as cited here and in previous comments, it is recommended that shallow soil gas samples be used as only one line of evidence. Furthermore, it is recommended that the groundwater COPCs be modeled using the J&E Groundwater Model.

Specific Comment #12 Table 1 LOUs Within and Directly Upgradient of the Study Area Parcels

Parcel C does not list LOU #58 yet Figure 4 indicates it is within or directly upgradient. Please correct accordingly.

Specific Comment #13 Table 3

Please provide the equation(s) used to derive the risk-based concentrations (RBCs).

Specific Comment #14 Table 4 Field Duplicate Qualifications

Please verify the calculation for sample pairs E-SG-6-030813 1,2 Dibromoethane, E-SG-6-030813 cis-1,3 Dichloropropene, E-SG-6-0308131 1,1,1,2-Tetrachloroethane as they do not appear to be correct.

Specific Comment #15 **Table 7 Soil Gas Summary Statistics – Combined 2008 and 2013 Data**

Several chemicals were which were detected in 2008 were not analyzed in 2013 yet the report does not provide rationale for elimination of these chemicals from the suite. The chemicals are noted as follows:

- N-Butylbenzene @ 100% detection frequency
- Ethanol @ 92% detection frequency
- N-Octane @ 50% detection frequency
- N-Propylbenzene @ 75% detection frequency

Please provide some discussion on the subject.

Specific Comment #16 **Table 8**

Please expand this table to include all groundwater COPCs listed in Table 9.

Specific Comment #17 **Table 11**

Was vapor intrusion modeling and associated risk calculations conducted for chloroform for Parcel E? If not, because Figure 4 and Figure 5 show elevated chloroform concentrations in groundwater immediately south/southwest (upgradient) of Parcel E, it is recommended that a groundwater-based vapor intrusion model be used to quantify the potential future risk associated with chloroform in groundwater given the expectation that this chloroform will soon migrate beneath this parcel.

Specific Comment #18 **Table 12 and Table 14**

Are there any data soil properties data available for samples collected at depths less than or equal to 5 feet? If so, they should be used. The default saturation (ratio of water-filled porosity to porosity) for a loamy sand is approximately 19% whereas the value used in the model (0.154 / 0.366) equates to approximately 42%. The values listed in the table are associated with samples collected from depths ranging between 9 and 15 feet. Please provide justification for using these samples for vapor intrusion model simulations based on a source depth of only 5 feet, especially given the moist/wet conditions noted on some of the boring logs included in Appendix F in the 9- to 15-foot depth interval in which the soil properties samples were collected. The potential for lower moisture conditions in the depth interval ranging between 0 and 5 feet, and associated higher risk values, should be discussed.

Specific Comment #19 **Table 13 and 'VLOOKUP' Table**

Many of the chemical property values in these tables are outdated in comparison to those more recently published by the USEPA. It is recommended that the updated USEPA values be used. For example, the reference concentration for TCE – which is a COPC as listed in Table 9 - has been revised downward from 0.04 mg/m^3 to 0.002 mg/m^3.

Specific Comment #20 **Table 14**

Footnote b of this table states that the volumetric moisture content is "As measured per ASTM D 2216". This is incorrect as ASTM D 2216 measures moisture content on a mass basis (e.g., grams of water per gram of soil). Mass basis moisture values should be adjusted using dry bulk density and water density values as described in NDEP (2010) *Soil Physical and Chemical Property Measurement and Calculation Guidance*.

Specific Comment #21 **Figure 4, Figure 5, and Figure 6**

Please add a groundwater flow direction arrow (or arrows) to these figures. Further, Figure 5 indicates the Primary Source of Groundwater VOC is from Off-Site sources. As new field data is collected the validity of this assumption is called into question, specifically as regards Units 4 and 5 investigations. Revision to this figure is recommended.

Specific Comment #22 **Figure 5**

The figure suggests that there are chloroform data are from 2008 and 2013. Are there more recent chloroform soil gas data?

Specific Comment #23 **Figure 6**

Comparison to Figure 5 shows the chloroform in groundwater plume is migrating to the northeast. A discussion regarding the potential for soil gas concentrations to increase or decrease at the various parcels in the future as the chloroform in groundwater plume continues to migrate should be included. API Publication Number 4741 (2005) notes that for deeper sources (i.e., greater than 10 meters [~30 feet] – which is in reasonable agreement with the 35-foot depth modeled in this report), vertical vapor-phase travel times can be on the order of years to decades.

Specific Comment #24 **Figure 7 and Figure 8**

Are there contemporaneous groundwater and soil gas data? From what year? Are there co-located (in plan-view) groundwater and soil gas data?

Specific Comment #25 **Appendix H, J&E, Groundwater Advanced and Soil Gas Advanced Models.**

Please provide the rationale and reference for adding the Reference Concentration on the Chemical Properties sheet for both models.

Specific Comment #26 **Appendix I, Shallow Groundwater Evaluation, Section 1.5, page I-4.**

The text states that "It is expected that the soil gas sampling will provide a more accurate risk characterization because the samples are collected closer to the receptor. In general, the closer the sampled medium is to the receptor, the more relevant the data are for estimating exposure and greater its weight of evidence (California Environmental Protection Agency [Cal/EPA] 2011)." Please refer to Comment #10 above.

Editorial Comments

Specific Comment No. #27 **Page 7, Section 1.4 Geologic and Hydrogeologic Setting**

This section states:

> "Soil types identified in the on-site soil borings include poorly sorted gravel, silty gravel, poorly sorted sand, well sorted sand, and silty sand (ENSR 2005)"

This discussion should tie back to the loamy sand parameter on Table 12. Suggest footnote.

Specific Comment #28 **Page 8, Section 1.4 Geologic and Hydrogeologic Setting, last paragraph, last sentence.**

This statement is not support without reference to technical report. Suggest adding reference.

Specific Comment #29 **Page 16, Section 2.3 Study Area CSM, third bullet**

This bullet states:

> "Additional investigation is necessary at the Unit 4 and 5 Buildings to better understand the distribution of chloroform in this area. This work was begun in early 2016 and will continue into 2017."

Yet, on the following page and paragraph the Deliverable states,

> "…nor is there evidence of significant on-Site sources of groundwater contamination."…."There is no evidence to suggest that soils at the Study Area are acting as a source of groundwater VOC contamination; further, concentrations in soil are not indicative of historic releases of chloroform to soils"

Suggest deleting these statements as there is insufficient data until the site investigation is complete.

Specific Comment #30 **Page 30, Section 4.2.2 Scatterplots for Co-located Soil Gas and Groundwater Samples**

Although classified as "shallow" groundwater monitoring wells, TR-6 is screened from 60 - 80 ft bgs in the UMCf and TR-8 is screened from 63-93 ft bgs UMCf as compared to M-92 Parcel F) which is screened from 39 - 49 ft bgs. Perhaps this should be noted/considered in discussions correlating groundwater data to soil gas data.

Specific Comment #31 **Page 35, Section 5.2.1 Conceptual Site Model**

It should be noted that the nearest resident north - northwest is only ~1550 ft away from Parcel D and the nearest resident south is only ~500 ft from parcel H.

Specific Comment #32 **Figure 10 Explanation b**

Please correct the sentence for Explanation b.

Specific Comment #34 Table 10 References

USEPA, 2002. Should be revised to USEPA, 2002b.

References

Abreu, L., Johnson, P., and McAlary, T. 2006. 3D Model Simulations and Implications to Near Building Sampling. USEPA VI Workshop, AEHS Conference, San Diego, CA. March.

Massmann, J., and D. F. Farrier. 1992. Effects of Atmospheric Pressures on Gas Transport in the Vadose Zone. Water Resources Research, v. 28, n. 3, p. 777 – 791.

NDEP, 2010. Soil Physical and Chemical Property Measurement and Calculation Guidance, BMI Plant Sites and Common Areas Projects, Henderson, Nevada. March 11.

USEPA, 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term. Office of Solid Waste and Emergency Response. Publication 9285.7-08I. May.

USEPA, 2004. User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. February.

USEPA, 2015. OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. EPA9200.2-154. June.