



environmental management, inc.

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**Date:** June 22, 2010

**To:** Shannon Harbour, P.E.  
Nevada Division of Environmental Protection (NDEP)

**RE:** Response to NDEP's June 9 Comments on *RZ-A Human Health Risk Assessment, Tronox LLC, Henderson, Nevada*, dated May 11, 2010

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1. *General comment, for future hard copy submittals, please include an electronic copy on CD-ROM of the entire human health risk assessment (HRA), including text, tables, figures, and appendices. Please also include the back-up documentation for the HRA data set (e.g., DVSR reports, individual laboratory reports, etc.). Please note that the data does not have to be separated into each remediation area due to time constraints. An electronic copy of these files on a CD-ROM is acceptable (these files do not need to be provided via electronic mail).*

**Response:** Comment noted.

2. *General comment, NDEP has noted that the HRA does not include risks associated with the inhalation of indoor (or outdoor) VOCs, so the cumulative incremental lifetime cancer risks (ILCRs) and hazard indices (HIs) are currently not known for this remediation zone (i.e., exposure unit). TRX should note that following completion and reporting of the site-wide soil vapor investigation, a HRA addendum will need to be prepared such that cumulative ILCRs and HIs for this exposure unit will be documented for purposes of risk management decisions to complete the closure process for this exposure unit.*

**Response:** Additional text has been added to the document to further emphasize this point (see Section 1.3, p. 3; Section 7.0, pp. 62-63) that indicates following completion of the site-wide soil vapor and leaching evaluation an addendum to the RZ-A HRA will be prepared to complete the closure process for the RZ-A exposure unit.

3. *General comment, NDEP has noted that the HRA does not include a "migration-to-groundwater" evaluation, which is a key component of a soil HRA (USEPA, 1996, 2002). TRX should note that a HRA addendum will need to be prepared in the future for this migration pathway in order to support risk management decisions for soil in this exposure unit.*

**Response:** See response for Comment 2 above.

4. *General comment, asbestos is discussed in Section 2 and in Section 4. However, it is not discussed in Section 3 with the COPC selection process. TRX should add a discussion of asbestos to Section 3 and should identify asbestos in the list of COPCs on page 29.*

**Response:** Text has been added to Section 3.5.2 (p. 34) and asbestos (long chrysotile fibers) has been added to the list of COPCs later in that same section (p. 35).

5. *General Comment, please add an executive summary to this report.*

**Response:** An Executive Summary has been added to the revised report.

6. *Section 1.1, page 2, last paragraph, TRX states that “The prevailing wind direction for the period between March 2003 and 2008 is to the northwest and south-southeast at wind speeds up to about 8 to 13 miles per hour.” TRX should additionally discuss the implications of this information in regards as to what lies to the northwest of the facility, to the south-southeast of the facility, etc. Additionally, TRX should include wind rose diagrams to illustrate this information more clearly.*

**Response:** A wind rose diagram has been added to Figure 1 and text has been added to Section 1.1 (p. 2) regarding the properties that are located upwind and downwind of the site.

7. *Section 2.1, page 5, NDEP has the following comments:*
  - a. *Please review and revise the first sentence as a word appears to have been left out and as such, the meaning of the sentence is not clear.*
  - b. *Please add cyanide to the list of SRCs.*

**Response:** (a) The first sentence in Section 2.1 has been revised (p. 6).  
(b) Cyanide was added to the list of SRCs immediately following that paragraph (p. 6).

8. *Section 2.3, page 8, NDEP has the following comments:*
  - a. *Please revise footnote 3 so that Section 3.5 is referenced instead of Section 3.9.*
  - b. *For consistency with Section 3.1.1 of the Work Plan and Figure 4, please include inhalation exposure to radon among the potentially complete exposure pathways described in this section.*
  - c. *NDEP has noted that in Section 3.5.1, TRX states that soil samples were generally collected from 0.5 to 2 feet below ground surface (fbgs) and from 10 to 11.5 fbgs. Please provide a discussion in Section 2.3 to explain the following:*
    - i. *Why the 0 – 0.5 fbgs surface soil interval is not evaluated as an exposure medium*
    - ii. *Why the 2 to 10 fbgs soil interval was not sampled.*

**Response:** (a) In Section 2.3, footnote 3 has been revised to reference Section 3.5 (p. 9).



- (b) A new footnote has been added to Section 2.3 (footnote 5) to address radon (p. 9).
- (c) Further discussion of the sampling depth intervals has been added to Section 2.3 (p. 10). Additionally, this issue has been added to the uncertainty discussion in Section 6.4.1 (p. 53). Although not applicable to the RZ-A HRA, it is noted that for other dioxin impacted RZ areas, additional sampling will be conducted to address potential dioxin surface concentrations in the 0-0.5 foot depth range.

9. *Section 3, page 10, please provide a brief description of the protocol for collecting and processing the soil samples that support the risk assessment, including soil boring methods, sample volume, vertical integral of a soil sample, field sieving, etc.*

**Response:** A new section, Section 3.2, has been added to the text (pp. 11-12).

10. *Section 3.3, NDEP has the following comments:*

- a. *Pages 11-17, TRX should note that key components of the data usability (DU) evaluation (as per USEPA, 1992 and NDEP, 2008) were not included in this Section. In addition, it is not clear if there was a DU evaluation conducted for Area IV (referenced at the bottom of page 10) that would be relevant. TRX should contact NDEP to schedule a teleconference to discuss the DU evaluation. Additionally, please note that all laboratory reports are required as a component of the DU process (USEPA, 1992, NDEP, 2008) and should be provided with the HRA independently of the DVSR reference (see related general comment).*
- b. *Page 16, TRX states that “Most of the issues identified during this evaluation did not result in the qualification of laboratory data but did involve re-submittal of data from the laboratories to correct problems that were discovered during the validation process.” Please provide more detail about the “issues identified” and the re-submittal process for the Site data.*

**Response:** (a) TRX participated in a conference call with NDEP on June 14, 2010. Based on those discussions, portions of the Data Usability Evaluation (now Section 3.4, pp. 13-20) and Data Usability and Summary for RZ-A (now Section 3.5, pp. 20-24) have been significantly expanded.

(b) Additional text has been added to what is now Section 3.4 (p. 19) to clarify that, with multiple laboratories conducting the analyses of Phase B samples, data package and EDD amendments were made prior to finalizing the DVSRs, representing less than 2% of the entire Phase B data set.

11. *Section 3.4, page 18, the last sentence of the first paragraph refers to Section 3.4.2 but this section does not exist. Please revise.*

**Response:** The text in what is now Section 3.5 has been corrected to refer to what is now Section 3.6.2 (p. 23).

12. *Section 3.5.1, page 20, 3rd paragraph, TRX states that “Site data from locations within RZ-A at sample starting depths between 0 and 10 ft bgs were included in this evaluation.” Please include a discussion about exact sample sizes, including how*



*many samples were available from each depth for background and site data. This information should match the data presented in Table 4.*

**Response:** Based on further discussion on this comment with NDEP during the June 14, 2010 conference call, additional text has been added to what is now Section 3.6.1 that provides the range of number of samples in the background and site data sets at each depth intervals, with a reference to Tables 4 (metals) and 6 (radionuclides) (p.25).

13. *Section 3.5.1, page 20-21, 4<sup>th</sup> paragraph, TRX states that “EDA was performed using summary statistics... and quantile-quantile plots and side-by-side box-and-whisker plots to qualitatively evaluate whether the Site and background data are representative of a single population.” NDEP has the following comments:*
- a. *Please reference that these plots are available in Appendix B. Please include more detail about quantile-quantile and box-and-whisker plots (either here or in Appendices B and C), such as:*
    - i. *What purpose do they serve and how they are read and interpreted?*
    - ii. *What is the significance of data which stray from the line in the Q-Q plots?*
    - iii. *What do the solid circles, x’s and open circles represent on the box plots?*
  - b. *Please clarify whether:*
    - i. *Normality tests were performed for the data in the quantile-quantile plots.*
    - ii. *Any data determined to be non-normal based on the quantile-quantile plots. If so, please clarify how the non-normality was handled.*
    - iii. *Any tests performed to determine if outliers exist in the Site data.*

**Response:** (a) Additional text has been added to what is now Section 3.6.1 to refer the reader to Appendix B for the quantile-quantile (Q-Q) and box-and-whisker plots, as well as (i) explain the purpose of these plots and how they are interpreted, (2) the significance of data that stray from the line on Q-Q plots, and (iii) what the open circles and x’s on the box plots represent (pp. 25-26). There are no solid circles on the box plots.

(b) Additional text has been added to what is now Section 3.6.1 to clarify that (i) normality tests were not performed for the data on the Q-Q plots, (ii) no data were therefore determined to be non-normal, and (iii) no tests were performed to determine if outliers exist in the site data (p.26).

14. *Section 3.5.1.1, page 24, the last sentence on this page refers to Section 3.3.2 but this section does not exist. Please revise.*

**Response:** The text has been changed in what is now Section 3.6.1.1 to refer to what is now Section 3.6.2 (p. 30)

15. *Section 3.5.1.1, page 25, TRX states that “This difference could be due to a number of reasons...item 3) there were generally many more samples in the background data set as compared to the RZ-A data.” Please explain why more data in the background data set would lead to a finding of lower site data than background data and how this is considered a possible explanation for such a difference.*

**Response:** This text has been deleted from what is now Section 3.6.1.1 (p. 30).



16. Section 3.5.1.2, page 26, 1<sup>st</sup> full paragraph, NDEP has the following comments:
- TRX states that “The results of the equivalence test for secular equilibrium of radionuclides in RZ-A are presented in Table 5a.” Please provide more details about this test, including specifying the following:
    - The null and alternative hypotheses for this test
    - The overall p-value represent
    - Delta
    - Why the upper and lower 95% confidence intervals were calculated
  - TRX states that “...however, the RZ-A analysis is based on 42 samples whereas the site-wide analysis is based on 507 samples.” Please explain the implications of this sentence.

**Response:** Additional text has been added to what is now Section 3.6.1.2 to (a) specify each of the details requested in (i) through (iv), and (b) further explain that the number of samples affects the confidence limits in the estimated mean proportions of radioactivity and the wider the confidence limits, the more likely that the null hypothesis (that the data are not in secular equilibrium) will not be rejected, given a fixed value for delta (pp. 31-32).

17. Section 3.5.1.2, page 27, 2<sup>nd</sup> full paragraph, TRX states that “The correlation matrices show a positive correlation...” Please reference (Table 5b-i).

**Response:** A reference to Table 5b-i has been added to what is now Section 3.6.1.2 (p. 32).

18. Section 3.5.2, page 29, 3<sup>rd</sup> full paragraph, TRX states that “Based on a review of readily available toxicology studies...” Please provide references for this statement.

**Response:** Two references have been added to what is now Section 3.6.2 to address this comment. Chu et al. 1986 was previously provided to NDEP following a conference call on April 16, 2010. A second reference, HSDB 2010, was also added for completeness (p. 35).

19. Section 4.1.2, page 32, NDEP has the following comments:

- Pooled AS equation, please rewrite the equation so that the Pooled AS corresponds to that presented in the NDEP Asbestos Guidance document.
- Last paragraph, please write out the 95% UCL of the Poisson distribution for clarity.

**Response:** In Section 4.1.2, (a) the pooled AS equation has been corrected and (b) the equation used to calculate the 95% UCL of the Poisson distribution has been added (p. 37).

20. Section 4.1.3, page 33, asbestos equation, NDEP has the following comments:

- TRX should note that when writing out this equation, the equations for the PEFs (both commercial workers and construction workers) should be included. These PEFs can be found in the NDEP Asbestos Guidance.
- Please provide the values for  $CF_1$ ,  $CF_2$ , and  $CF_3$  in the text for consistency.



**Response:** (a) Based on further discussion on this comment with NDEP during the June 14, 2010 conference call, additional text and one equation pertaining to calculating the PEF for the construction worker scenario has been added to Section 4.1.3 (p. 38). In addition, a footnote has been added to Table 9 referring the reader to Appendix D, where all of the PEF equations are provided.  
(b) The requested values have been provided in Section 4.1.3 (p. 39).

21. *Section 4.2.1, Inhalation, page 35, in future submittals, TRX should ensure that the equations presented in the text match the way in which it is implemented in the calculation spreadsheets. For example, the EC equation on page 35 does not have a conversion factor, soil concentration, or PEF term but these do appear in the spreadsheet calculations.*

**Response:** The equations in Section 4.2.1 (pp. 40-41) and in Appendix D have been updated to ensure that they are consistent.

22. *Section 5.0, please provide the asbestos cancer risk coefficients used in the risk assessment*

**Response:** Based on further discussion on this comment with NDEP during the June 14, 2010 conference call, the equations used to calculate the factor "R" and the URVs have been added to Section 5.0 (p. 45).

23. *Sections 6.2.1 through 6.2.3, pages 44-45, even though the HIs are less than 1, please identify the chemical(s) that have the highest contribution to the non-carcinogenic health hazard.*

**Response:** No change was made to the text in response to this comment because the requested information was already included in the previous version of the report.

24. *Section 6.3, page 45, please provide equations for asbestos cancer risk for consistency with Sections 6.1 and 6.2.*

**Response:** The equation used to estimate potential cancer risks from asbestos exposure has been added to Section 6.3 (p. 51).

25. *Section 6.4, page 45, please note in the text that uncertainty also arises from variability as well as lack of knowledge as this paragraph currently states.*

**Response:** The text in Section 6.4 has been updated to note that uncertainty also arises from variability (p. 52).

26. *Section 6.4.7, pages 49-50, NDEP has the following comments:*

- a. *Please discuss COPC-specific uncertainties in the toxicity criteria for COPCs that were the largest contributors to chemical cancer risk and HI.*
- b. *Please include a discussion of uncertainties related to the risk coefficients used for the asbestos risk assessment*



**Response:** (a) As noted in Section 6.1, the largest contributor to chemical cancer risk is hexachlorobenzene (HCB), and as noted in Section 6.2, the largest contributors to the HI are iron and perchlorate. The toxicity criteria for HCB and perchlorate are from EPA's IRIS database; therefore, uncertainties in the toxicity criteria for these chemicals has been added to Section 6.4.7 (p. 57). The toxicity criterion for iron is a Provisional Peer Reviewed Toxicity Value (PPRTV) as cited in NDEP's BCL table. The basis for PPRTVs is not available to the general public; therefore, information regarding the uncertainties associated with this value could not be provided.

27. *Section 6.4.8, pages 50-51, please discuss the potential additivity of chemical and asbestos cancer risk.*

**Response:** A discussion regarding the potential additivity of chemical and asbestos cancer risk has been added to Section 6.4.8 (p. 59).

28. *Section 7.0, page 53, 1<sup>st</sup> bullet, please be explicit in the text that the ILCRs and HIs reported in the HRA are only for soil pathways and do not include the vapor inhalation pathway as determining whether ILCRs and HIs are below NDEP's point of departure levels can only be determined after characterization of the VOC inhalation pathway has been completed.*

**Response:** The second paragraph of Section 7.0 in the previous version of the report, which precedes the 1<sup>st</sup> bullet, explicitly states that the HRA is limited to evaluating exposure via direct contact and acknowledged that the HRA did not consider potential exposure to chemicals in soil vapor. However, the text of the 1<sup>st</sup> bullet has been revised and a sentence was added at the end of the section to further emphasize this point (pp-62-63).

29. *Tables 10 and 11, the chemical-specific bioavailability factors noted in these tables were not found in the report. Please provide these values in Table 12 and add footnotes to Tables 11 and 12 stating where the bioavailability and dermal absorption values are found.*

**Response:** No chemical-specific bioavailabilities were used in the RZ-A HRA. Tables 10 and 11 were revised to indicate that (1) a bioavailability factor of 100% was used in the risk calculations and (2) the chemical-specific dermal absorption factors can be found in Table 12.

30. *Table 12, please provide the dates when IRIS, PPRTV, and NCEA were reviewed to acquire the toxicity criteria and provide citations or URLs for all references on the table.*

**Response:** Table 12 has been revised to include dates when websites were accessed and associated URLs. In addition, the table has also been revised to indicate that the source of the values attributed to HEAST, NCEA, and PPRTV was the NDEP BCL table.



31. *Table 16, Uncertainty Analysis, this Table should integrate all aspects of the key data usability issues.*

**Response:** Table 16 has been updated to include the key issues associated with the data usability evaluation.

32. *Figure 4, NDEP has the following comments:*

- a. *TRX should add the inhalation exposure pathway for gas-phase contaminants for the Migration to Groundwater Contact Medium.*
- b. *Under "Secondary Inter-media Transfer", TRX should add footnotes to the "Volatilization into Indoor/Outdoor Air" and "Migration to Groundwater" boxes to indicate that these pathways were not evaluated in the current soil HRA and will be evaluated in forthcoming reports.*

**Response:** Figure 4 has been revised to (a) include the inhalation exposure pathway for the "Migration to Groundwater Contact Medium" and (b) indicate that "Volatilization into Indoor/Outdoor Air" and "Migration to Groundwater" are not evaluated in this report and will be evaluated in an addendum to the RZ-A HRA.

33. *Section 7.0, page 53, 1<sup>st</sup> bullet, please be explicit in the text that the ILCRs and HIs reported in the HRA are only for soil pathways and do not include the vapor inhalation pathway as determining whether ILCRs and HIs are below NDEP's point of departure levels can only be determined after characterization of the VOC inhalation pathway has been completed.*

**Response:** This is a duplicate of Comment No. 28.

