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Mr. Matt McClincy
Oregon Department of Environmental Quality
Northwest Region
2020 SW Fourth Avenue, Suite 400
Portland, OR 97201-4987

Subject: **Final Upland Human Health Risk Assessment**
**Arkema Portland Facility**

Dear Mr. McClincy:

On behalf of Legacy Site Services Inc., enclosed are two copies of the Final Upland Human Health Risk Assessment (HHRA) for the Arkema Portland Facility. The final HHRA is being submitted in accordance with Oregon Department of Environmental Quality's (DEQ's) comments on the May 2008 Draft HHRA that were provided in a letter dated October 1, 2008. LSS and DEQ discussed and clarified DEQ's comments during a conference call on November 10, 2008. Provided below is a summary of DEQ's comments and LSS' responses including how the comment was addressed in the Final Arkema Upland HHRA.

**DEQ Comments and LSS Response to Comments on the Draft Human Health Risk Assessment, Arkema Site: Upland Areas, Portland Oregon**

Each of DEQ's October 1 comments are provided below in bold text followed by LSS' responses and resolutions as discussed with DEQ during the November 10 conference call in normal text.

1. **DEQ Comment: Page xv, top of page. The sentence appears to say that the 90UCL on the mean is used as the exposure point concentration for both the CTE and RME exposure scenarios. This would contradict the previous sentence. The mean is used in the CTE, and the 90UCL is used in the RME.**

   **LSS Response:** The 90UCL on the mean was used for all exposure scenarios. The text

in the Final HHRA was revised.

2. **DEQ Comment: Page 2-7, second to last paragraph. Include the April 2007 groundwater sampling results in the risk assessment.**

   **LSS Response:** The April 2007 groundwater data were not available in time to be included in the site groundwater dataset used in the HHRA. The April 2007 groundwater data were evaluated from a risk perspective as part of the uncertainty evaluation in the Risk Characterization section of the HHRA. The uncertainty evaluation concluded that no additional COPCs would be identified after applying the risk-based screening process used in the HHRA to the April 2007 groundwater data. The HHRA concluded that the health risks were negligible for scenarios related to inhalation of volatiles released from groundwater despite using a data set dominated by wells in the most impacted area of the site (i.e., HI < 0.001 and cancer risks ≤ 5E-7). The uncertainty evaluation concluded that the April 2007 groundwater data would not change these risk conclusions based on a comparison of the maximum concentrations for COPCs in the historic dataset used in the quantitative HHRA.

   Nevertheless, it was agreed during the November 10 conference call that LSS would include comparisons of chemicals from the April 2007 data set to the historical groundwater dataset already included in the HRHA. This comparison included a screening of the April 2007 maximum groundwater concentrations against the relevant inhalation RBCs. The evaluation is presented and discussed in Section 6.7, Uncertainty Analysis, of the Final HHRA.

3. **DEQ Comment: Page 2-13, second paragraph. For completeness, evaluate excavation worker exposure to groundwater. It can be evaluated by comparison with DEQ's RBCs for excavation workers** (http://www.deq.state.or.us/lq/rbdm.htm)**, which include dermal and inhalation pathways.**

   **LSS Response:** LSS included an evaluation of the excavation worker exposure in the Final HHRA.

4. **DEQ Comment: Page 3-3, top sentence. EPA no longer supports the use of ½ the detection limit for non-detect values. Use the more sophisticated methods available in EPA's ProUCL program, version 4, to handle non-detect values. It is unlikely that this refinement will substantially alter the EPCs.**

   **LSS Response:** We agree that subsequent to the development of this HHRA, the EPA

has recommended more sophisticated methods for dealing with non-detect values. We further agree that use of these more sophisticated methods is unlikely to change the EPCs, especially for the risk driving COPCs. The risk results for all receptors across the site are dominated by the soil ingestion pathway. Less than seven COPCs contribute more than 2% to total risk for any receptor across the site. The three dominate risk driving COPCs at the site were arsenic, DDT and dioxin/furans. The frequency of detection for arsenic was 100% in areas where it drove risks. Similarly for DDT, the frequency of detection was between 94 and 100 percent in the risk relevant areas. Dioxin/furans were expressed as a TEQ value. At least one dioxin/furan was detected in every sample used in the calculation of the EPC, however some congeners were evaluated at a location using the ½ DL substitution.

In conclusion, we believe that the DL substitution refinement would have a negligible impact on the risk conclusions given that the EPCs for risk drivers at the site were generally unaffected by the ½ DL substitution policy. A quantitative evaluation of the effect of the ½ DL substitution for risk driving chemicals is provided in the Final HHRA.

5. **DEQ Comment: Page 3-3, second to last paragraph. Trespasser exposure in Lots 3 and 4 is not included because much of the soil is covered by building foundations and paving. Trespassing is typically included as a relevant exposure pathway at unoccupied industrial sites, and, as stated, trespassers (skateboarders) have been observed on this portion of the site. Revise the report to include exposure to unpaved areas and exposure to potential chemicals on paved areas. Exposure to chemicals on building foundations and pavement should be considered, at least qualitatively.**

   **LSS Response:** During the November 10 conference call it was clarified that LSS had taken aggressive measures to abate trespassing in general and skateboarding in particular. It was agreed that the Final HHRA would revise the text to: reflect the skateboard abatement measure; acknowledge the potential for this exposure to happen; discuss the difficulties in quantifying the exposure for a skateboarding trespasser; and, that potential risks for skateboard trespassers would be less that for the occupational receptors evaluated for the same areas of the Site.

6. **DEQ Comment: Page 3-4, last paragraph. Groundwater is evaluated as a single dataset. Because a future building could be placed over areas with higher groundwater concentrations, generally the vapor intrusion pathway is evaluated using smaller datasets. Discuss this issue in the report. Given that the maximum detected concentrations (Table 3-21) are below the RBCs, this should result in a**

**minor modification. The conclusion that chemicals in groundwater are not a volatilization threat is still valid.**

**LSS Response:** It was agreed as part of the November 10 conference call that the uncertainty could be evaluated by calculating the vapor intrusion risks based on the maximum groundwater concentration. The requested evaluation was included as part of the uncertainty evaluation in the Risk Characterization section of the Final HHRA.

7. **DEQ Comment: Page 3-6. RBCs are stated as being taken from 2003 DEQ guidance. The correct reference appears to be to DEQ's 2007 guidance. DEQ added RBCs for many more chemicals in 2007, and apparently these RBCs were used in the screening tables. For future reference, chemicals for which default RBCs are not available could have been added to the RBC spreadsheet. Also, trespasser RBCs could have been developed from modifying the input parameters to residential RBCs.**

   **LSS Response:** The text was edited to provide the correct reference.

8. **DEQ Comment: Page 3-14, Section 3.5.3. Exposure to dust was evaluated separately, but is generally included in the exposure to soil. There is no need to revise this section. However, note that if RBCs are used in the risk assessment, the RBC values for exposure to surface soil include dust exposure.**

   **LSS Response:** Fugitive dust calculations were computed separately to facilitate risk characterization based on intake estimates coupled with toxicity criteria. We agree that had we used RBCs in the HHRA beyond selection of COPCs, then there would be no need to evaluate inhalation exposures to soil separately from the direct contact exposures.

9. **DEQ Comment: Page 3-19. The use of the r-crack value in the Johnson-Ettinger model is challenged in this section. DEQ is not aware of errors in the EPA's program. Arkema should either refer to an analysis in the literature that discusses the error, or provide their own evaluation. Otherwise, remove the statement.**

   **LSS Response:** The text was revised to remove the reference to the error in the r-crack value of the Johnson-Ettinger model.

10. **DEQ Comment: Page 5-7, Section 5.2.3. For reasonable maximum exposure, use the higher cancer slope factor (CSF) for PCBs. The lower CSF can be used for central tendency exposure, or discussed in the uncertainty section.**

**LSS Response:** This requested revision was made in the Final HHRA.

11. **DEQ Comment: Page 5-9, Section 5.2.4.20. EPA's assumption of a CrVI:CrIII ratio of 1:6 is for occupational exposure, and is unlikely to apply to the exposure scenarios at this site. For sites with chromium VI, DEQ has used a slope factor specific to chromium VI. Revise the report to use the toxicity information for chromium VI available on EPA's new regional screening level table** (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm).

    **LSS Response:** The requested revisions was made in the Final HHRA.

12. **DEQ Comment: Page 5-14, Section 5.2.6.5. As discussed in DEQ's RBDM guidance, use the slope factor for TCE of 0.4 $(mg/kg/day)^{-1}$ instead of 0.0016 $(mg/kg/day)^{-1}$. The lower CSF can be used for central tendency exposure, or discussed in the uncertainty section.**

    **LSS Response:** The requested revisions was made in the Final HHRA.

13. **DEQ Comment: Tables 3-3 to 3-20. DEQ does not have any RBCs for TPH heavy oil. It is not appropriate to report an RBC of >max taken from the RBC for TPH-mineral oil. Instead, address TPH heavy oil qualitatively. It is unlikely that an RBC for heavy oil, if developed, would be exceeded by site concentrations.**

    **LSS Response:** The requested revisions was made in the Final HHRA.

14. **DEQ Comment: Tables 3-3 and 3-4, and Tables 3-22 and 3-23. If there are no differences in the data in these tables, they can be combined.**

    **LSS Response:** The information is similar, but it was considered more transparent to retain each of the tables rather than combine them.

15. **DEQ Comment: Tables 3-10 to 3-15, and Tables 3-16 to 3-20. Some of the mean chemical concentrations are greater than the maximum detected concentrations. Provide an explanation for this. It may be an artifact of low numbers of detected chemicals, and high detection limits. Regardless, screening is conducted using maximum concentrations, so the conclusions should not change.**

    **LSS Response:** We have footnoted these instances in the tables. The footnote provides

an explanation for the exceedance of the maximum detected concentration by the calculated mean. As noted in the comment, these instances did not affect the COPC screening as it was based on the maximum detected concentration.

16. **DEQ Comment: Table 3-15. Based on the screening results provided in Appendix B, the soil to indoor air screening for value for 1,4-dichlorobenzene appears to be greater than the soil saturation limit, indicating that vapors from this pathway are not a threat to indoor air. 1,4-Dichlorobenzene may not be a chemical of potential concern by this pathway.**

    **LSS Response:** The chemical was retained for evaluation in the risk assessment due to uncertainties in the model application. Eliminating this chemical from the pathway would have a negligible impact on the risk conclusions given that the remaining COPC, tetrachloroethane, contributes 80% of the total risks.

17. **DEQ Comment: Table 3-20. Correct the soil to outdoor air RBC screening value for methylene chloride is from 1390 mg/kg to 140 mg/kg. Soil concentrations are still below the RBC, so this does not alter the conclusion to screen the chemical out.**

    **LSS Response:** The requested edit was made in the Final HHRA.

18. **DEQ Comment: Table 3-25. In some cases, such as for pentachlorophenol and hexachlorobenzene in the riverbank, the EPC values are greater than the maximum concentrations. DEQ rules allow for an EPC to be based on the 90 percent UCL on the arithmetic mean, or the maximum concentration, whichever is less.**

    **Specify the units in the table.**

    **LSS Response:** The EPC protocol for the HHRA specified that in cases where the 90UCL exceeded the maximum detected concentration, the maximum would be used as the EPC. The table was reviewed to identify instances where process was violated and determine the appropriate resolution. This condition was not violated for risk driving chemicals, therefore, the risk conclusions should be unaffected by any revisions. We have corrected the two instances noted in the comment.

    The table was edited to indicate that the units are mg/kg.

19. **DEQ Comment: Table 3-26. Specify units in the table.**

**LSS Response:** The table was edited to indicate the units.

20. **DEQ Comment: Table 5-3. Use the Aroclor oral and inhalation slope factors of 2 $(mg/kg/day)^{-1}$ instead of 1 $(mg/kg/day)^{-1}$, at least for use in RME calculations. The lower slope factors can be discussed in the uncertainty section.**

    **The oral slope factor for 2,3,7,8-TCDD as presented in HEAST and DEQ RBDM guidance is $1.5 \times 10^5$ $(mg/kg/day)^{-1}$, not $1 \times 10^6$ $(mg/kg/day)^{-1}$. However, DEQ will be adopted the slope factor in EPA's new regional screening level table of $1.3 \times 10^5$ $(mg/kg/day)^{-1}$, which is taken from CalEPA. For this risk assessment, use the current EPA regional value. The unit risk factor for 2,3,7,8-TCDD is 38 $(ug/m^3)^{-1}$, not 33 $(mg/m^3)^{-1}$. This converts to an inhalation slope factor of $1.3 \times 10^5$ $(mg/kg/day)^{-1}$, not $1.2 \times 10^2$ $(mg/kg/day)^{-1}$.**

    **TCE is an exception to the use of new EPA regional values. DEQ has decided to use the upper end of EPA's slope factor range for TCE, as presented in DEQ's RBDM guidance. Use the oral and inhalation slope factors for TCE of 0.4 $(mg/kg/day)^{-1}$ instead of 0.0016 $(mg/kg/day)^{-1}$.**

    **The inhalation slope factor for hexachlorobenzene is 1.6 $(mg/kg/day)^{-1}$.**

    **The above revisions to toxicity factors will alter the results of the risk calculations. It appears that the main change will be in the calculated risks associated with dioxins in riverbank soil (Tables C-32 to C-40).**

    **LSS Response:** The requested revisions were made and risks recalculated for the Final HHRA.

21. **DEQ Comment: Table 5-4. Perform the evaluation using the 2005-6 WHO TEFs.**

    **LSS Response:** During the November 10 conference call, LSS indicated that the TEF had remained the same or decreased for the most potent and prevalent dioxins at the Site. It was decided that an uncertainty analysis would be conducted to evaluate the risk implications of applying the new TEF to the Site data. The uncertainty analysis focused on the combining the dioxin/furan Site data with the new TEF values to see if the TEQ values would be affected. The requested analysis was included in the Final HHRA.

22. **DEQ Comment: Tables 6-6 to 6-10, Table 6-17, and Table 6-20. There is a typographic**

**error in the sum, which indicates an HI instead of an excess lifetime cancer risk.**

**LSS Response:** The tables were revised to indicate the sums represent total excess lifetime cancer risk.

23. **DEQ Comment: Table 6-28. The 2,4'-DDx compounds were not analyzed in all samples from Lots 1 through 4. Discuss the uncertainty associated with this data limitation. A comparison of 2,4'-DDx and 4,4'-DDx data should be used to identify relative contributions.**

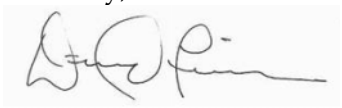
    **LSS Response:** The requested comparison is provided in the uncertainty analysis of the Risk Characterization section of the Final HHRA.

24. **DEQ Comment: Table 7-1. Note "a" indicates a list of risk-driving chemicals, which is not included.**

    **LSS Response:** The table was revised to indicate the risk-driving chemicals.

If you have any questions, please feel free to contact me at 503-284-5545.

Sincerely,



David Livermore, R.G., L.H.G.
Principal-in-Charge

Enclosures

cc: Todd Slater, LSS
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