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student housing. The current document presents a health risk assessment based on these new data.

Document Reviewed

We reviewed "Appendix A, Draft Human Health Risk Assessment Update, Operable Unit 2 Landfill, Fort Ord, California". This document, dated 15 March 2002, was prepared by Harding ESE, Inc., contractors to the Army. It is part of a larger document (which we did not review), entitled "Draft Landfill Gas Ambient Air Monitoring Report, September 2001, Operable 2 Landfill, Former Fort Ord, California", dated April 2002, and prepared by IT Corp., contractors to the Army.

General Comments

The screening risk assessment is clear and well presented. Detected concentrations of volatile chemicals emitted from the landfills of OU-2 apparently present cancer risks and non-cancer hazards which require action on the part of the Army to lower emissions and decrease exposures. The Army has underestimated cancer risk and non-cancer hazard by improperly excluding some detected chemicals as chemicals of potential concern (COPC). We feel that an assessment of cumulative risk might be needed for this portion of the base, because emissions from the landfills might not be the only source of residents' exposure to contaminants. The risk assessment can become acceptable upon adequate responses to our specific comments below.

Specific Comments

1. **Detection Limits, Sec. A2.3, p. A5:** The Army states that detection limits for some analytes exceeded concentrations of toxicological interest. In any and all future sampling, the Army must strive to detect all significant concentrations. Meeting concentrations associated with toxicity criteria should be a minimum acceptable goal.
2. **Conversion Factor, Sec. A3.1, p. A6:** Conversion of vapor concentration from parts per million by volume to mass per unit volume uses a conversion factor based on the universal gas constant. This factor should be 24.55 at 25°C and 1 atmosphere pressure, but it is given as 24.055 in the denominator of the expression at the bottom of this page. Please make any necessary re-calculations using the correct factor.
3. **Presence of Monoaromatic Fuel Components, Table A1:** We note that benzene, ethyl-benzene, xylene(s), and toluene were detected in air downwind from the landfills at concentrations exceeding local background. Were fuel hydrocarbons disposed in the landfills at OU-2? If so, these should be removed aggressively before they contaminate groundwater resources.

4. **Selection of COPC, Sec. A3.2, p. A8 & Table A1:** We disagree with the method of selecting COPC. Also, the Army has misapplied its stated method. The Army wants to eliminate COPC whose maximum concentrations (C_{MAX}) are less than their respective toxicity criteria, such as chronic Reference Exposure Levels (REL) from the Office of Health Hazard Assessment or Preliminary Remediation Goals (PRG) in air from USEPA Region 9. We will accept the elimination of detected chemicals when C_{MAX} is a small fractions of the appropriate toxicity criterion. However, if C_{MAX} is a significant fraction of its toxicity criterion, it should be retained as a COPC. In Table A1, we see that C_{MAX} for 1,2,4-trimethylbenzene is about one-half its PRG. This chemical should be retained as a COPC. Benzene was detected at $C_{MAX} > PRG$; therefore, it must also be retained as a COPC. Several other chemicals were detected at $C_{MAX} \leq PRG$ or $REL \times 0.01$. We agree that these may be eliminated.
5. **Exposure Pathways, Sec. A5.1, p. A10:** We accept that the use of C_{MAX} from outdoor air will not underestimate risk in indoor air **if the only source of contaminants is outdoor air**. It seems entirely possible that residents a few hundred feet from a landfill heavily laden with volatile, water-soluble substances such as benzene, chloroform, and chloromethane might also be exposed to vapors penetrating from soil gas and/or groundwater beneath their homes. We recommend that the Army examine the necessity for estimating cumulative risk from all media for these receptors. For instance, is the groundwater gradient tending eastward, toward the student residences? What contaminants are present in soil gas and groundwater near the residence buildings? We feel these questions deserve close scrutiny. If, in fact, residents are exposed to contaminants via other pathways, these should be addressed in a cumulative risk assessment.
6. **Risk Characterization, Sec. A6, pp. A12 ff.:** Using the values for C_{MAX} for the COPC, the Army estimates excess cancer risk for adult residents at $3 \text{ E-}5$, driven principally by carbon tetrachloride (Table A4). This amount is underestimated by approximately 10%, because benzene was not retained as a COPC. Non-cancer hazard for the resident children is estimated at about 4. This is also underestimated by about 10%, because 1,2,4-trimethylbenzene was not included as a COPC.
7. **Conclusions, Sec. A7, p. A18:** The Army compares the estimated risk for nearby residents to $1 \text{ E-}5$, which they apparently and erroneously think is a point of departure for cancer risk. DTSC's policy has always been to use $1 \text{ E-}6$ as a point of departure, as recommended in the National Contingency Plan. We believe the Army has underestimated cancer risk. We agree with the Army that non-cancer Hazard Index of about 4 indicates that resident children could well be at risk of toxic effects from emissions from the landfills at OU-2. The Army should take aggressive action to lower the emissions from these landfills and consequent exposure to nearby residents.

Conclusions and Recommendations

1. Detected concentrations of volatile chemicals emitted from the landfills of OU-2 present cancer risks and non-cancer hazards higher than acceptable benchmarks. The Army should take action to lower these emissions and decrease exposures.
2. The Army has underestimated cancer risk and non-cancer hazard by improperly excluding some detected chemicals as chemicals of potential concern (COPC), notably benzene and 1,2,4-trimethylbenzene.
3. Residents might be exposed to vapors penetrating their residences from soil gas or groundwater. Therefore, we feel that an assessment of cumulative risk might be needed for this portion of the base.

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