

**TECHNICAL REVIEW COMMENTS ON  
HUMAN HEALTH RISK ASSESSMENT  
PRESENT LANDFILL, INACTIVE HAZARDOUS WASTE STORAGE AREA,  
AND EAST LANDFILL POND AREA AND ADJACENT  
SPRAY EVAPORATION AREAS (OU7)  
TECHNICAL MEMORANDUM NO. 1  
EXPOSURE SCENARIOS**

**ROCKY FLATS PLANT  
GOLDEN, COLORADO**

Prepared for:

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
Region 8 Federal Facilities Remedial Branch  
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## 1.0 INTRODUCTION

PRC Environmental Management, Inc. (PRC) conducted a technical review of the Human Health Risk Assessment, Present Landfill, Inactive Hazardous Waste Storage Area and East Landfill Pond and Adjacent Spray Evaporation Areas (OU7), Technical Memorandum No. 1, Exposure Scenarios for the Rocky Flats Plant (RFP). This document was prepared by the U.S. Department of Energy (DOE) in January 1993. PRC prepared this review for the U.S. Environmental Protection Agency (EPA) under contract number 68-W9-0009, Technical Enforcement Support (TES) 12, work assignment number C08060.

## 2.0 GENERAL COMMENTS

1. The intent of Technical Memorandum No. 1 is to identify and describe potential and reasonable maximum exposure scenarios for present and future human receptors in OU7 and to identify reasonable maximum intake parameters which will be used to estimate chemical intake. Although the memorandum comprehensively identifies exposure scenarios, the intake parameters presented in most of the scenarios fall short of reasonable maximum values conventionally used for Superfund sites. The parameters should be revised to reflect a more conservative approach which will provide consistency with other Superfund sites.
2. The document asserts that future development of off-site land will be mainly industrial, which is not supported by information presented in the document. This assertion is misleading and conflicts with tables presented in Section 3.0 which indicate a nearly three-fold increase in residential population. Residential development around RFP is currently unrestricted, and master projection plans predict that such development is likely. A future off-site residential scenario has not been included for evaluation but should be considered because this information is essential for risk managers when considering various options for remedial action are considered.
3. A future on-site construction worker exposure scenario has not been addressed. Future on-site construction workers will have different exposures to site-related contaminants than current on-site workers or future on-site office workers and should be considered for completeness.

### 3.0 SPECIFIC COMMENTS

1. Page 3-21, First Full Paragraph and page 3-23, Table 3-4. Agricultural land use for off-site areas is described as plausible in the text, but according to Table 3-4 will not be evaluated because it is improbable. This conflict should be resolved. Additionally, the table indicates that current offsite agricultural land use will not be evaluated because the exposure is bound by offsite residential exposures and is likely to decrease in the future.

It would be in the best interest of DOE to consider all possible exposures and not just the upper bound scenarios. If the remedial manager decides not to use upper bound risks, valuable information will not be available.

Rationale: The table conflicts with accompanying text.

2. Page 3-25, Second Paragraph. The text explains in great detail the health and safety programs in place at RFP to protect workers from exposure to chemicals of concern (COCs). This statement is inaccurate. The site has yet to be characterized and COCs have not been identified for OU7. Moreover, chemical concentrations and exposures cannot be determined at this time. Thus, health risks from exposure to COCs are currently unknown for OU7.

Rationale: Health and safety plans are not relevant in a risk assessment.

3. Page 4-3, Last Paragraph. The text states "Dermal contact with soil will be assessed quantitatively only if results of OU7 Phase I sampling programs demonstrate the presence of organic chemicals of concern in surface soil samples at concentrations exceeding background." This approach is inappropriate for three reasons (EPA 1989a). First, all COCs should be evaluated for every appropriate pathway. Second, unlike inorganic chemicals which are naturally present as background, all organic chemicals should be considered anthropogenic. Thus, there are no background concentrations which COCs can be compared to. Third, if organic chemicals are detected in background samples, the selection of the background area will be invalidated because it indicates the area was impacted by RFP activities. Dermal contact should be included in the quantitative assessments.



Rationale: Ingestion of homegrown fruit should be addressed in the risk assessment.

8. Page 4-12, Section 4.5.2.4. Surface water contact and incidental surface water ingestion have not been included as exposure pathways for the hypothetical future on-site ecological researcher. Section 2.6.3 indicates that surface water is present on OU7. Therefore, incidental contact with this water should be assessed. These pathways should also be assessed for future on-site residents, future construction workers, and current on-site workers.

Rationale: Potential exposure pathways from contact with surface water should be addressed in the risk assessment.

9. Page 4-14, First Full Paragraph. The text states that incidental soil ingestion and dermal exposure from wind-deposited soils will not be included in this assessment because their contribution to risk is expected to be insignificant. If modeling of particulates in air will not be conducted, reasons supporting this decision should be presented.

Rationale: Omitting exposure pathways from the risk assessment should be explained in detail.

10. Page 4-14, First Full Paragraph. The text indicates that a matrix effect, indicating bioavailability of chemicals in soil, will be used in determining soil intake. Bioavailability factors are chemical-specific and dependent on the particular chemical matrix in which the chemical is ingested. These forms are widely variable for each chemical. Unless sufficient information can be provided to substantiate chemical-specific bioavailability factors, this factor should be eliminated from the soil intake equation.

Rationale: Bioavailability factors vary widely and contribute uncertainty to the intake equations.

11. Page 4-15, Last Paragraph. Ingestion of homegrown fruit is not considered as an exposure pathway for hypothetical future on-site residents but should be quantitatively addressed for a more conservative and complete assessment of risk (EPA 1989a, 1986). Reasonable maximum exposure (RME) estimates are available from the Exposure Factors Handbook (EPA 1989b). Plant uptake of chemicals in the soil, as well as surface deposition of particulates, should be included in the assessment of fruit ingestion (Baes et al. 1984).

Rationale: All potential exposure pathways should be addressed in the risk assessment.

12. Pages 5-2 and 5-3, Section 5.1.1. Several of the generic exposure assumptions are not consistent with those conventionally used at a Superfund site. The RME exposure frequency of 3 days per week for the current on-site worker is too low. It should be 5 days per week. The RME exposure frequency for the future on-site ecological researcher should be 5 days per week for 50 weeks per year. Exposure frequencies should not be adjusted for snowfall because potential exposures are likely to occur despite ground snow cover. The RME exposure duration for the current landfill worker should be 25 years. To assume that it would be 5 years would impose an institutional control on exposure, which is inappropriate for a risk assessment. These assumptions should be amended because they do not reflect RME conditions.

Rationale: RME values and assumptions should be health-conservative.

13. Page 5-4, First Indented Paragraph. The inhalation rate of indoor workers should be 0.83 cubic meters per hour. The value listed is not the most conservative RME assumption.

Rationale: Exposure assumptions should reflect RME values.

14. Page 5-4, Fourth Indented Paragraph. A deposition factor of 25 percent is proposed in the assumptions for inhalation exposure. If 75 percent (EPA 1985) of inhaled particles do not deposit in the lung, they must either be swallowed or expectorated. Ingestion calculations should be adjusted to reflect swallowing of inhaled particulate matter if a deposition factor is used in the inhalation equation. Additionally, deposition factors depend on a number of variables, including aerodynamic particulate diameter and concentration of this fraction in ambient air. Data supporting the deposition factor used in the risk assessment should be provided.

Rationale: Use of a deposition factor should be supported by site-specific data. Intake from ingestion should be adjusted accordingly.

15. Page 5-5, Last Paragraph. The text proposes the use of a "fraction ingested from contaminated source" factor to modify soil ingestion based on the amount of time spent outdoors and the size of OU7 relative to the total area of RFP. The use of this fraction is inappropriate and could underestimate soil intake. The soil ingestion input parameters from Risk Assessment Guidance for Superfund (RAGS) (EPA 1989a) or the Exposure Factors Handbook (EPA 1989b) include ingestion of indoor dust, which should be considered to have contaminant concentrations equal to outdoor soils. A factor for fraction ingested should not be used in determining chronic daily intake from soil.

Rationale: Fractions reducing exposure estimates from soil are inappropriate for RME assumptions.

16. Page 5-6, Section 5.1.4. Using a 4-month harvesting season to reduce the intake of homegrown vegetables is inappropriate. The RME value for ingestion of vegetables is 80,000 mg/day (EPA 1989b) based on a typical consumption of 200,000 mg/day and RME proportion of 40 percent of vegetables being homegrown. The RME value should be used to determine contaminant intake through this pathway.

Rationale: RME values should be used to determine contaminant intake.

17. Page 5-7, First Indented Paragraph. The use of a matrix factor to account for bioavailability of contaminants in homegrown produce is inappropriate. Particulates deposited on the surface of a plant are not covalently bound and should be assumed to be available for absorption by the gastrointestinal tract. Although it is possible that contaminants taken up by plants are less bioavailable than particulates on the surface of plants, very little information regarding this issue is available. Therefore, a reliable matrix factor cannot be estimated and should be eliminated from the intake equation.

Rationale: The matrix factor is inappropriate for ingestion of contaminants from homegrown produce.

18. Page 5-7, Section 5.1.5. The value used to represent RME exposed body surface area is not consistent with the value conventionally used for residential receptors. Residential receptors are not likely to wear long sleeves and long pants when gardening in their yards and therefore would have more body surface area exposed than indicated. This body surface area value should be increased for both on- and off-site residential receptors. EPA's Dermal Exposure

**Assessment: Principles and Applications (EPA 1992) provides more acceptable body surface area estimates.**

**Rationale:** The body surface area value presented is not an RME estimate for residential receptors.

19. **Page 5-8, Second Paragraph.** The soil adherence factor listed is the midpoint of recommended values, but it is not the RME value. The RME value, as suggested by the Dermal Exposure Factors Handbook (EPA 1992) is 1.0 milligram per square centimeter (mg/cm<sup>2</sup>).

**Rationale:** The proposed soil adherence factor is not an RME value.

20. **Page 5-8, Last Paragraph.** As described in specific comment 15, the use of a fraction ingested factor is inappropriate and should be eliminated from the equation.

**Rationale:** See specific comment 15.

21. **Pages 5-11 through 5-31, Tables 5-1 through 5-21.** The summary tables reflect the inaccuracies noted in the text and should be corrected.

**Rationale:** The tables should be modified to incorporate changes made in the text.

22. **Page 5-21, Table 5-11.** The soil ingestion rate for the hypothetical future on-site ecological researcher underestimates potential exposure. An ingestion rate of 100 milligrams per/day is the acceptable value for this receptor (EPA 1989a, 1989b).

**Rationale:** The soil ingestion rate presented for the ecological researcher is not conservative.

23. **Page 5-25, Table 5-15.** The "fraction exposed from contaminated surface" should be eliminated from this equation. This factor is being used in a manner similar to the fraction of soil ingested from a contaminated source (see specific comment 15) and is incorrect for similar reasons. It is incorrect to assume that exposure depends on the size of the area relative to the total size of the RFP buffer zone. Exposure should be dependent on the amount of time spent in the area, which in this case is 8 hours per day.

Rationale: Fractions reducing exposure estimates are inappropriate for RME assumptions.

#### 4.0 REFERENCES

- Baes, C.F.; Sharp, R.D.; Sjoreen, A.L.; and Shore, R.W., 1984. *A Review of Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*. Oak Ridge National Laboratory. Prepared for U.S. Department of Energy, ORND-5786.
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