

**RESPONSES TO  
U.S. ENVIRONMENTAL PROTECTION AGENCY  
AND  
COLORADO DEPARTMENT OF HEALTH COMMENTS**

**ON**

**HISTORICAL INFORMATION SUMMARY AND  
PRELIMINARY HEALTH RISK ASSESSMENT  
OPERABLE UNIT NO. 3 - SITES 200-202  
FINAL DRAFT  
OCTOBER 24, 1991**

**U.S. DEPARTMENT OF ENERGY  
ROCKY FLATS PLANT  
GOLDEN, COLORADO**

**ENVIRONMENTAL RESTORATION PROGRAM**

**APRIL 5, 1991**

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By W. R. Salinas W. R. Salinas  
Date 4/21/91

**EPA COMMENT RESPONSES**  
**FINAL HISTORICAL INFORMATION SUMMARY AND PRELIMINARY HEALTH**  
**RISK ASSESSMENT - OPERABLE UNIT NO. 3, SITES 200-202**

NOTE: The following are responses to EPA comments received by DOE on February 15, 1991 regarding the November 5, 1990 draft final of the Sites 200-202 Historical Information Summary and Preliminary Health Risk Assessment. These comments were grouped into General Comments and Specific Comments.

**GENERAL COMMENTS**

EPA-G1        A complete site conceptual model must be developed which shows consideration of the source of contamination in the reservoirs, the appropriate release mechanisms, the appropriate transport and receiving media, and all potential exposure pathways. We are concerned that certain exposure pathways have been discounted without adequate justification.

Response:     Exposure pathways are qualitatively evaluated in this document based on their probability of occurrence and associated risk. All potential exposure pathways, however, will be addressed under scheduled RFI/RI activities at Sites 200-202, and are therefore not being discounted from future study. This point has been clarified in the final Historical Information Summary and Preliminary Health Risk Assessment, Operable Unit No. 3, Sites 200-202 (hereafter referred to as the "Historical Report").

EPA-G2        Data sources for many of the statements and assumptions made in the document are not provided. The rationale for important assumptions must be provided and appropriate references cited. This will result in a more credible document.

Response:     Efforts have been taken to more carefully develop statements, assumptions, and conclusions in the Historical Report, and to reference these as appropriate.

EPA-G3        The conclusion that the available data are not of sufficient quality to be used in a quantitative risk assessment is the basis for all the statements regarding risk that are made in the document yet is unjustified by the information presented. For this reason, it is imperative that a complete evaluation of the available data be included in the final Historical Information and Preliminary Health Risk Assessment Report. This evaluation should follow the criteria contained in the EPA publication "Guidance for Data Useability in Risk Assessment". Only after such an evaluation can conclusions be drawn about the quality of the data. At this point however, we strongly disagree with the conclusion that the data from past studies are not of sufficient quality to support a quantification of human health risk.

Response:     Appendix A evaluates existing data for Sites 200-202 against criteria set forth in the EPA "Guidance for Data Useability in Risk Assessment." This guidance was published in October 1990, immediately prior to the completion of the draft Historical Report. It is the conclusion of this evaluation that the existing data are not sufficient to support a quantitative risk assessment.

EPA-G4        Regardless of the data useability for quantitative risk assessment, the final document must include some type of quantitative indicator of relative risk of the contamination in the reservoirs. Section 4.7.3 is an attempt at such an indication but needs to be further developed in the final report.

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Response: Appendix C provides a "generic" risk assessment calculation for plutonium in reservoir sediments.

**SPECIFIC COMMENTS**

EPA-1 **Page ES-1, last paragraph:** While EPA does not disagree that data must meet certain criteria for inclusion in a quantitative risk assessment, the mere statement that "...the specificity and quality of existing information are insufficient to perform a rigorous quantitative human health risk assessment" does not indicate that any criteria were considered in coming to this conclusion. Refer to EPA guidance on data useability in risk assessment (EPA 1990b) for acceptable criteria. The final report must include an evaluation of the available data which is referred to in this draft using the criteria contained in this guidance document. This evaluation will provide the basis for any conclusion on the applicability of the data to risk assessment.

Response: Appendix A evaluates existing data for Sites 200-202 against criteria set forth in the EPA "Guidance for Data Useability in Risk Assessment." This guidance was published in October 1990, immediately prior to the completion of the draft Historical Report. It is the conclusion of this evaluation that the existing data are not sufficient to support a quantitative risk assessment.

EPA-2 **Page ES-2, fourth paragraph:** Provide a reference for the first sentence of this paragraph beginning, "Past environmental investigations..."

Response: The Executive Summary does not contain references. Information contained in the Executive Summary is referenced as appropriate where it appears in the main text.

EPA-3 **Page ES-3, last paragraph:** Statements regarding the report's consideration of the highest exposure potential need to be clarified to reflect that consideration was only given to human exposure. It is conceivable that after consideration of environmental receptors, other exposure pathways will be shown to be the most critical, e.g., ingestion of contaminated sediments by aquatic biota.

Response: The conclusion in question states that exposure potential is for human receptors. The conclusion has been rewritten to indicate that all potential exposure pathways will be addressed under scheduled RFI/RI activities for Sites 200-202, which will include an environmental evaluation.

EPA-4 **Page ES-3, last paragraph:** It is not meaningful to compare Pu levels in reservoir sediments with the Colorado Department of Health (CDH) standard for plutonium in the top surface layer of soil.

Response: The comparison is meaningful because the pathway being considered is airborne reentrainment of exposed sediments.

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EPA-5      **Page ES-3, last paragraph:** The plutonium levels detected in the sediments of Great Western Reservoir are significantly higher than those detected in Standley Lake. This difference should be stated in the conclusions.

Response:      This is now stated in the conclusions.

EPA-6      **Page ES-3, last paragraph:** Given the configuration of the off site drainages, it is expected that plutonium levels in the sediment of Mower Reservoir are similar to those in Standley Lake, not Great Western Reservoir.

Response:      It can be inferred that plutonium in Mower Reservoir resulting from surface water releases (i.e., Woman Creek) would be similar for Mower Reservoir and Standley Lake; however, plutonium resulting from airborne releases, and from erosion and transport of contaminated soil by surface runoff, would be similar for Mower Reservoir and Great Western Reservoir. This point is clarified in Section 2.3.2.

EPA-7      **Page 2, second paragraph:** The specific objectives for the Historical Information Summary and Preliminary Health Risk Assessment Report should be consistent with the primary objectives as stated in the Interagency Agreement (IAG). The IAG contemplates a quantitative risk assessment in this report. An objective of providing a "preliminary qualitative health risk assessment" appears to be pre-decisional. The decision to provide a qualitative assessment can only be made after an evaluation of the available data.

Response:      The discussion of IAG requirements for the Historical Report has been expanded in Section 1.1. The specific objective identified in the comment has been changed in response to the comment.

EPA-8      **Page 6, Section 2.1.1, Location and Description:** There are four steps in the baseline risk assessment process: data collection and evaluation, exposure assessment, toxicity assessment, and risk characterization (EPA, 1989). The exposure assessment step begins with a characterization of the site exposure setting. This characterization discusses among other things, the land use considerations for the site. For this reason, it is important to describe in detail what types of access restrictions are in place. The first paragraph of this section mentions that public access to Great Western Reservoir and the surrounding area is restricted. Elaborate on the nature of these restrictions. Are certain activities restricted? Is complete access restricted at certain times? Are certain populations restricted?

Response:      Section 2.1.1 has been rewritten to emphasize that no public access to Great Western Reservoir is permitted.

EPA-9      **Page 8, Section 2.1.2.1, Reservoir and Drainage Sediments:** Provide a table of historical data and baseline (background) concentrations of radionuclides for comparison purposes. Provide a reference and a description of the baseline data (such as collection location) also.

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Response: This information is contained in the documents provided in Appendix D and is summarized in Section 2.1.3.1. Historical data for Great Western Reservoir and Standley Lake are tabulated in Tables 2.1 and 2.2, respectively.

EPA-10 **Page 9, third paragraph:** The statement made here and elsewhere that "decay of naturally-occurring radium-226 in surface water and domestic waters near the Rocky Flats Plat (RFP) represents a much greater relative contribution to public radiation exposure than does plutonium released from the RFP..." is irrelevant. Any radiation exposures resulting from RFP releases will be in addition to any naturally occurring radiation exposures. Also the statement indicates that public exposure to plutonium from RFP releases has been well characterized whereas it is repeatedly stated throughout the report that the data is inadequate for risk assessment purposes. The statement should be rephrased or eliminated. The plutonium released from RFP is not a natural contaminant. Any exposures resulting from RFP releases are not directly comparable to naturally occurring radiation exposures.

Response: This statement has been removed.

EPA-11 **Page 11, first paragraph:** The depth at which the contaminated sediments exist in the reservoirs of concern is never given in the report and should be added. This information would help to support statements made throughout the report that plutonium has not migrated from the reservoir bottom sediments where it was originally deposited.

Response: The depth to which the contaminated sediment horizon has been buried varies within the reservoirs due to varying sedimentation rates. The most recent studies to characterize the reservoir sediments were conducted in 1983 for Great Western Reservoir and 1984 for Standley Lake. Four cores were collected from each reservoir during these studies. Representative depths of burial for the contaminated horizons, based on the cores collected from each reservoir, are shown in Documents D-9 (Great Western Reservoir) and D-10 (Standley Lake) of Appendix D. These studies concluded that no evidence of plutonium migration existed compared to data collected in the 1970s by other investigators (EPA, Battelle, et al.). It is expected that the contaminated horizon in each reservoir has been buried by additional sedimentation since these studies were performed. Data will be collected during scheduled RFI/RI activities at Sites 200-202 to verify these conclusions.

EPA-12 **Page 12, first paragraph:** The unequivocal statement that tap water was below standards is not supported given that other sections of the test allege that the data base as a whole is inadequate for quantifying exposure. Provide some information about the quality of the database from which this conclusion is drawn in order to put the uncertainty in perspective.

Response: The uncertainty associated with these analyses (by Battelle) are included in Section 2.1.3.2.

EPA-13 **Page 12, first and fifth paragraphs:** The drinking water standards briefly mentioned on this page and elsewhere, including page 17, should be presented in a table to allow direct comparison with historical data, which should also be presented in a table. However, the statements in this section are erroneous. EPA has never had a plutonium standard for public

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water supplies in 3,700 dpm/l, and EPA has not to date promulgated a uranium standard for public water supplies.

**Response:** The drinking water standard was improperly referenced in the draft Historical Report, but has been corrected in Section 2.1.3.2. The 3,700 dpm/l figure cited was a DOE concentration guideline, not an EPA drinking water regulation, and has been removed from the text.

**EPA-14** **Page 12, third paragraph:** This paragraph seems to indicate that RFP has contaminated all regional water bodies and drinking water supplies with transuranic contaminants. If this is true, the paragraph should remain as is and further investigation into the movement of transuranics from RFP is needed. However, if this is not what is meant, then the paragraph should be carefully rewritten. The paragraph implies a very broad contamination problem that, if true, contradicts repeated statements in the report concerning the immobility of plutonium in the environment.

**Response:** The paragraph was not meant to imply broad-scale contamination and has been rewritten in Section 2.1.3.2.

**EPA-15** **Page 13, Section 2.2.1, Location and Description:** The Health Advisory Panel, which includes an EPA Regional VIII representative, has been shown recent video tapes of Standley Lake at different times of the year at significantly different water levels. The area of exposed lake bottom fluctuates throughout the year. Given this fact, amend the text in this section of the report to reflect actual conditions as appropriate.

**Response:** Any reservoir which is drawn upon as heavily as Standley Lake will experience wide fluctuations in water level between wet and dry seasons. The potential for exposure to plutonium in near-shore sediments is considered in Sections 3.0 and 4.0. The most significant exposure pathway in terms of human health risk is identified in Section 4.0 as airborne reentrainment of exposed sediments. Past studies have indicated that most of the plutonium in Standley Lake sediments occurs in the deeper areas of the reservoirs, not near the shoreline.

**EPA-16** **Page 15, Section 2.2.2.1, Reservoir and Drainage Sediments:** The statement that analysis of Standley Lake sediments showed above baseline concentrations, but failed to confirm contamination of the reservoir, appears contradictory. This statement should be clarified. As written, the statement is confusing.

**Response:** This paragraph has been rewritten in Section 2.2.2.1.

**EPA-17** **Page 17, Section 2.2.2.2, Reservoir and Drainage Water Quality:** To simply state that concentrations were above or below detection limits is meaningless unless the quantitative values for these detection limits are given.

**Response:** The expected background concentrations due to atmospheric fallout are referred to in the Battelle study (Appendix D, Document D-5), but are never specifically quantified. Battelle may have used the 0.03 pCi/l background estimated by EPA in their 1970 study and based

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upon sampling of Autrey Reservoir, Calkins Lake, and Standley Lake water (Appendix D, Document D-1). This is clarified in Section 2.2.2.2.

EPA-18      **Page 18, second sentence:** As in other areas of the text, provide a table of relevant standards to allow direct comparison with available data.

Response:      Water quality standards applicable to surface waters exiting the RFP are summarized in monthly and annual RFP environmental monitoring reports. These reports are referenced in Section 2.2.2.2.

EPA-19      **Page 20, first paragraph:** Contrary to the first sentence in this paragraph, EPA does not believe there is any question that Woman Creek and Walnut Creek were pathways of plutonium contamination in Great Western Reservoir and to a lesser extent, Standley Lake.

Response:      The sentence in question has been rewritten in Section 2.4.

EPA-20      **Page 20, second paragraph:** The 1990 study conducted by the Colorado School of Mines which is referenced in this paragraph may be important in defining the background concentrations of radionuclides. Please provide EPA with a copy for review. Specifically, EPA is interested in the choice of a peak value as a baseline concentration for plutonium in sediments of Front Range lakes.

Response:      No response required.

EPA-21      **Page 22, Section 3.1, Historic Sources:** This section implies that the only contaminants that is present above background levels in the reservoirs is plutonium. Investigations by DOE conclude that <sup>241</sup>Am is present in the waters and sediments of Great Western Reservoir (Battelle, 1974). Also, it must be clarified that the available studies only considered a limited number of contaminants. For example, DOE acknowledges that tritium was accidentally released in 1973 however, tritium contamination in sediments has not been studied (Rockwell, 1988b). The fact that plutonium may represent a subset of the radionuclides possible at the site is acknowledged in Table 4.2 but it should be clarified in the text to avoid misleading the reader.

Response:      It is clarified in the Historical Report that plutonium is the only RFP-derived contaminant which has been extensively characterized in the reservoirs. Americium is also believed to exist in the reservoir sediments above background concentrations (see Appendix D, Document D-5). Other potential RFP-derived contaminants (beryllium, numerous radionuclides) have been measured in various environmental media in past studies and/or are monitored through routine water quality monitoring at the reservoirs and their tributary streams (Sections 2.1.3.2 and 2.2.2.2). Other potential contaminants of concern will be addressed and characterized as appropriate during scheduled RFI/RI activities at Sites 200-202.

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EPA-22      **Page 22, Section 3.2, Source Area Characterization:** The assumption is made here, and throughout the report, that the plutonium present in site soils (sic) is plutonium dioxide, but no rationale or data to support this assumption are provided. Not are any references cited that discuss site-specific data. Data should be provided that verify this assumption or a rationale to justify it should be presented. Plutonium dioxide is described in the report as being insoluble, which leads to a long retention time in the lung but little adsorption in the gut. Insolubility also reduces environmental mobility. These are important factors when evaluating potentially important transport and exposure pathways. Justification of this assumption is essential to validate the health risk evaluation.

Response:      Section 3.1.1 includes several references to support the assumption that most of the plutonium present in the reservoirs is plutonium hydroxide.

EPA-23      **Page 22, Section 3.2, Source Area Characterization:** The statement that sediment load is the main water transport mechanism for plutonium should be justified with a reference and rationale.

Response:      This statement, which was a conclusion based upon supporting information developed in the paragraph preceding it, has been removed.

EPA-24      **Page 25, Section 3.3, Release Mechanisms and Exposure Pathways:** Colloidal transport of plutonium in groundwater is briefly mentioned; however, no discussion of the potential for colloidal transport of plutonium by site surface and groundwaters is provided. Additionally, the recommendations and conclusions do not address this possibility by suggesting further study of surface and groundwaters. Some further discussion of this phenomenon is required, if only to dismiss it as a reasonable possibility based on site conditions, data, or other rationale. Colloidal transport of plutonium and americium far beyond distances previously expected has been shown to occur (Penrose, et. al. 1990). It is important to explain how colloidal transport is related to the contamination of solid waste management units (SMWU) 200 through 202; particularly if the statement made previously in the report is true, that is, that prior to RFP operations no transuranics were present in regional waters but are now detected throughout the region (page 12; DOE, 1990a). The evaluation should include analysis of all potential transport pathways.

Response:      The possibility of colloidal plutonium transport in ground water will be addressed during future RFI/RI activities at Sites 200-202. Section 3.2.3 clarifies this point and contains a more thorough discussion of the Penrose et al. study and its possible implications for plutonium migration at Sites 200-202.

EPA-25      **Page 26, Section 4.0:** This section should restate that a quantitative risk assessment will be performed in accordance with the EPA guidance (EPA, 1989) as part of the RI. This is important because the assessment conducted is inadequate with respect to EPA guidance. It would also assure that this document serves only as a preliminary assessment for directing further studies.

Response:      Stated in text.

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EPA-26      **Page 26, Section 4.0:** A brief data evaluation section should be added at the beginning of this section. This section should also include a tabular presentation that demonstrates the historical data's inadequacy for a quantitative risk assessment. For example, the table should list the various studies and show the differing or unknown analytical methods, the differing or questionable detection limits, the differing analytical laboratories, and the quality assurance procedures. Section 4.4 can provide the basis for this section. Placing a data evaluation section at the beginning of the risk evaluation section would provide justification for the assertion that the historical data are inadequate for a quantitative risk assessment and validate the qualitative approach used. A systematic tabulation of the data's inadequacies will provide the basis for the justification.

Response:      The data useability section is included in Appendix A, and the issues stated on this comment have been reviewed in this section.

EPA-27      **Page 26, Section 4.0:** Section 4.0 of the report should be reorganized to reflect the four discrete steps in risk assessment: hazard identification, exposure assessment, toxicity assessment, and risk characterization. The way section 4.0 is currently organized appears to be illogical.

Response:      The EPA RAG combines the toxicity assessment and hazard identification. The exposure assessment is broken down into source term, exposure pathways, and exposure routes. The risk characterization follows.

EPA-28      **Page 26, third paragraph:** The third line in this paragraph states, "Media specific analyses of other radionuclides present at the RFP, such as americium 241, have not been performed for these sites." This sentence contradicts the information presented in Section 3. The 1974 Battelle study of both Great Western Reservoir and Standley Lake indicated the presence of americium and cesium 137. This paragraph needs to be corrected to acknowledge those results.

Response:      The text has been corrected to reflect this comment.

EPA-29      **Page 27, Section 4.1, Conceptual Approach:** The last two sentences in the first paragraph of this section should be deleted. Although there are controls on the discharge from the A, B, and C series ponds, the deposition to sites 200-202 from air emissions has not been demonstrably eliminated. Also, these statement are extraneous to the analysis.

Response:      These sentences have been deleted.

EPA-30      **Page 27, first paragraph:** EPA does not agree with the internal hazard ratio for plutonium and americium, at least based on ingestion. Depending on which  $f_1$  is used, the ratio is more on the order of 10:1 or 100:1. Moreover, a 40% contribution to overall risk as indicated in this paragraph is generally considered significant in CERCLA assessments.

Response:      The hazard ratio for plutonium and americium has been deleted.

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EPA-31      **Page 29, Section 4.2, Potential ARARs:** The applicable or relevant and appropriate requirements (ARARs) mentioned in this section should be organized in a table which may be referenced as needed.

Response:      The ARAR section has been deleted.

EPA-32      **Page 29, Section 4.2, Potential ARARs:** The standards for plutonium activity and total alpha activity are provided. However, the total alpha activity (which would include radium-226) that has been detected is not given. The historical data should be presented as discussed in previous comments. Based on the information in the reports, the reader should be able to independently evaluate the contribution of plutonium to the total alpha activity in the reservoirs. The information in the report should also allow the reader to reach the same ultimate conclusions as those provided.

Response:      The ARAR section has been deleted.

EPA-33      **Page 30:** An exposure assessment needs to be completed before a toxicity assessment. A discussion of the exposed populations and the types of land use scenarios that are considered in this risk assessment (whether qualitatively or quantitatively) should be included. Only after such as assessment can the appropriate exposure pathways be identified.

Response:      The RAG is a guidance document not a regulation. The toxicity assessment has been placed before the exposure assessment because it is presented as a description of the hazard. The exposure assessment section has been expanded to address exposed populations. Both current and future land use scenarios have been included.

EPA-34      **Page so, Section 4.3, Toxicity Assessment:** The toxicity assessment is inadequate. There is no mention of the basic indicators of toxicity such as the weight of evidence, the cancer potency slope factors, reference doses, or discussions on what studies these factors are based on. This information is available in the Health Effects Assessment Summary Tables published quarterly by EPA and should be included in the toxicity assessment. Also, Section 7.7 on page 7-20 of the Risk Assessment Guidance for Superfund, Volume I, contains explicit guidance on summarization and presentation of toxicity information in a risk assessment. The toxicity assessment should include information on americium as well as plutonium since other sections of the report indicate that americium may contribute 40% of the total site risk.

Response:      The toxicity assessment has been expanded.

EPA-35      **Page 30, Section 4.2:** The water and air monitoring data mentioned briefly in this section should be summarized in a table (average plus or minus one standard deviation, maximum, and minimum for some representative time period) and moved to the section on historical data. There should also be a discussion of how well the data represent a reasonable estimate of air emissions from the reservoirs. These data are mentioned but not used in the evaluation, consequently, the reason the data are not used and the way they compare quantitatively with the standards should be discussed.

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Response: The air data have been added.

EPA-36 **Page 30, Section 4.2:** The assumption that the plutonium present in Class Y and that it is unlikely to exist in any form other than plutonium dioxide in "a reducing environment" is never justified. Also, the same assumption is used for the plutonium in the soils of SWMU 199 which is not necessarily a reducing environment, particularly at the surface. Either the assumption should be justified in both analyses or characterization of the present form of plutonium should be added as a data need.

Response: Characterization of plutonium during the RFI/RI has been added as a data need.

EPA-37 **Page 31, last paragraph:** The statement that "the low levels of internal exposure that workers and the public could potential receive from sites 200-202...can cause genetic and somatic...effects..." is supported by a reference that does not appear in the bibliography. Also, the "low levels" referred to are undefined because no does have been calculated. This discussion should be rewritten with evidence and references included. Precise language and adequate references are necessary for any discussion regarding health effects resulting from low level exposure to toxic or radioactive compounds. These are essential because these health effects are often very difficult to prove.

Response: These statements and the reference have been deleted.

EPA-38 **Page 31, Section 4.2:** The internal radiation hazard from ingestion of plutonium and americium should be discussed.

Response: Internal exposure is included in the toxicity assessment.

EPA-39 **Page 32, Section 4.5, Exposure Pathways:** The discussion on release mechanisms, transport media, and receiving media is confusing. For example, surface runoff and biotic uptake are described as transport media when in fact these are release mechanisms and recreational use is described as a release mechanism when in fact it is a land use which will define activities leading to potential exposure. Refer to Chapter 6 of the Risk Assessment Guidance for Superfund, Volume I, for guidance on the correct use of these terms. The final report must reflect a consideration of the contamination source, the release mechanisms, transport media, and receiving media.

Response: These terms are used consistently within the document and, therefore, should not be changed. Chapter 6 of the RAGs uses different terminology.

EPA-40 **Page 32, Section 4.5:** Exposure pathways are discussed without identification of potential receptors. Section 4.9 is placed after the risk characterization section. Section 4.9 should be moved to precede the discussion of pathways. It should also be slightly expanded to include a brief description of nearby farms, towns, parks, and wilderness areas, the types of population which may be receptors, and the types of activities these receptors may be engaged in. Also, an evaluation of potential future land use should be included. Different

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receptors and potential pathways may result from changes in land use. Potential receptors should be identified and described before the exposure pathways to those receptors are discussed. This should be done prior to the evaluation of the applicability of pathways.

Response: It is not within the scope of a qualitative risk assessment to perform an exhaustive examination of receptor locations. Section 2.0 has been expanded to include future land use descriptions.

EPA-41 Page 33, Section 4.5.2, Identification of Transport Media: The statement that the only primary transport media for plutonium is the contaminated sediments is not accurate. The sediments in sites 200-202 are the current source of contamination, and surface water, biota, and air are transport media into which contamination can potentially be released. The receiving media which must be considered include surface water, biota, soil, air, and groundwater. EPA recommends substantial revisions to Figure 3-1 to reflect an accurate description of the potential releases of the sediment contamination.

Response: The wording has been changed to reflect that fugitive dust is the primary release mechanism from sediment.

EPA-42 Page 35, Section 4.5.2.2, Plutonium Uptake in the Food Chain: This section of the report presents information on the relevant parameters to be considered in evaluating the potential for uptake in the food chain but fails to make any conclusion about the exposure pathways which will be considered in the risk assessment. The report would be greatly improved by drawing some conclusion about the significance of this pathway and how it is considered in the risk assessment. The use or potential use of the reservoirs for sport fishing requires a consideration of the benthos to fish to human exposure pathway. This pathway cannot be discounted based on the information given in this section of the report.

Response: The food chain pathway has been addressed in Appendix C.

EPA-43 Page 35, third paragraph: The statement, "The effect of this conservative assumption is that the characterization of risk resulting from this assumption will be overstated..." is more appropriate in a discussion of uncertainty.

Response: Statement deleted.

EPA-44 Page 36, Section 4.5.2.2.: The statements made in the first paragraph regarding the low solubility and low mobility of plutonium in the physical and biological environments should be referenced.

Response: Statement deleted.

EPA-45 Page 36, Section 4.5.2.2: The first two sentences in the second full paragraph, which are a generic description of aquatic nutrient cycling, appear unrelated to the last statement regarding the  $K_{ow}$  of plutonium and uptake of plutonium by terrestrial plants. The purpose

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of this discussion should be clarified or eliminated. A reference should be provided and a statement regarding the low  $K_{ow}$  of plutonium should be moved to the paragraph where this parameter and its relationship to food chain transfer are discussed.

Response: Statement deleted.

EPA-46 **Page 36, second paragraph:** Is  $K_{ow}$  a good indication of potential uptake for inorganic compounds, especially plutonium? Cite references which support this. Otherwise, the text may need to be revised.

Response: Statement deleted.

EPA-47 **Page 36, third paragraph:** The value for  $K_{ow}$  is described as "extremely low" and the root uptake of plutonium is described as "negligible" without a value for these parameters given to support this conclusion. The final report should list the parameter values from the cited reference in order to support these statement.

Response: Statement deleted.

EPA-48 **Page 37, Section 4.5.2.2:** The paragraphs concerning foliar deposition of radionuclides are not linked to site conditions such as use of reservoir water for food crop irrigation. There is no discussion of the relationship between the factors presented and the conditions at SWMUs 200 through 202. Consequently, it is not clear what the discussion of foliar deposition is meant to contribute to the analysis.

Response: Statement deleted.

EPA-49 **Page 37, Section 4.5.2.3:** Some migration of plutonium from SWMU 199 to the reservoirs under consideration may be occurring as a result of erosion processes, according to Section 3.4 of the report on SWMU 199 (DOE, 199b). Include a discussion of this migration in the Historical Information and Preliminary Health Risk Assessment report.

Response: This information has been added throughout the report.

EPA-50 **Page 37, Section 4.5.2.3:** Provide a reference and present values for the "...very low to undetectable concentrations of plutonium..." in Great Western Reservoir and Standley Lake. Also provide a reference and values for the statement that public water supply concentrations have always been below EPA standards.

Response: Statement deleted.

EPA-51 **Page 37, Section 4.5.2.3, Surface Water:** The sentence beginning, "This scenario has a low probability of occurrence..." can be supported by adding information about the sediment

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depth interval where plutonium was detected and the concentrations of plutonium which were detected. With this information, the reader can judge the validity of the conclusion.

Response: Statement deleted.

EPA-52 Pages 38 and 39, Sections 4.5.2.4, and 4.5.3.1: According to the SWMU 199 report, plutonium has been detected in one groundwater well (page 38; DOE, 1990b). Therefore the cause of this contamination must be evaluated to determine the potential for plutonium migration to groundwater from sites 199 through 202. The statement that "in no case has the plutonium impacted groundwater" (page 39; DOE, 1990a) must also be eliminated.

Response: Statement deleted.

EPA-53 Page 38, Section 4.5.3., Potential Exposure Pathways at Sites 200-202: The exposure scenario that will be considered in the risk assessment is mentioned in this section but is not defined. The scenario must be defined completely, including identification of the exposed populations, land use, and duration of exposures. Without this definition, the subsequent discussion of pathways is confusing.

Response: Exposure scenario developed in Appendix C.

EPA-54 Page 40, Section 4.5.3.1: No sampling data or reference is provided to support item 2 concerning the lack of bioaccumulation of plutonium at the sites. Correct this deficiency by presenting data summaries in the historical data section and by citing the appropriate references.

Response: References supporting this statement have been added throughout the document.

EPA-55 Page 40, Item #4: The conclusion that plutonium is not readily available for remixing in the reservoir water is not supported by the information in the report. The preliminary risk assessment must give full consideration to the potential risks associated with contaminated sediment re-suspension in the reservoir water. The draft report appears to be pre-decisional in not considering certain exposure pathways. The basis for ignoring certain pathways is not clear and is not supported by the information in the report.

Response: Sediment resuspension is included in generic risk assessment in Appendix C and also in this section.

EPA-56 Page 40, Section 4.5.3.2, Soil: This section is apparently intended to address the potential exposure pathways associated with soil contamination. As written, this section is inconclusive. The discussion on the distribution coefficient for plutonium indicates that plutonium is immobilized in soil. Dermal contact, soil ingestion, and particulate inhalation remain legitimate pathways which need to be examined in a risk assessment.

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Response: Dermal contact, soil ingestion, and particulate inhalation will be characterized during the RFI stage.

EPA-57 **Page 41, Item #5:** EPA representatives have seen video tapes of high winds sweeping clouds of dust from exposed near-shore sediments at Standley Lake. Certainly, the "It is possible" terminology needs to be changed. Further, since tremendous quantities of dust have been observed after re-entrainment from sediments, the analysis predicting a crusty plate-like surface may need to be re-thought.

Response: The terminology reflects potential conditions and should not be changed.

EPA-58 **Page 43, Section 4.6.1:** The discussion of plutonium's biological half life is confusing. It is unclear what the values presented in parentheses represent. This discussion should be clarified.

Response: Biological half life has been rewritten to address this comment.

EPA-59 **Page 44, Section 4.6.2, Ingestion:** Provide a page number in the cited reference for the assumption that Class Y plutonium is the class of plutonium found at the sites. The rationale for this assumption is not clear as the draft document is currently written.

Response: References have been provided that support the assumption that Class Y plutonium is predominant at the site.

EPA-60 **Page 44, Section 4.6.2, Ingestion:** The EPA value for  $f_1$  is  $1 \times 10^{-4}$  for plutonium (EPA, 1990) not a  $1 \times 10^{-5}$ , which is used here. There have been some differences of opinion between EPA and ICRP on the value for this parameter. EPA is investigating these differences. The authors may wish to carry out their own investigation.

Response: The HEAST provides a slope factor based on an  $F_1$  value of  $1 \times 10^{-5}$ .

EPA-61 **Page 44, Section 4.6.2, Ingestion:** The reference used to support the statement that the chemical form of plutonium at the sites is insoluble is not site-specific. More justification or explanation of this assumption is required.

Response: No site specific data is available that supports the assumption. This will be validated or refuted during the RFI/RI. This statement has been added to the document (again).

EPA-62 **Page 44, Section 4.6.3, Dermal Contact:** It is not clear that it is "highly unlikely" that the concentrations of soluble plutonium at sites 200-202 are sufficiently high to lead to transfer into a biological system through an open wound. Provide information about how high concentrations would have to be in order of this transfer to occur. Also, refer to the existing data to support this claim.

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Response: It is not likely that individuals will swim, boat, or participate in other recreational activities with a gaping wound. As stated in this section, the dermal absorption coefficient of  $5 \times 10^{-5}$  is an indicator of the lack of dermal absorption.

EPA-63 **Page 46, Section 4.7.2, Physical Model:** The last statement on the page requires references and justification. When considering ingestion doses, the residence time of plutonium in the lung seems irrelevant, regardless of whether or not gut residence time is negligible compared to lung residence time.

Response: Statement deleted.

EPA-64 **Page 47, Section 4.7.3, Risk From All Modes of Exposure:** Because no dose equivalent has been calculated, it is inappropriate to state that the dose equivalent is negligible. Data should be tabulated and presented as discussed in previous comments so the data can be compared with the unit risks presented, along with the appropriate caveats concerning data quality. Major assumptions should be justified with references and a clear rationale. If this is done, a conclusion that the risk associated with the contaminated reservoirs is most likely low to negligible would be better supported.

Response: Statement deleted.

EPA-65 **Page 51, Section 4.8.1.3, Spillway Sediments:** In this section and a number of other places in the text, sediment data is compared to the soil activity screening level adopted by CDH. This comparison is not appropriate. CDH activity screening level applies to the top 1/8" of soil collected using a specific composite sampling technique. The available sediment data was collected using dredge and core sampling techniques and the concentrations were determined on a wet weight basis. For these reasons, the CDH screening level and the analytical results are not comparable and this is certainly not a basis for discounting the exposure pathway of inhalation of fugitive dust from resuspension of reservoir sediments.

Response: Statement clarified to reflect this.

EPA-66 **Page 53, Section 4.8.2.2, Reservoir Sediments:** Given available evidence of re-entrainment of sediment particles due to high winds, this pathway appears to be probable rather than "potential".

Response: It has not been conclusively determined that near-shore sediments in fact contain plutonium.

EPA-67 **Page 54, Section 4.8.3.2, Reservoir Sediments:** Sediment and water samples were taken from Mower Reservoir by EPA during the 1970 sampling effort. The results of the radionuclide analysis of these samples are available in the EPA report documenting this sampling activity (EPA, 1971).

Response: Text modified to include sampling data from these studies.

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EPA-68      **Page 55, Section 4.9, Populations at Risk of Exposure:** The fact that the assessment is qualitative does not preclude an adequate description of potential receptors.

Response:      Section 2.0 has been expanded to include a description of receptors.

EPA-69      **Page 56, Section 4.19, Uncertainties in the Risk Evaluation:** The statement that, "toxicological data errors are probably the largest source of uncertainty..." implies that the data are incorrect. The statement should be reworded. The author probably means that extrapolating the data to different species and doses is highly uncertain. The statement is misleading.

Response:      The statement has been reworded.

EPA-70      **Page 59, Section 5.0, Conclusions and Recommendations:** The sediment to benthos to fish to humans pathway could be credible particularly for Standley Lake. This pathway needs to be analyzed further. The basis for discounting it in this report is not clear.

Response:      The benthos-fish-human pathway has been added.

EPA-71      **Tables:** Table 4.1 will need to be re-worked as the conceptual model is changed to more accurately reflect the release and transport mechanisms, and receiving media. The information in Table 4.2 should be brought into the text more often in order to put the report in perspective. Table 4.2 can be used to help identify data needs (e.g., the particle size issue is given a high rating for its potential impact on risk and yet is included as just another parameter to be measured). Specific mention of Am, which may contribute moderately to uncertainty, is not made, but measurements of the organic content of sediments is mentioned and this is not even provided as a source of uncertainty in the table. The identification of data gaps is clearly one of the most important aspects of risk assessment when there are criteria problems with the environmental data. Also, the criteria used to make the assignments of relative uncertainty should be provided.

Response:      It is felt that the Tables are adequate as submitted.

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**REFERENCES**

Battelle, 1974, Battelle Northwest Laboratories, "Radionuclide Concentrations in Reservoirs, Streams, and Domestic Waters Near the Rocky Flats Installation", 1974.

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DOE, 1990b, U.S. Department of Energy, Final Draft: Remedy Report, Operable Unit 3 - SWMU 199. U.S. Department of Energy, Rocky Flats Plant, Environmental Restoration Program, Golden, Colorado, October 24, 1990.

EPA, 1973, U.S. Environmental Protection Agency, Radioactivity Levels in the Environs of the Rocky Flats Plutonium Plant, Colorado. U.S. EPA, Region VIII, Technical Investigations Branch, Surveillance and Analysis Division, Part I, December 15, 1973.

EPA, 1989, U.S. Environmental Protection Agency, Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual (Part A), Interim Final. U.S. Environmental Protection Agency/540/1-89/002, December 1989.

EPA, 1990a, U.S. Environmental Protection Agency, Health Effects Assessment Summary Tables Fourth Quarter FY-90. OERR 9200 6-303 (90-4), September 1990.

EPA, 1990b, U.S. Environmental Protection Agency, Guidance for Data Useability in Risk Assessment, Interim Final. U.S. Environmental Protection Agency/540/G-90/008, October 1990.

Penrose, W., W. Polzer, E. Essington, D. Nelson, and K. Orlandini, 1990, Mobility of Plutonium and Americium through a Shallow Aquifer in a Semiarid Region. Environmental Science Technology, Vol. 24, pp. 228-234, 1990.

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Note: The following are responses to CDH comments received by DOE on February 15, 1991 regarding the November 5, 1990 draft final of the Sites 200-202 Historical Information Summary and Preliminary Health Risk Assessment. These comments were grouped into General Comments and Specific Comments.

GENERAL COMMENTS

CDH-G1 Many of the comments on this document are identical or similar to the comments on the "Remedy Report - Operable Unit 3, SWMU 199," Final Draft, October, 1990 (hereafter call RR-OU3). To avoid restating these comments here as they apply to the Historical Information Summary, they are referenced.

Response: No response required.

CDH-G2 Once again, the Division is concerned that because this document only contains a qualitative health risk assessment, it does not fulfill the requirements of the IAG (general comment 1; RR-OU3). Please summarize more completely the data quality, data quantity, needed but missing data, and reasons why a quantitative health risk assessment can not be completed. This document is entitled, in part, "Preliminary Health Risk Assessment" and it is unclear why a quantitative risk assessment can not be attempted in this document with the text clearly stating the shortcomings of the calculations and that the results are very preliminary.

Response: The approach taken to addressing this concern in the final Historical Information Summary and Preliminary Health Risk Assessment, Operable Unit No. 3, Sites 200-202 (hereafter referred to as the "Historical Report") is similar to that taken in the final Past Remedy Report, Operable Unit No. 3 - IHSS 199 (hereafter referred to as the "Past Remedy Report"). Historical data for the reservoirs are summarized throughout the report (see Tables 2.1 and 2.2), and selected data sources are provided in Appendix D. A "generic" risk calculation for potential exposure pathways to plutonium contamination in reservoir sediments is presented in Appendix C. Discussion of the IAG requirements for the Historical Report are expanded in Section 1.2, including a more detailed rationale for the development of a qualitative risk assessment.

CDH-G3 Many of the following comments ask for data and/or maps of data that need to be included in the text or added as appendices. As with the comment to the RR-OU3 (general comment 3), this document is to be a summary of all historical information on the sites. The Division does not consider a two or three sentence paragraph of a major data collection and analysis to be a complete summary. For a reader to understand completely and confidently both the strengths and short-comings of any study, well chosen maps and tables of data would be a tremendous help and would still remain within the limited scope of this document. Just because this data has not been validated and, in fact, would probably not stand up to rigorous QA/QC protocol does not mean it is valueless and should be hidden.

Response: It was not the intent of the authors to deliberately hide or discredit any of the previously collected data for Sites 200-202. Much of this data was collected and summarized in reports by CDH and EPA, and is available from a number of public information repositories. As in the Past Remedy Report, it is clarified in the Historical Report that existing data for the reservoirs were collected for purposes of site characterization rather than risk assessment. As stated in the comment CDH-G2 response, Sites 200-202 data sources have been appended to the Historical Report. These data sources include maps and tables of data collected to date on the sites.

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CDH-G4 The distinction between soluble and insoluble plutonium needs to be made throughout this document (general comment 4; RR-OU3).

Response: Section 3.0 has been expanded to include a more complete discussion of the form of plutonium present in the reservoirs. Existing data are not of sufficient specificity to distinguish between types of plutonium, but numerous studies of plutonium in the environment are referenced to support the assumption that the plutonium present in the reservoir sediments is largely plutonium hydroxide.

CDH-G5 General comment 5 to the RR-OU3 mentions the on-going dose reconstruction and toxicological review being conducted by the Colorado Health Department and funded by DOE. Please refer to that comment and determine how that study will impact this report.

Response: The CDH dose reconstruction and toxicological review study for off-site areas around the RFP, being performed by Chem-Risk, Inc., is still in its infancy. At present, efforts are focused on limiting the list of potential RFP-derived contaminants to be considered under the study. It is acknowledged that the Chem-Risk study eventually will provide valuable information for the formulation of health risk assessments for off-site areas; however, the information generated to date by the study is not in a form which is applicable to the Historical Report. Future RCRA Facility Investigation/Remedial Investigation (RFI/RI) activities at Sites 200-202 will be closely coordinated with the Chem-Risk study in order to maintain consistency and avoid redundancy between the two efforts.

CDH-G6 General comments 6 and 7 to the RR-OU3 are also applicable to this document and need to be addressed.

Response: It is clarified in the Historical Report that plutonium is the only RFP-derived contaminant which has been extensively characterized in the reservoirs. Americium is also believed to exist in the reservoir sediments above background concentrations (see Appendix D, Document D-5). Other potential RFP-derived contaminants (beryllium, numerous radionuclides) have been measured in various environmental media in past studies and/or are monitored through routine water quality monitoring at the reservoirs and their tributary streams (Sections 2.1.3.2 and 2.2.2.2). Other potential contaminants of concern will be addressed and characterized as appropriate during scheduled RFI/RI activities at Sites 200-202.

Again, it was not the intent of the authors to cast the CDH, past investigators, or any other parties in a negative light. It is clarified in the Historical Report that existing data for the reservoirs were collected for purposes of site characterization rather than for risk assessment. The report attempts to place the existing data in proper historical perspective, such that their usefulness, value, and "quality" do not appear to be in question.

**SPECIFIC COMMENTS**

CDH-1 Executive Summary, page ES-2: The third paragraph on this page states that the releases to the reservoirs were the result, primarily, of routine RFP operations during the 1950's and 1960's.

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The text should note that significant releases occurred after this time frame. An example would be when the B series ponds were reconstructed. Also, releases from the 903 pad area were not a result of routine operations!

Response: The authors agree that RFP releases are known to have continued into the 1970s, particularly the referenced holding pond reconstruction activities. The text has been changed to reflect this. Releases from the 903 Pad during the late 1960s resulted from what was, at the time, a routine waste management practice at the RFP (i.e., storage of plutonium-bearing lathe coolant at the 903 Pad), rather than from an incidental or accidental occurrence.

CDH-2 Executive Summary, page ES-3: The first bullet on the top of page ES-3 could be expanded to include the fact that the HASL/EML chronological dating of sediment deposits in Standley Lake identified the period of greatest plutonium deposition as 1958-1968. This corresponds to the time when the 903 pad was in operation.

Response: The bullet list in the Executive Summary has been rewritten. The correspondence identified in this comment has been added to Section 2.2.2.1.

CDH-3 Executive Summary, page ES-3: Mower Reservoir was sampled and the sediment concentrations reported by EPA and CDH in their respective 1970 efforts.

Response: Information about the February and September 1970 sampling efforts at Mower Reservoir have been incorporated throughout the text.

CDH-4 Executive Summary, page ES-4: The value of 0.02 pCu(sic)/m<sup>3</sup> is a DOE order value which is consistent with the same values in NRC and CDH regulations.

Response: The last bullet on page ES-3 has been changed in response to this comment.

CDH-5 Section 1.2: Please see the comment regarding OU re-prioritization under the IAG in the comments to the RR-OU3.

Response: The first paragraph of Section 1.2 has been revised in response to this comment.

CDH-6 Section 2.0: Please describe how the flow from the main production facility is diverted around and/or prevented from reaching the reservoirs.

Response: This information was contained in the draft Historical Report. It is now provided in Sections 2.1.2.2 and 2.2.1.

CDH-7 Section 2.0: The third paragraph of this section states that sections 3 and 4 of this document are based on the conclusion that radionuclides (plutonium and americium) are the only contaminants of concern. This may be true, but most (if not all) of the sampling done to date has only

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sampled for these two constituents and there is no knowledge of what other contaminants may also be present in the reservoir sediments. Therefore, the assumptions made in this document may invalidate sections 3 and 4.

**Response:** Again, it is clarified in the Historical Report that plutonium is the only RFP-derived contaminant which has been extensively characterized in the reservoirs. Other potential RFP-derived contaminants (beryllium, numerous radionuclides) have been measured in various environmental media in past studies and/or are monitored through routine water quality monitoring at the reservoirs and their tributary streams (Sections 2.1.3.2 and 2.2.2.2). Other potential contaminants of concern will be addressed and characterized as appropriate during scheduled RFI/RI activities at Sites 200-202.

**CDH-8**     Section 2.0: While individual data points may not be validated, the abundance of data points over time is a form of validation in itself. The data can definitely be used to identify the magnitude and range of contaminant values related to these IHSS's. Any new data set will also probably be out-dated and un-useable years from now. Please remove statement like "Existing data are of unknown quality" and "the specificity and quality of these data is insufficient..." and replace them with statement that recognize that the data was accumulated under proper QA/QC procedures at the time and was of high quality. Then explain that these procedures have been updated and changed since this data was collected and that, while still useful for certain analyses, new data must replace the old for rigorous quantitative health risk assessment (please see general comment 7 to the RR-OU3).

**Response:** It is clarified that existing data for the reservoirs were collected for purposes of site characterization rather than for risk assessment. The Historical Report attempts to place the existing data in proper historical perspective, such that their usefulness, value, and "quality" do not appear to be in question.

**CDH-9**     Section 2.1.1: Please provide a map showing the location of the two boreholes that the U.S. Army Corps of Engineers used in the 1989 evaluation of a surface water interceptor system.

**Response:** The locations of these boreholes are not provided in the Army Corps of Engineers document. This point is clarified in the first paragraph of Section 2.1.2.1.

**CDH-10**    Section 2.2.2: Please provide a detailed map of the Great Western Reservoir area that shows the complete surface water system: Lower Church Ditch, the Broomfield diversion ditch, the Walnut Creek drainage with the "A" and "B" series ponds and their respective purposes, other ditches like the McKay Ditch, etc. The Broomfield Diversion ditch was not constructed west of GW reservoir, as is indicated in the text, but constructed to begin on the west side of the reservoir and continue around the south side of the reservoir to empty into the drainage below the reservoir outlet.

**Response:** Figure 2.1, based upon a 1980 USGS topographic map of the area, shows all of the features mentioned in this comment except for the Broomfield Diversion Ditch. The location of this feature is described in detail in Section 2.1.2.2.

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CDH-11 Section 2.1.2.1: A map should be included that shows the location and data values for the bottom sediment sampling done by the EPA in 1970. How deep was the contaminated sediment layer at that point?

Response: This information is contained in Appendix D, Documents D-1 and D-2.

CDH-12 Section 2.1.2.1: A map should be included that shows the location and data values for the sampling that EPA did in 1973. The time frame of the pond reconstruction should be specifically referenced as well (1972-1973).

Response: This information is contained in Appendix D, Document D-3. The pond reconstruction timeframe is mentioned in Section 2.1.3.1.

CDH-13 Section 2.1.2.1: What is the location of the cores used by Battelle in 1974 that age-dated the lake sediment. Where were the lake and stream sediment samples taken that established higher-than-background levels for radionuclides?

Response: This information is contained in Appendix D, Document D-5.

CDH-14 Section 2.1.2.1: Please provide a map of the location and data values for the sampling that Dow Chemical did in 1975.

Response: The 1975 Dow Chemical report summarized existing data from the two EPA studies (1970 and 1973) and the 1974 Battelle Pacific Northwest Laboratory study. No sampling of Sites 200-202 was conducted to support this document. This is clarified in Section 2.1.3.1.

CDH-15 Section 2.1.2.1: Can it be concluded from the Rockwell International study of the spillway sediments that no plutonium ever migrated or was released over the spillway? Does this mean that no plutonium contamination that was water borne ever went downstream of the GW reservoir dam?

Values for the samples split with Broomfield and CDH did exceed the state soil standard. Please review this data. Broomfield had a concern about the disposal of this dredged sediment because it exceeded the standard.

Response: The Great Western Reservoir spillway is on the reservoir (west) side of the dam, not on the downstream side. The very low concentrations of plutonium and americium in the spillway sediments compared to reservoir bottom sediments was attributed to differing sediment sources and sedimentation mechanisms. These low concentrations may suggest, but certainly do not conclusively indicate, that plutonium has not migrated downstream from the reservoir.

Plutonium concentrations reported in the two Rockwell International spillway sediment reports (Appendix D, Documents D-7 and D-8) were well below the 0.9 pCi/g CDH state soil standard. These samples were analyzed by the Rocky Flats Plant laboratory. These reports do not mention splitting these samples with CDH or the City of Broomfield.

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CDH-16 Section 2.1.2.1: Please provide a map of the location and data values for the sampling done by Rockwell International in 1983. How deep and thick was the plutonium contaminated layer at the time of this study?

Response: This information is contained in Appendix D, Document D-9.

CDH-17 Section 2.1.2.1: From the studies summarized, is it possible to verify the sedimentation rates given for the 1983 Rockwell International study? From the text, it is unclear whether this value was based on 60 core samples or if 60 samples were taken, some of which (no number given) were sediment cores.

Response: The description of the 1983 Rockwell International study in Section 2.1.3.1 has been rewritten in response to this comment. The estimated sedimentation rates were based on the four cores collected during the study, and were comparable to sedimentation rates estimated from Great Western Reservoir sediment cores during the 1974 Battelle study (Appendix D, Document D-5).

CDH-18 Section 2.1.2.1: This section would be aided by the same introductory maps that the Division asked to be included in the RR-OU3. The first of these would be similar to Figure 2-1, but would include adjacent land ownership and zoning to the reservoirs. The second should show the wind blown plutonium soil contamination plume that emanated from the 903 Pad and continues off-site to the east in and around the three reservoirs. Comparisons could then be made of the relative contamination levels in the surrounding soils and the lake sediments and an estimation could be made as to how much of the plutonium in the lake sediments came from surface waters exiting the plant and how much came from wind blown dust settling into the lake.

Response: A section on demographics in the general vicinity of Sites 200-202 has been added (Section 2.5). In the absence of more site-specific demographic data for the reservoirs, the generic risk assessment (Appendix C) uses "worst-case" assumptions regarding potentially exposed populations. Site-specific demographics will be characterized during scheduled RFI/RI activities at Sites 200-202.

As discussed in the Remedy Report, the extent of off-site soil contamination derived from the 903 Pad has not been conclusively defined through past studies. The source of this contamination was effectively eliminated in 1969 when the 903 Pad was capped with asphalt. Since that time, the plutonium in soils has been subjected to very different weathering processes and environmental conditions than the plutonium in the reservoir sediments. Also, airborne plutonium which settled onto the reservoirs was subjected to quite different depositional mechanics than that which settled onto land. Evaluation of the relative impacts of airborne and waterborne pathways on the reservoirs based on comparison of measured concentrations in soil and sediments is therefore questionable. Past studies of Great Western Reservoir have concluded, based on empirical evidence, that both pathways contributed to plutonium concentrations in the reservoir, but have not attempted to estimate the relative contributions of each pathway.

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CDH-19 Section 2.1.2.2: The Rocky Flats Program Unit does not maintain all of the data from CDH, the City of Broomfield, and RFP.

Response: This statement, based on misunderstanding of a discussion with the CDH Rocky Flats Program Unit, has been removed from Section 2.1.3.2.

CDH-20 Section 2.1.2.2: There is a discussion in the text on the formulation and verification of the baseline value for plutonium levels in soil and sediment samples. However, there is no discussion on how the baseline value was formulated for water samples. Please include an explanation of this baseline value.

Response: The EPA estimated dissolved plutonium baseline concentration in water (0.03 pCi/l) was based on water sample results from three impoundments (Autrey Reservoir, Calkins Lake, and Standley Lake). It was assumed that plutonium releases from the RFP had not resulted in measurable increases in dissolved plutonium concentrations in these impoundments, and that the background concentrations were attributable to atmospheric fallout (Appendix D, Document D-1).

CDH-21 Section 2.1.2.2: Regarding the tritium release to GW reservoir, it would be helpful to reference the fact that it took four years for the reservoir to return to background levels based on CDH and RFP surveillance.

Response: This fact has been referenced in Section 2.1.3.2.

CDH-22 Section 2.1.2.2: The text states that the latest surface water quality data is presented in the 1988 RFP annual environmental monitoring report and says that all of this latest data is below the EPA and CDH drinking water standards. What are these standards and how far below them were the sample data values?

Response: Sections 2.1.3.2 and 2.2.2.2 now identify standards with which surface water exiting the RFP must comply. Detailed descriptions of these standards, and information about RFP compliance with the standards, are contained in monthly and annual RFP environmental monitoring reports, which are referenced in the text.

CDH-23 Section 2.1.2.2: Several ongoing sampling programs are mentioned in the last paragraphs of this section but no discussion in the text presents what these programs are finding. Please summarize the results of these sampling programs to date.

Response: The details of RFP surface water monitoring programs, some of which have been ongoing since 1951, are summarized in monthly and annual RFP environmental monitoring reports, which are referenced in the text.

CDH-24 Section 2.2.1: As with the comment above concerning Great Western reservoir, there needs to be a map included in this portion of the text that shows a detailed diagram of the surface water system that includes Standley Lake reservoir. This map should show the water supply ditch

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coming from Clear Creek, the entire Woman Creek drainage with the "C" series ponds and their respective uses, the interceptor ditch south of the plant site, the above-ground pipeline to the NPDES treatment facility, the Mower reservoir ditch, etc.

Response: Figure 2.1, based upon a 1980 USGS topographic map of the area, shows all of the features mentioned in this comment except for the South Interceptor Ditch and the aboveground pipeline carrying treated Pond C-2 discharge. The location of the South Interceptor Ditch is described in detail in Section 2.1.2.2. The aboveground pipeline presently is not in use, and its precise location is not directly relevant to the discussion of Site 201.

CDH-25 Section 2.2.1: The final sentence on page 13 says that Standley Lake is fed by Woman Creek. Earlier in the text, on page 4, the text states that surface water control measures now prevent flow from the main production facility from reaching the reservoirs. Please clarify this apparent contradiction.

Response: This is not a contradiction. Surface water controls described in Section 2.2.1 prevent flow from the RFP main production facility (within the 385-acre controlled area as shown in Figure 1-1) from reaching Standley Lake. Woman Creek flow originating upgradient of the main production facility is diverted around the facility and back into the Woman Creek drainage downstream of the facility, where it continues off of the RFP and into Standley Lake.

CDH-26 Section 2.2.1: In the third paragraph of this section, the text discusses the above-ground pipeline that transfers water from the Woman Creek drainage to the Broomfield Diversion Ditch. This pipeline is not presently transporting any water and has not for some months. In addition, the agreement between DOE and the City of Broomfield has now expired. What are the current plans for this pipeline and will the DOE-Broomfield agreement be extended?

Response: Section 2.2.1 has been updated to reflect this new information, which developed since the completion of the draft Historical Report.

CDH-27 Section 2.2.2.1: In a similar fashion to the comments on Great Western reservoir above, please include maps of sample locations and data values for the various studies done on water quality and sediment sampling for Standley Lake reservoir. This should include, but is not limited to, the 1970 and 1973 EPA studies, the 1974 Battelle study, and the 1984 Rockwell International study.

Please emphasize the fact that the inferences made from the single core taken during the Battelle study have severe limitations. Reservoir wide conclusions on a single data point could be very inaccurate.

Response: The requested information is contained in the Appendix D documents referenced throughout Section 2.2.2. The discussion of the Battelle study emphasizes that the extrapolation of total plutonium and americium inventories in Standley Lake were based on a single core.

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CDH-28 Section 2.2.2.2: Throughout this report, values need to be referenced in any discussion of baseline values or EPA and CDH water, soil, sediment, or air standards.

Response: Baseline concentration values are now identified throughout Section 2.0.

CDH-29 Section 2.2.2.2: What have the ongoing sampling programs found in the way of plutonium contamination?

Response: The details of RFP surface water monitoring programs, some of which have been ongoing since 1951, are summarized in monthly and annual RFP environmental monitoring reports, which are referenced in the text.

CDH-30 Section 2.3: In the first paragraph of this section, the text states that Mower Reservoir is located on land which was the subject of a lawsuit against RFP. According to the maps provided in the RR-OU3, it does not appear that Mower Reservoir was included in this land. Please clarify this apparent contradiction.

Response: Mower Reservoir is within the lawsuit subject acreage (see documents in Appendix D of the Remedy Report). The maps provided as figures in Section 2.0 of the Remedy Report show the portions of the lawsuit acreage targeted for remediation under the Settlement Agreement, not the lawsuit acreage in its entirety.

CDH-31 Section 2.3: As stated earlier, Mower Reservoir has been sampled by both EPA and CDH (1970).

Response: Information about the February and September 1970 sampling efforts at Mower Reservoir have been incorporated throughout the text. The section on Mower Reservoir (Section 2.3) has been rewritten in response to this comment.

CDH-32 Section 3.0: Please include a reference to the information in the USGS reports on plutonium in ground water by Jess Cleveland (a former RFP/Dow employee).

Response: Section 3.0 has been rewritten, and includes numerous references to studies of plutonium in the environment, including plutonium in ground water.

CDH-33 Section 3.2: How deep within the lake sediments is the plutonium contaminated layer? How does this depth affect the availability of the plutonium to the release mechanisms?

Response: The depth to which the contaminated sediment horizon has been buried varies within the reservoirs due to varying sedimentation rates. The most recent studies to characterize the reservoir sediments were conducted in 1983 for Great Western Reservoir and 1984 for Standley Lake. Four cores were collected from each reservoir during these studies. Representative depths of burial for the contaminated horizons, based on the cores collected from each reservoir, are shown in Documents D-9 (Great Western Reservoir) and D-10 (Standley Lake) of Appendix D.

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The contaminated horizon in each reservoir has been buried by additional sedimentation since these studies were performed. Section 3.0 is a conceptual model in which all conceivable release mechanisms are identified; the actual potential for release, which is controlled in part by the depth of burial, is addressed in Section 4.0.

CDH-34 Section 3.3: The mobilization of sediments from recreational uses can be significant, particularly in the shallower reaches of the reservoirs. The City of Broomfield stopped recreational use of GW Reservoir because of the increased treatment necessary.

Response: It is acknowledged that recreational use can disturb sediments in shallower areas of reservoirs. However, past studies have indicated that most of the plutonium in reservoir sediments occurs in the deeper areas of the reservoirs, not near the shoreline. Broomfield disallowed recreational use of Great Western Reservoir due to concerns over recreational pollution of the water supply (e.g., motorboats, trash, sanitary facilities), and not over concerns about resuspension of sediments or potential exposure of recreational users to sediments.

CDH-35 Section 3.3: On page 25, reference again needs to be made to the USGS reports on plutonium in the ground water referred to in the comment on section 3.0 above.

Response: Section 3.2.3 has been rewritten to include several references to studies of plutonium in ground water.

CDH-36 Section 4.0: Referring to the third paragraph of this section, dosimetric considerations for plutonium at RFP that are used by both RFP and CDH (see FEIS 1980) use AM-241 at 20% of the PU-239+240 radiometric concentrations. Because of the long-term residency of these sediments and soils, use of the maximum ingrowth values is required in any assessment.

The final sentence of this section is correct if both Pu and Am have the same GI absorption (1E-3). Am-241 needs to be included because of the long-term residency using the maximum transient equilibrium values. Additionally, a statement needs to be included regarding the potential of past releases of non-radioactive hazardous materials.

Response: Text deleted.

CDH-37 Section 4.2: Please refer to the two comments regarding proposed ARAR's in the comments to the RR-OU3 and address them here as they relate to this document.

Response: ARAR section deleted.

CDH-38 Section 4.2: Please see the comment regarding the Memorandum of Understanding and the Mutual Cooperation Agreement in the comments on the RR-OU3 and address it relative to this document.

Response: ARAR section deleted.

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CDH-39 Section 4.2: Mower Reservoir was sampled. Please see previous comments.

Response: ARAR section deleted.

CDH-40 Section 4.2: The CDH values of 0.03 and 0.05 pCu(sic)/l have been exceeded in the past. As an example, see the data for the time period that includes the B series ponds reconstruction.

Response: ARAR section deleted.

CDH-41 Section 4.2: In the last paragraph of this section, please note that the 0.02 pCu/m<sup>3</sup> is based on the ICRP recommendations and has been incorporated into the regulations of DOE, NRC, and CDH.

Response: ARAR section deleted.

CDH-42 Section 4.2: Also in the last paragraph, the Division is unaware of any measurement data that unequivocally indicates that the airborne plutonium at RFP is Class Y. If this is an assumption, so indicate.

Response: ARAR section deleted.

CDH-43 Section 4.4: Once again, please re-word the text to indicate that past sampling met past QA/QC requirements, even though it does not meet today's protocols.

Response: Text reworded.

CDH-44 Section 4.5.2.1: While there may be three categories in which soil particles can be dislodged from the ground surface, there are more than three specific mechanisms. Please clarify the text on this item.

Response: The text has been modified.

CDH-45 Section 4.5.2.2: Please remove iodine from the list of elements with no known metabolic function. Iodine plays an important role in thyroid activity, which, in turn, plays a large role in body metabolism.

Response: Text reworded.

CDH-46 Section 4.5.2.2: In the fourth paragraph of this section, reference is made to "first crops." What about second, third, etc. crops?

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Response: Paragraph deleted.

CDH-47 Section 4.5.2.3: Referring to the first paragraph of this section, plutonium resides predominantly in a discrete layer, but is present in all layers of these sediments.

Response: Statement reworded.

CDH-48 Section 4.5.3: Since no values accompany the rankings (high-negligible), this section is meaningless.

Response: The author disagrees. This is a qualitative assessment and as such, there is an inherent limitation.

CDH-49 Section 4.5.3.1: Item 2 in the text must be qualified to indicate that only bio-accumulation in fish has been specifically referenced in this document. Item 3 should be re-worded to say "Plutonium, in amounts of significance in the sediments..."

Response: Text changed.

CDH-50 Section 4.5.4: Item 4 should be re-worded to say "Apparently, the plutonium is strongly bound..."

Response: Text changed.

CDH-51 Section 4.6.2: Contrary to the DOE 1988 quote, the absorption of Pu and Am in the GI track used by DOE is 1E-3. This is cited in the DOE orders and the MOU and MCA with the State. There is no specific data from the RFP environment that indicates otherwise.

Response: The HEAST only quotes an f, of 1X10<sup>-5</sup> and the CSF is based on that value.

CDH-52 Section 4.7.1: The narrative descriptors are useless without quantifiers. One definition of "negligible" may be orders of magnitude different from another.

Response: The inherent limitation of the qualitative risk assessment precludes the use of quantifiers.

CDH-53 Section 4.7.2: The assumption for risk that is used (and needs to be referenced in the text) is 1E-3 which is the f1 factor for GI absorption. There is no specific data to the contrary and it is the value of preference in DOE Orders.

Response: See Response No. 51.

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CDH-54 Section 4.7.2: Limiting the discussion to only Class Y plutonium is inappropriate because there is no specific data demonstrating the absence of Class W.

Response: The determination of Class Y and Class W plutonium will be achieved during the RFI/RI. Numerous references have been provided that indicate the likely form of plutonium in the environment is Class Y.

CDH-55 Section 4.8.1.4: There is a viable scenario of unknown significance. If sediments of greater than 2 dpm/g were dredged and stored in piles with no wind protection, some plutonium would be re-entrained.

Response: It is not expected that this is a reasonable scenario to be included in this qualitative risk assessment.

CDH-56 Section 5.0: In addition to the data types listed as needed for a quantitative health risk assessment, please add stratified water samples from within the reservoirs and biota sampling. These are addressed within EPA guidance documents for RFI workplan preparation.

Response: Statement added to text.

CDH-57 Section 5.0: There are localized areas in GW Reservoir where the state standard is exceeded. The average value would be below the standard.

Response: The state standard applies to Pu in soil, not sediment concentrations are stated here for comparison only.

CDH-58 Section 5.0: Mower Reservoir was sampled by EPA and CDH.

Response: Text changed.

CDH-59 Section 5.0: Ingestion is a viable pathway and was important for the construction of ponds B-5 and A-4, the Broomfield Diversion Ditch, and the sampling prior to discharge.

Response: Text changed.

CDH-60 Section 5.0: The Division is not aware of any specific studies relative to these reservoirs that would support the last bullet.

Response: The bullet list of conclusions in this section has been rewritten in response to this comment and numerous others.

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CDH-61 Section 6: There are 12 references included that are not given an "identifier." Are these references cited in the text? If not, they should either be removed, or relocated and their purpose specified.

Response: Section 6.0 is a bibliography, not a list of references. Only referenced entries are given a bold-type reference label, as noted at the beginning of the section.

CDH-62 Table 2.1: This table is a very good addition to this document. It could be expanded to discuss the various data set short-comings and QA/QC problems associated with each study. This would help explain why a quantitative health risk assessment is not possible at the present time. Please put a similar table in the RR-OU3. It would be very helpful there, as well.

There are some data sets missing from Table 2.1. For GW Reservoir, the Broomfield and CDH data are missing. From the Standley Lake section, CDH data is missing. The EPA and CDH data have not been cited for Mower Reservoir, and CDH monthly data summaries and special reports are not listed for general data sources. Please remember! CDH data is significant. The CDH lab certifies other labs within Colorado for all analyses, participates in various inter-laboratory comparisons, and has independent and valid data (contrary to DOE and DOE contractor opinion).

Response: Some data sets located and used in text.