Colorado Department
of Public Health
and Environment

November 12, 2002

Dear Member of the Community:

The Rocky Flats Cleanup Agreement (RFCA) Parties, the Department of Energy (DOE), the Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE) are releasing for a 60-day public review and comment period proposed modifications to RFCA Attachments and the addition of a new Attachment in accordance with Paragraph 117 of RFCA. Two key modifications include: a proposed reduction of the Radioactive Soil Action Levels (RSALs) for plutonium, americium and uranium, and the implementation of an integrated risk-based approach for determining accelerated actions in the subsurface. The 60-day public review and comment period ends on January 13, 2003.

Enclosed with this letter are the proposed modifications for public review and comment:

- RFCA Attachment 5, *Action Levels and Standards Framework for Surface Water, Ground Water and Soils*;
- RFCA Attachment 10, *RCRA Closure for Interim Status Units*; and
- New RFCA Attachment 14, *Original Process Waste Lines (OPWL) Subsurface Soil Approach.*

Also enclosed is a *Technical Basis Document* that summarizes the proposed modifications and the Parties' rationale for proposing them. The *Technical Basis Document* is intended to inform the public regarding the key aspects of the proposed modifications and to facilitate an effective public review process.

The proposed modifications and the *Technical Basis Document* have been prepared jointly by the RFCA Parties. However, the proposed modifications are subject to EPA and CDPHE approval after consideration of comments and incorporation by DOE of any changes deemed necessary for approval. The RFCA Parties will prepare a comment responsiveness summary that shows how comments were considered in the final RFCA modifications.

Proposed conforming modifications to the Environmental Restoration RFCA Standard Operating Protocol (ER RSOP) are expected to be available for a 30-day public review period beginning on or about December 12, 2002. The ER RSOP proposed modifications are also subject to EPA and CDPHE approval after consideration of comments and incorporation by DOE of any changes deemed necessary for approval.

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A Compact Disk containing the five Task Reports that constitute the *Results of the Interagency Review of Radionuclide Soil Action Levels*, September 30, 2002 is also enclosed. However, the Task 3 Report and Appendices entitled, *Calculation of Surface Radionuclide Soil Action Levels for Plutonium, Americium, and Uranium*, on this disk does not contain Appendix E – *RESRAD Run Results Printout,* due to its large size. This information, and other Administrative Record file documents, can be found online at the following website: www.rfets.gov (and click on the Navigation button).

Public comments should be submitted in writing, postmarked not later than January 13, 2003, to:

Rick DiSalvo
Department of Energy, Rocky Flats Field Office
10808 Highway 93, Unit A, Golden, Colorado 80403-8200

We welcome community input regarding the proposed modifications.

Sincerely,

Joseph A. Legare,
RFCA Coordinator
U.S. Department of Energy
Rocky Flats Field Office

Steve Gunderson
RFCA Coordinator
Colorado Department of
Public Health and Environment

Timothy Rehder
RFCA Coordinator
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cc w/o Enclosure:
E. Schmitt, RFFO
J. McGraw, EPA
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cc w/Enclosure:
Administrative Record

Colorado Department
of Public Health
and Environment

Modifications to the Rocky Flats Cleanup Agreement Available for Public Comment

The Department of Energy (DOE), Colorado Department of Public Health and Environment (CDPHE), and Environmental Protection Agency (EPA) are proposing modifications to the Rocky Flats Cleanup Agreement (RFCA) that will guide the remainder of the environmental cleanup. The modifications propose a revised cleanup approach for the soils at Rocky Flats.

The draft modifications will be subject to a 60-day public comment period from Nov. 12, 2002, to Jan. 13, 2003.

Copies of the document can be found at the Rocky Flats Public Reading Room, Front Range Community College, 3705 112th Ave., Westminster. The document will also be available on the Rocky Flats webpage: www.rfets.gov. For additional information, please contact Steve Gunderson, CDPHE at (303) 692-3367 or Patrick Etchart, DOE, at (303) 966-7547.

Send written comments:
Rick DiSalvo
DOE RFFO
10808 Hwy 93, Unit A
Golden, CO 80403-8200

PART I

TECHNICAL BASIS DOCUMENT

November 12, 2002

Technical Basis Document for the Proposed Modification to the Rocky Flats Cleanup Agreement Attachments to Implement Integrated Risk-Based Accelerated Action Framework

November 12, 2002

Acronym List

ALARA - As Low as Reasonably Achievable
CDPHE - Colorado Department of Public Health and Environment
CERCLA - Comprehensive Environmental Response Compensation and Liability Act
CHWA - Colorado Hazardous Waste Act
DOE - Department of Energy
EPA - Environmental Protection Agency
ER RSOP - Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation
HI - Hazard Index
IHSSs - Individual Hazardous Substance Sites
nCi/g – nano Curie per gram
OPWL – Original Process Waste Lines
OSWER - EPA's Office of Solid Waste and Emergency Response
OU - Operable Unit
PAC - Potential Area of Concern
pCi/g or pCi/L– pico Curie per gram or per liter
PPRG - Programmatic Preliminary Remediation Goals
PRG - Preliminary Remediation Goals
RCRA - Resource Conservation and Recovery Act
RFCA - Rocky Flats Cleanup Agreement
RfD – Reference Dose
RFETS - Rocky Flats Environmental Technology Site
RFI/RI-CMS/FS - RCRA Facility Investigation/Remedial Investigation-Corrective Measures Study/Feasibility Study
RSALOP - Radionuclide Soil Action Level Oversight Panel
RSALs - Radionuclide Soil Action Levels
Site - Rocky Flats Environmental Technology Site
SOR - Sum-of-Ratios
SWMUs - Solid Waste Management Units
UBC - Under Building Contamination

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Technical Basis Document for the Proposed Modification to the Rocky Flats Cleanup Agreement Attachments to Implement Integrated Risk-Based Accelerated Action Framework

1.0 Introduction and Purpose

This Technical Basis Document summarizes the changes being proposed to existing Rocky Flats Cleanup Agreement (RFCA) requirements for cleanup of the Rocky Flats Environmental Technology Site (RFETS or Site). It discusses and identifies supporting data and information sources, including public comments and recommendations, which were considered by the Department of Energy (DOE), the Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE), hereinafter, "the RFCA parties" in preparing the proposed modifications.

When contamination is found above an action level it triggers an evaluation and a RFCA accelerated action determination. The proposed RFCA modifications incorporate new proposed surface Radionuclide Soil Action Levels (RSALs) for plutonium, americium and uranium that are more conservative that the current RSALs. The proposed RSAL for plutonium 239/240 is 50 pCi/g.

The new proposed RSALs are in response to public concern over the RSALs selected by the RFCA Parties in 1996, new technical information and changes to regulations and EPA guidance. The RFCA Parties are also proposing new, more conservative soil action levels for other contaminants of concern.

These RSALs and the soil action level changes for other contaminants are predicated upon the adoption of the integrated risk-based approach in the proposed RFCA modifications for surface and subsurface contamination. The proposed changes reflect four underlying principles.

- Removal of greater amounts of surface soil contamination will be triggered, because it is easily accessible to a surface future user, may easily migrate and removal to reduce these risks is preferred.
- Removal of subsurface contamination, which is less accessible and less mobile than surface soil contamination, will be triggered based on the potential pathways of exposure that present a risk.
- More surface soil removal and consideration of subsurface pathways will better serve to protect surface water quality to meet surface water standards so that surface water is suitable for all uses.
- Recognition that institutional controls and long-term stewardship will be applied as appropriate to control residual risks because RFCA accelerated actions are not expected to result in removal of all contamination.

The new RSALs and action levels for other soil contaminants of concern are based on the midpoint of the acceptable lifetime excess cancer risk range promulgated pursuant to

CERCLA.[1] This midpoint of the risk range is expressed as 1 excess cancer in 100,000[2] reasonably maximally exposed persons or, in scientific notation, a risk of $1x10^{-5}$. The reasonably maximally exposed person is the wildlife refuge worker. The wildlife refuge worker is the reasonably anticipated future user based upon the anticipated future land use after cleanup, consistent with EPA policy and guidance.[3] In addition, non-cancer causing contaminants must not present a human toxicity Hazard Index (HI)[4] of more than 1 or present an unacceptable risk to ecological receptors. The proposed new RSALs are also protective for an open space and rural residential land use. The proposed new non-radionuclide soil action levels are also protective of an open space user.

Contamination extending into the subsurface will be evaluated and an accelerated action decision made using a Soil Risk Screen[5] to consider the pathways by which the contamination could present an unacceptable exposure risk (i.e., greater than $1x10^{-5}$) to an anticipated future user.

The proposed modifications reflect an integrated risk-based approach that will result in more risk reduction at the Site than would be achieved under the current RFCA and will contribute to the efficient performance of the final remedy. The RFCA Parties believe this can be implemented within the current projected closure project budget resources for RFETS. As under the current RFCA, if additional funds are required to complete actions necessary to adequately protect human health and the environment and to comply with legal obligations, the DOE is obliged to seek the funds needed to meet these obligations.

2.0 Summary of Proposed Modifications

The proposed modifications are contained in two existing RFCA Attachments and one new RFCA Attachment. These Attachments are:

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[1] See, 40CFR 300.430(e)(2)(i). Note that for plutonium 239/240, the RSAL represents a calculated risk of about $5x10^{-6}$.

[2] The risk of cancer is described in terms of the probability that an individual will develop cancer by age 70 because of exposure to cancer causing chemicals. For each chemical of concern, this value is calculated using the daily intake of the chemical from the Site (averaged over a lifetime) and the cancer slope factor for the chemical. The resulting value is an estimate of the number of cancer cases expected in excess of those caused by the daily intake of background or non-site related chemical contamination. A risk level of $1x10^{-5}$ indicates an excess cancer case in ten out of one million individuals exposed to cancer causing chemicals at the site, or a 0.001% individual risk of developing cancer from exposure.

[3] See, OSWER Directive 9355.7-04, *Land Use in the CERCLA Remedy Selection Process*, May 25, 1995.

[4] The potential for non-cancer effects is evaluated by comparing an exposure level over a specified time period (e.g., life-time) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-cancer effects from that chemical are unlikely. The Hazard Index (HI) is the sum of HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that toxic non-cancer effects from all contaminants are unlikely. An HI > 1 indicates that site-related exposures may present a risk to human health.

[5] See, OSWER Publication 9355.4-14FSA, *Soil Screening Guidance: Fact Sheet*, July 1996.

- RFCA Attachment 5, *Action Levels and Standards Framework for Surface Water, Ground Water and Soils*;
- RFCA Attachment 10, *RCRA Closure for Interim Status Units*; and
- New RFCA Attachment 14, *Original Process Waste Lines (OPWL) Subsurface Soil Approach.*

Section 3 of this Technical Basis Document provides the background for the proposed modifications. This background provides a perspective of the current RFCA requirements, the RFCA Parties' rationale for the changes being proposed and a description of the proposed modifications. Appendix A contains information related to public involvement activities that assisted the RFCA Parties in developing the proposed modifications. Appendix B provides information on the conceptual model developed to account for burrowing animals that may bring subsurface soil contamination to the surface.

Section 4 of this Technical Basis Document is a guide to the specific sections of RFCA Attachments 5 and 10 where proposed changes can be found. It also provides a brief description of new Attachment 14.

The administrative record file developed for the proposed modifications is discussed in Section 5 of this Technical Basis Document. Appendix C contains a list of documents that are cited in this Technical Basis Document, which were considered by the RFCA Parties in developing the proposed modifications.

3.0 Background

Various hazardous substances have been released to the environment at RFETS, which are required to be remediated by DOE through Comprehensive Environmental Response Compensation and Liability Act (CERCLA) response actions. Some released hazardous substances are also hazardous wastes or constituents that are subject to Resource Conservation and Recovery Act and Colorado Hazardous Waste Act (RCRA/CHWA) corrective action requirements. Certain areas where hazardous wastes were placed or managed must also be properly closed. The RFCA is a combined CERCLA section 120 interagency agreement and RCRA/CHWA compliance order that describes the regulatory process and the approach to complete required response actions, corrective actions and unit closures.

3.1 The Accelerated Action Framework Developed in 1996

The RFCA incorporates an accelerated action approach[6] to remove or otherwise control hazardous substance contamination at individual hazardous substance sites (IHSSs)[7] at the Site. The IHSSs exist within several larger areas designated as

[6] Rocky Flats Cleanup Agreement, July 19, 1996 (RFCA) paragraph 79.

[7] An IHSS is a specific location at the Site where solid wastes, hazardous substances, pollutants, contaminants, hazardous wastes or constituents may have been released to the environment. See, RFCA paragraph 25 ak. IHSSs include Potential Areas of Concern (PACs) and Under Building Contamination (UBC). See, RFCA Attachment 3, *RFETS [IHSS] List.*

Site Operable Units[8] that were originally designated in 1991 and were consolidated in 1996 as described in RFCA Attachment 1, *Operable Unit Consolidation Plan*, and shown in RFCA Attachment 2, *Site Map*.

The RFCA describes the consultation process and decision document submittal process that DOE uses to propose an accelerated action for cleanup or other mitigating actions at an IHSS for CDPHE and/or EPA approval after public review and comment. Accelerated actions reduce risk and expedite the cleanup process. They are expected to contribute to the efficient performance of the anticipated final remedy for the Site.

RFCA accelerated actions are interim actions that will be reevaluated as appropriate in the final remedy decision process. The final remedy will be selected after completion of the RCRA Facility Investigation/Remedial Investigation-Corrective Measures Study/Feasibility Study (RFI/RI-CMS/FS)[9], the release of a Proposed Plan for public comment and the subsequent issuance of the final Corrective Action Decision/Record of Decision. The RFCA Parties do not anticipate, and the CERCLA cleanup criteria for establishing final remediation goals and selecting the final remedy[10] do not require, removal of all contamination or achieving background levels.[11] Similarly, RCRA/CHWA corrective actions and closures of hazardous waste units do not require removal of all hazardous waste or constituents.

To implement the accelerated action approach, the RFCA Parties adopted numerical action levels for surface and subsurface soils, surface water and groundwater that when exceeded trigger evaluation and if appropriate, require accelerated actions to address the contaminants of concern.[12] The action levels for potential contaminants for each media type were developed in 1996 and are listed in Action Level tables in RFCA Attachment 5, *Action Levels and Standards Framework for Surface Water, Ground Water and Soils* (RFCA Attachment 5). If an action level is exceeded, an evaluation and action determination for the removal, control, mitigation, etc., of the contamination through an accelerated action is triggered.

The current action levels for soils were calculated based upon anticipated future land use assumptions described in the RFCA Preamble and RFCA Appendix 9, *The Rocky Flats Vision*. These land use assumptions were further refined as depicted on RFCA Attachment 5, Figure 1, *Conceptual RFETS Land Uses*.

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[8] See, 40 CFR 300.5 and 430 (a)(1)(ii).

[9] DOE is currently working on the tasks to complete the Draft RFI/RI-CMS/FS in accordance with the CDPHE and EPA approved *Final Work Plan for the Development of the [RI/FS] Report*, March 11, 2002.

[10] See, 40 CFR 300.430 (a)(1)(iii), (e) and (f).

[11] See generally, *Preamble to the Rocky Flats Cleanup Agreement*, section B, "Objectives", RFCA Appendix 9, *The Rocky Flats Vision* and RFCA Appendix 10, *Discussion and Analysis of the Rocky Flats Vision*.

[12] RFCA paragraph 75. For surface water, the action levels are consistent with promulgated Colorado water quality standards.

Figure 1 depicts the areas of restricted open space, with capped areas and allowance for limited industrial use in the Industrial Area Operable Unit and the areas of restricted and unrestricted open space in the Buffer Zone Operable Unit.

The soil action levels are divided into those for non-radionuclides, and those for radionuclides, which are known as "Radionuclide Soil Action Levels" or RSALs. The current RSALs are dose-based. They were calculated based upon a draft EPA rule, subsequently withdrawn, that specified radiation dose limits for CERCLA response actions involving radionuclide releases.[13] Current soil action levels for non-radionuclides are based upon lifetime excess cancer risk or toxicity limits, or the potential for organic chemicals in subsurface soils to contaminate ground water above safe drinking water limits.[14]

While the current RFCA non-radionuclide soil action levels are risk-based, they were calculated based upon conceptual land use assumptions described in the RFCA Preamble consistent with the "The Rocky Flats Vision". The specific Site areas where these conceptual land uses are assumed are shown in the current RFCA Attachment 5, Figure 1, *Rocky Flats Conceptual Land Uses*. The proposed modifications to RFCA Attachment 5 include a revised Figure 1. The calculation and input parameters from which the current non-radionuclide soil action levels were derived are contained in the *Programmatic Preliminary Remediation Goals* document.[15]

The current surface soil action levels for radionuclides and inorganic contaminants are also used as the subsurface soil action levels, because in 1996 the RFCA Parties had not yet developed a model and exposure parameters for estimating risks posed by subsurface contamination.[16]

A two-tier system was developed for soil action levels (and for ground water action levels) to guide the action determination process. For non-radionuclides, Tier I action level concentrations were calculated to a lifetime excess cancer risk of $1x10^{-4}$ or a Hazard Index of 1. If the Tier I action level is exceeded an

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[13] The basis for and calculated dose-based values for the 1996 RSALs is described in the Public Review Draft, August 30, 1996, and Final, October 31, 1996, *Action Levels for Radionuclides in Soils for the [RFCA]*. Note that because the draft EPA rule contained a dose limit for unrestricted land use, a residential land use assumption and conceptual model was also used to calculate RSALs.

[14] Non-radionuclide surface soil action levels are based upon risk-based or chemical toxicity-based mathematical formulas developed for the open space user and industrial user (office worker) exposure pathways. The methodology and calculated values are described in, *Programmatic Preliminary Remediation Goals Tables*, Appendix N of RFCA Appendix 3, *the Implementation Guidance Document*. The methodology and formula for action levels for organic chemicals in subsurface soils are based on leaching to groundwater and shown in RFCA Attachment 5, Table 4. For inorganic chemicals in subsurface soil the surface soil action level is applied. See, RFCA Attachment 5, Section 4.2.

[15] See, *Programmatic Preliminary Remediation Goals* July 19, 1999, Appendix N of the *RFCA Implementation Guidance Document*, RFCA Appendix 3.

[16] See, *Action Levels for Radionuclides in Soils for the [RFCA]*, Final, October 1996, Appendix M of the *RFCA Implementation Guidance Document*, RFCA Appendix 3, section 4.4, Subsurface Soil Assessment. Also see, RFCA Attachment 5, Section 4.2 A.2.

appropriate accelerated action must be evaluated and taken. Tier II action level concentrations were calculated to a lifetime excess cancer risk of $1x10^{-6}$. Soils below Tier II action levels do not trigger any action determination. Soil concentrations between Tier I and Tier II require an evaluation to determine what, if any accelerated action beyond management controls may be appropriate based upon consideration of certain factors, such as risks posed to ecological receptors or to surface water quality. Further discussion of the basis for the current Tier I and Tier II RSALs is in section 3.2.

In addition, RFCA Attachment 10, *RCRA/CHWA Closure for Interim Status Units*[17], describes the accelerated actions required to remove or otherwise address residual hazardous wastes to achieve closure of each unit. This was finalized in 1996 based upon the hazardous waste regulatory requirements for closure in effect at that time.

3.2 Concern Over Current Radionuclide Soil Action Levels

When RFCA was signed in July 1996, a working group was convened to determine the application of the draft EPA rule dose limits and to derive and select appropriate RSALs. The draft EPA rule specified that CERCLA response actions for radionuclides must achieve an annual dose limit of 15 mrem for either a restricted or an unrestricted land use scenario. This draft rule further provided that in a restricted land use scenario cleanup must be sufficient to not exceed an annual dose of 85 mrem from residual contamination if a restricted land use assumption failed and unrestricted (i.e., residential) use occurred.

The working group developed a Site conceptual model and the exposure scenario and parameters for an office worker in the Industrial Area, for an open space user in the Buffer Zone and for a hypothetical future resident as an unrestricted user. The lowest calculated radionuclide concentrations at the annual dose limit for each exposure scenario was then selected as the RSAL.

For radionuclides, Tier I action level concentrations are based on an annual dose of 15 mrem to an office worker in the Industrial Area or 85 mrem to a hypothetical future resident in the Buffer Zone. Tier II action level concentrations are based upon an annual dose of 15 mrem to a hypothetical future resident anywhere on the Site.

Because of questions about the methodology used to establish the RSAL and public concern that the radionuclide concentrations were not sufficiently conservative, DOE funded a review of the RSALs through the Rocky Flats Citizen's Advisory Board to the Radionuclide Soil Action Level Oversight Panel (RSALOP). Beginning in 1998, the RSALOP administered an open public

[17] Note that 37 IHSS's were tentatively identified in RFCA Attachment 3 as hazardous waste units. For some IHSS's this identification needs to be confirmed. The RFCA Parties have agreed to review these past decisions in light of additional or more complete information at the appropriate time. See, RFCA Attachment 10, *RCRA/CHWA Closure for Interim Status Units*, Part III.

process for an independent review of the RSAL conducted by a contractor, Risk Assessment Corporation. As a key part of the review, Risk Assessment Corporation was also tasked to recommend a technical methodology for deriving RSALs and to use the new methodology to independently calculate RSALs, which it did in February 2000. The RSALOP recommended that the RSALs derived by Risk Assessment Corporation be adopted for the Site.[18]

3.3 Reevaluation of Radionuclide Soil Action Levels

In addition to the RSALOP recommendation and consideration of the conceptual model, exposure parameters and methodology information developed by Risk Assessment Corporation, the RFCA Parties agreed that they should review the current RSALs should be reevaluated for the following reasons.

- RFCA requires a periodic review of new technical and/or regulatory information affecting the action levels.[19]
- Local governments and community members opposed the current RSALs when they were established as not being sufficiently stringent.
- The draft EPA rule for dose-based cleanup of radiologically contaminated sites that was used as the basis for the current RSALs was withdrawn and EPA issued guidance that radionuclide cleanups must meet CERCLA risk-based criteria.
- A new and different dose-based "decommissioning rule" was promulgated by the U.S. Nuclear Regulatory Commission and subsequently adopted by CDPHE that is potentially relevant and appropriate for Site cleanup.[20]
- New technical information relevant to the RSALs has become available since the current levels were developed in 1996.

An RSALs Working Group composed of technical experts, toxicologists and health physicists from the EPA and CDPHE, with support from DOE and Kaiser-Hill Company, L.L.C. staffs, conducted this RSALs review. The RSALs review was conducted as an open public process and the RFCA Parties considered public input and recommendations related to the RSAL review. One public forum established to assist the RFCA Parties during the review was the "RFCA Stakeholder Focus Group", which met with the RFCA Parties routinely for approximately 18 months. The Technical Basis Document Appendix A provides a summary of the general topics of discussion and the public input and responses provided during the review process, including a list of RFCA Stakeholder Focus Group meetings.

The RSAL review was divided into five separate tasks, which resulted in the Task Reports described below.

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[18] See, *Final Report, Technical Project Summary*, Risk Assessment Corporation, February 2000, and the February 15, 2000, letter from the RSALOP Co-Chairs to the Acting Manager, Rocky Flats Field Office.
[19] See, RFCA Part 20, Periodic Review, and RFCA paragraph 5.
[20] See, 10 CFR 20, Subpart E and 6 CCR 1007-1, RH 4.61.

The Task 1 Report, *Regulatory Analysis*, discusses relevant regulatory and EPA guidance developments, including a full discussion of the dose-based decommissioning rule since the RSALs were last calculated by the agencies in 1996. It also contains proposals and recommendations, discussed below, regarding selection and implementation of new RSALs. The analysis is specific to the Site and to RFCA.

The Task 2 Report, *Computer Model Selection*, describes the process used to evaluate and select the computer model to calculate new dose based RSALs. Several candidate computer models were analyzed using a set of selection criteria described in the Task 2 Report. The report presents the results of the selection process, including the recommended computer model for use in the RSALs review.

The Task 3 Report and Appendices, *Calculation of Surface RSALs for Plutonium, Americium and Uranium*, discusses the exposure scenarios that the agencies used for the calculation of new RSALs, as well as the methods of calculation, the associated input parameters, and the results of the calculations. Radionuclide concentrations in soil based on annual dose limit calculations using the RESRAD 6.0 model and concentrations based on risk calculations using the Environmental Protection Agency's standard risk methodology are presented in the Task 3 Report. The Report also presents examples of sum-of-ratio adjusted values for multiple radionuclides.

Task 4 Report, *New Scientific Information*, summarizes the new scientific information that was reviewed by the RSALs Working Group to determine whether the information should be considered in the calculation of the new RSALs. The Task 4 Report does not recommend how the information should be used, only whether it should be considered.

The Task 5 Report, *Determining Cleanup Goals at Radiologically Contaminated Sites*, discusses how cleanup levels have been developed at other radiologically contaminated sites. The Task 5 report documents cleanup levels and presents case studies from selected sites to demonstrate variations in the decision-making framework and basis.

The five Task Reports have been grouped into one document, *Results of the Interagency Review of Radionuclide Soil Action Levels*, September 30, 2002, which is on line at www.rfets.gov.

3.4 Proposed New RSALs

The Task 1 Report recommended calculation of residual contamination concentrations that correspond to the acceptable CERCLA risk range – at 1×10^{-4}, 10^{-5} and 10^{-6} lifetime excess cancer risk - and that correspond to the decommissioning rule acceptable annual dose limit – 25 mrem/yr – to a future user. This recommendation was fully implemented in developing the Task 3

Report. In addition, the radionuclide concentration resulting in a chemical toxicity Hazard Index (HI) of 1 is also calculated in the Task 3 Report for comparison to concentrations for the acceptable risk range and annual dose limits.

The Task 1 Report recognized that the decommissioning rule annual dose for a future unrestricted user must also be "as low as reasonably achievable" (ALARA). While the decommissioning rule indicates a preference for unrestricted release, a site may be cleaned up to a less stringent level if the party performing the cleanup can demonstrate either: (1) the additional cleanup necessary to qualify for an unrestricted release would cause net public or environmental harm, or (2) the contamination levels associated with restricted use are ALARA. Thus, the Task 3 Report contains calculated radionuclide concentrations for both restricted and unrestricted future use scenarios. A description of the scenarios is contained in the Task 3 Report.

In the Task 1 Report the RFCA Parties recommended that the RSAL should be based on a wildlife refuge worker as the reasonably anticipated land user. Because of the enactment of the "Rocky Flats National Wildlife Refuge Act of 2001"[21] (Refuge Act), the RFCA Parties believe it is appropriate to incorporate a wildlife refuge land use assumption into the proposed RFCA modifications.

An alternatives analysis, including application of the ALARA process, for an accelerated action triggered by the RSAL for cleanup to a level that supports unrestricted use, the suburban resident scenario, was also recommended. The Task 3 Report calculates contaminant concentrations based upon a rural resident scenario that is more conservative than the suburban resident. While recognizing serious doubts that the entire site can be cleaned to unrestricted use, the recommendation concluded that for contaminated areas above the RSAL DOE would perform an evaluation to determine what level of contamination removal is reasonably achievable. This alternative analysis evaluation was expected to be in the decision documents related to the conduct of a particular action.[22]

The RFCA Parties are implementing the recommendations in the preceding paragraph as follows. DOE will evaluate alternatives for conducting soil removal accelerated actions in relevant decision documents. For accelerated actions performed on an IHSS in accordance to the Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation (ER RSOP), an ALARA evaluation is required during conduct of an accelerated action in accordance with the ER RSOP to determine whether additional soil removal is warranted. A similar approach will be followed for accelerated actions conducted

[21] Defense Authorization Act for Fiscal Year 2002, P.L. 107-107, sec. 3171, *et seq.*, 16 U.S.C. sec. 668dd, note.

[22] The recommendation also stated that it was expected that the decision document related to the 903 Pad would be the next document developed after the selection of a new RSAL. This reference should have been to the 903 Lip Area. Nonetheless, alternatives for soil removal accelerated actions will be evaluated in the proposed modifications to the ER RSOP and any subsequent accelerated action decision documents.

under other decision documents where soil removal is a part of the action. However, in most cases, the RFCA Parties believe that removal of soil to the new proposed RSAL levels will meet ALARA goal to reduce potential radiological dose. An exception might be where a small volume of additional excavation would eliminate isolated areas of residual contamination.

The RFCA Parties also recommended that the development of new RSALs should be designed to address surface contamination for the anticipated future user. They agreed that the new RSALs would not be designed based on RFCA surface water standards and would not guarantee the standards will be met. Additional steps that might be needed to protect surface water could include excavation of contamination to levels below the RSAL, re-contouring of areas in and around the industrial area, stabilization measures or the construction of engineered controls. The RFCA Parties also recommended that calculations for an appropriate RSAL for subsurface contamination in the Industrial Area would be performed at a later time when more is known about the nature and extent of such contamination, and the possible routes of exposure. The proposed modifications implement these recommendations as described above.

3.4.1 Basis for Proposed New RSALs

The proposed new RSALs have been selected [23] to achieve a lifetime excess cancer risk not greater than 1×10^{-5} for a wildlife refuge worker. When multiple radionuclides are present, and each individual radionuclide is below its individual action level, a sum-of-the ratios calculation will be performed to determine whether the action level is exceeded.[24] The new proposed RSALs also meet the decommissioning rule dose-based criteria, which are relevant and appropriate to the Site, and are within the acceptable CERCLA risk range.

3.4.2 Plutonium -239/240 RSAL

The calculated 1×10^{-5} risk-based plutonium-239/240 concentration is 116 pCi/g in the absence of other radionuclides. However, the RFCA Parties agree that a lower concentration is appropriate for the new RSAL. This will trigger more surface contamination removal, resulting in less diffuse plutonium-239/240 surface contamination available for wind erosion and precipitation runoff to mobilize and spread. Erosion and runoff mobilization are the primary means for movement of plutonium (and americium) to enlarge the area of contamination and to cause potential migration offsite. The lower RSAL is also consistent with

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[23] Based on the Task 3 Report calculated single radionuclide concentrations at the 5th percentile of the probability distribution. In the case of uranium, which poses a toxicity concern unrelated to its radioactivity, a non-radionuclide action level is also selected based on total uranium concentration at an a Hazard Index of 1.

[24] The "sum-of-ratios" is calculated by adding the fractions (ratios) resulting from dividing the actual individual radionuclide concentration by the individual radionuclide RSAL. If the sum is greater than 1, the action level trigger is exceeded. This is essentially the same method used to determine a Hazard Index by summing all Hazard Quotients as discussed in footnote 3.

recommendations of the Actinide Migration Advisory Group.[25] On the other hand, the potential for plutonium and americium migration in the subsurface is very low because they are basically insoluble in groundwater, and they would not be easily accessible or otherwise available to cause surface exposures at depths greater than about 6 feet (other than in high erosion or landslide areas), as discussed in section 3.6.

The proposed new plutonium-239/240 RSAL is 50pCi/g, representing a risk of about $5x10^{-6}$ to a wildlife refuge worker. The resultant calculated annual dose to a wildlife refuge worker is about 1 mrem/yr. By lowering the plutonium-239/240 RSAL to below $1x10^{-5}$, the aggregate risk from all radionuclides after accelerated actions are completed would not be greater than $1x10^{-5}$ to the wildlife refuge worker. Based on the Task 3 Report, the new proposed RSAL concentrations are also calculated to result in an annual dose to the unrestricted user (rural resident) that is well below the unrestricted use regulatory limit, or about 2 mrem/yr. The RSAL concentrations are also calculated to result in an excess lifetime cancer risk to an unrestricted user of about $3x10^{-5}$, well below the upper end of the acceptable CERCLA risk range. Thus, the RSAL will trigger accelerated actions that achieve soil removal that supports unrestricted surface use.

However, the RFCA Parties propose to use 116 pCi/g[26] as the denominator for the plutonium fraction for any sum-of-ratios calculation when multiple radionuclides are present. Because the proposed RSAL is 50 pCi/g, the numerator in the sum-of-ratios calculation can not exceed this concentration. Because the RFCA Parties have agreed to the more conservative RSAL for plutonium, this means that plutonium concentrations will likely serve as a conservative action level trigger for americium-241, which is normally present in combination with plutonium 239/240 when americium-241 is not close to its RSAL.

Finally, while the new proposed RSAL is not specifically based upon meeting plutonium and americium surface water standards, lower RSALs will trigger removal of more surface contamination over a larger surface area. This will lessen the amount of surface contamination available for potential for surface run off that could impact surface water in the future.

3.4.3 Americium-241 RSAL

Americium is an actinide that behaves similarly to plutonium in the

[25] See, *Actinide Migration Evaluation Pathway Analysis Summary Report*, April 2002. Also see, *Actinide Migration Evaluation Pathway Analysis Report, Technical Appendix*, Kaiser-Hill Company, L.L.C., April 2002

[26] Calculated values are presented in this Technical Basis Document for clarity. The RFCA Parties are considering rounding the calculated values to the nearest significant figure for final RSALs and non-radionuclide action levels. For example,116 pCi/g would be finalized as 120 pCi/g.

environment. For the single isotope americium-241 the RSAL is 76 pCi/g, which represents a calculated lifetime excess cancer risk of $1x10^{-5}$. Since americium-241 is the daughter of the relatively short-lived plutonium-241 isotope, which is present in very small concentrations in the plutonium at the Site, plutonium and americium are found together at varying ratios.[27] The typical activity concentration ratio for americium to plutonium is about 0.18, but it has been found at much higher ratios in some areas at the Site.

3.4.4 Uranium RSALs and Non-Radionuclide Toxicity Hazard Index

Uranium constitutes a special case requiring consideration of both its cancer causing (i.e., by radiation) and its toxic properties. Plutonium and americium do not require the same dual consideration since the cancer risk dominates at concentrations less than those at which toxicity is a significant factor. Thus, there is a uranium RSAL and a uranium non-radionuclide-based action level to account for the non-carcinogenic risk contribution of total uranium. If uranium contamination is collocated with plutonium/americium contamination, the uranium cancer-based RSALs will be included in the sum-of-ratios calculation. In addition, uranium contamination will be compared to its toxicity based action level. If the uranium concentration exceeds either the RSAL or the toxicity based action level, an accelerated action determination is triggered. The toxicity based action level is 2,750 mg/Kg. The RSALs for individual radionuclides of uranium-234, 235 and 238 are 300, 8, and 351 pCi/g respectively.

3.4.5 Comparison of Proposed New RSALs to Current RSALs

Table 1 lists the current RSALs for plutonium-239/240, americium-241 and uranium -234, 235 and 238 for comparison with the proposed new RSALs. As discussed in sections 3.2 and 3.4 the current RSALs are dose-based, while the proposed new RSALs are risk-based. However, the proposed new RSALs also meet the decommissioning rule annual radiation dose criteria for the anticipated future wildlife refuge worker user and for the rural residential surface user.

[27] One of the operations conducted at RFETS was the separation of impurities, such as americium-241, from plutonium. The "purification" operations resulted in mixtures of plutonium and americium that do not reflect the typical ratio. Plutonium-241 has a half-life of 13.2 years and because of its low initial concentration in plutonium received by RFETS and 3-4 half-lives of decay, an RSAL is not needed.

	No other radionuclides present			Sum-of-ratios for multiple radionuclides (a)		
Radionuclide	**Current Tier I (pCi/g) (b)**	**Current Tier II (pCi/g) (c)**	**New Proposed (pCi/g) (d)**	**Current Tier I (pCi/g) (b)**	**Current Tier II (pCi/g) (c)**	**New Proposed (pCi/g) (d)**
Pu-239/240	1429	252	50	651	115	50
Am-241	215	38	76	117	21	17
U-234	1738	307	300	(e)	(e)	DU(f) 68 EU(g) 82
U-235	135	24	8	(e)	(e)	DU 2 EU 5
U-238	586	193	351	(e)	(e)	DU 164 EU 4

NOTES
(a) This example assumes that the Am-241/Pu-239/240 ratio equals 0.18 and that only Am-241 and Pu-239/240 are present.
(b) Hypothetical resident, based on 85 mrem/yr radiation dose.
(c) Hypothetical resident, based on 15 mrem/yr radiation dose.
(d) Wildlife refuge worker, based on $1x10^{-5}$ risk based approach in proposed RFCA modifications. That is, while the calculated concentration for Pu-239/240 for $1x10^{-5}$ risk is 116 pCi/g, the RSAL is set at 50 pCi/g.
(e) Not calculated for 1996 RSALs.
(f) Depleted uranium calculated using U-238:U-235:U-234 activity ratio of 70:1:29.
(g) Enriched uranium calculated using U-238:U-235:U-234 activity ratio of 4:6:90.

Table 1. Comparison of Current RSALs to Proposed New RSALs for Plutonium, Americium and Uranium Radionuclides

The formula for calculating the sum-of-ratios (SOR), given a specific radionuclide concentration ($C_{radionuclide}$) is:

$$(C_{Pu\text{-}239/240}/RSAL_{Pu\text{-}239/240}) + (C_{Am\text{-}241}/RSAL_{Am\text{-}241}) + (C_{U\text{-}238}/RSAL_{U\text{-}238}) + \ldots. = SOR$$

As discussed in section 3.4.2, the proposed new RSAL for plutonium-239/240 is 50 pCi/g, while the calculated $1x10^{-5}$ risk based concentration is 116 pCi/g. To illustrate how the plutonium-239/240 fraction will be calculated in the presence of other radionuclides, three hypothetical example scenarios are calculated below.

For the first scenario, plutoinium-239/240 soil concentration is 35 pCi/g and the americium-241 concentration is 14 pCi/g.

The sum of the ratios is: 35/116 + 14/76 = SOR = 0.49

Since the sum is less than 1, no action is triggered.

In the second scenario, assume the same plutonium and americium concentrations, but with a uranium-238 soil concentration of 200 pCi/g.

The sum of the ratios is: 35/116 + 14/76 + 200/351 = SOR =1.05

Since the sum is more than 1, the RSAL is exceeded and an accelerated action determination is triggered.

For the third scenario, assume the second scenario americium-241 and uranium-238 concentrations, but the plutonium-239/241 concentration is 65 pCi/g. No calculation is needed because the 50 pCi/g plutonium-239/240 RSAL is exceeded and an accelerated action determination is triggered.

3.5 Derivation of Soil Action Levels for Non-Radionuclide Contaminants of Concern

The proposed RFCA modifications include changes the current surface soil action levels for non-radionuclides. These have been calculated using the Task 3 Report risk-based calculation methodology that was used to calculate the new proposed RSALs. Similar to the RSALs, the RFCA Parties propose to base the new soil action levels on a $1x10^{-5}$ excess lifetime cancer risk or a non-cancer Hazard Index of 1 to a wildlife refuge worker.

The calculations for the new non-radionuclide soil action levels are shown in the *Preliminary Remediation Goals* (PRGs) document.[28] While the risk-based calculation methodology for radionuclides and other contaminants of concern is the same, some of the input parameters to the calculation are different. The RSALs and PRGs use all the same exposure assumptions and for the wildlife refuge worker, except for the location of the wildlife refuge worker's office. The RSALS assume that the office is located in the contaminated area. The PRGs assume the office is located in an uncontaminated area. The result is that the RSALs include a 4-hour per day outdoor exposure and a 4-hour per day indoor exposure. The PRGs include only the 4-hour per day outdoor exposure.

3.5.1 Ecological Preliminary Remediation Goals (PRGs)

Ecological PRGs are chemical-specific, calculated risk-based concentrations developed for a specific medium (soil) and land use (wildlife refuge) at Rocky Flats.[29] The concentrations were developed for several surrogate receptors, judged to be representative of species at

[28] The PRG document will replace the current PPRGs document as Appendix N of the *RFCA Implementation Guidance Document*, RFCA Appendix 3.

[29] The Ecological PRGs calculation methodology is also contained in the PRG document

Rocky Flats, using toxicological values under specific exposure conditions. These resulting values represent a concentration that is protective of those receptors that commonly come into contact with soil or ingest biota that live in or on soil. It is important to note that the ecological PRGs are initial guidelines. They do not establish that cleanup to meet that goal is warranted, but do trigger a consultative process to evaluate potential accelerated actions. Ecological PRGs can also be used to identify those contaminants of potential concern in soils requiring further evaluation in an ecological risk assessment for the site. An ecological risk assessment for the Site will be conducted as part of the Comprehensive Risk Assessment in the RFI/RI-CMS/FS.

3.5.2 Site-Wide Contaminants of Concern

The proposed new RSALs and non-radionuclide action levels are contained in Table 3, *Soil Action Levels*, in the proposed modifications to RFCA Attachment 5. The table identifies proposed Site-wide contaminants of concern (COCs), which are the hazardous substances that are wide-spread contaminants at the Site and are found or suspected to be at concentrations that pose a greater than $1x10^{-5}$ risk to a wildlife refuge worker. Accordingly, the main objective in identifying these Site-wide COCs is to ensure data is collected for these COCs at all IHSSs because their presence in soil is suspected regardless of the types of contaminants that may have been released at specific IHSSs.[30]

The main objective in identifying Site-wide COCs is to ensure data are collected at all IHSSs and in the areas outside of IHSSs that will be taken for comprehensive Site characterization purposes during the conduct of the RFI/RI-CMS/FS. The presence of Site-wide COCs in soil is suspected regardless of the contaminants that may have been released at specific IHSSs.

Process knowledge with respect to a waste release at a specific IHSS may indicate the potential for the presence of IHSS-specific COCs. In these instances, the analytical suites represented by the potential IHSS-specific COCs identified in the proposed *Soil Action Levels* table will be a part of the characterization program for these IHSSs.

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[30] Because analytical methods typically do not target individual COC analytes, but rather quantify all constituents within a given analytical suite, data for non-Site-Wide COCs that are within analytical suites for Site-Wide COCs will also be collected. Selection of Site-Wide soil COCs involves a 5 step screening process. The process eliminates data of inadequate quality, and analytes that 1) are major cations/anions or are otherwise not currently listed in ALF, 2) do not exceed 10% of the surface soil Action Levels (ALs) in RFCA Attachment 5, 3) are infrequently detected (<5% detection), 4) are at concentrations that are within background levels, and 5) are not waste-derived contaminants or are specific only to certain Individual Hazardous Substance Site (IHSSs).

3.6 Integrated Risk-Based Approach Considerations

As discussed in section 3.1, the current surface soil RSALs that were established in 1996 are used as the subsurface soil RSALs because a subsurface conceptual model had not been developed at that time. The "default" application of the surface soil RSALs to subsurface soil potentially triggers subsurface accelerated actions even though the pathway for exposure to an anticipated future user may present a negligible risk. During the reevaluation of the RSALs, the RFCA Parties determined that the $1x10^{-5}$ risk to a wildlife refuge worker, which is the basis for the proposed new RSALs, should be applied consistently Site-wide to both surface and subsurface soil contamination. That is, a risk-based approach must account for the fact that subsurface radionuclide contamination at the Site poses significantly less risk than surface contamination.

This integrated risk-based concept became a key element of the community dialogue related to the RSALs reevaluation. As part of this dialogue, the RFCA Parties made presentations and provided existing characterization and investigation information on the ground water, surface water and subsurface contamination sources at the Site. These presentations included discussion and solicitation of community feedback regarding the relevance and importance of this information to development of a soil risk screen methodology to implement the integrated risk-based approach. Appendix A of this Technical Basis Document, *Public Involvement Summary,* provides a list of the public meetings at which presentations were made during the community dialogue process.

Based upon consideration of community input from this dialogue, the RFCA Parties determined that several key interests and concerns should be addressed in the proposed modifications. These interests and concerns are summarized as follows:

- The proposal to lower the RSALs resulting in more surface soil contamination removal with the likelihood of less subsurface soil removal raised concerns over the current RFCA definition of subsurface soil, which is soil deeper than six inches from the surface. The possibility that shallow subsurface soils could eventually pose a surface risk through erosion or human processes must be recognized.

- Basing subsurface cleanup on risk to a wildlife refuge worker presents the possibility that high concentrations of subsurface contamination might not trigger an accelerated action to remove the soil. An upper bound contamination level that would trigger an accelerated action must be developed as part of the concept.

- The proposal to adopt a single risk value based on a wildlife refuge worker scenario also led to concerns that a change to the basis for current surface water standards, which are based on unrestricted use, would be proposed.

- The risk-based subsurface approach depends on several assumptions. The RFCA Parties made these assumptions based upon studies, characterization data and results of implemented response actions to date. These assumptions include:

    - subsurface soil plutonium and americium contamination at RFETS is insoluble in ground water and has not been detected as moving in ground water;
    - ground water passive barriers and treatment cells are likely to continue to control and remove ground water contamination into the foreseeable future; and
    - the Site will remain under federal jurisdiction and control.

The integrated risk based approach must serve to validate and consider the possible limits of the underlying assumptions about subsurface contamination. Effective controls to limit access to or disturbance of residual contamination and adequate monitoring to determine whether assumed conditions are changing and present unacceptable risks must be adopted.

In response to these interests and concerns, the proposed modifications reflect the following understandings reached by the RFCA Parties:

- No change to the current numerical surface water quality standards is proposed. However, a change to the averaging period for measurement of plutonium and americium from 30 days to one year is proposed for the on-site points of compliance.[31] Data collection will not change. The 30 day averaging period for water leaving the site, measured at Indiana St., will not change.

- Instead of a separate action level for surface and subsurface soil, action determinations are based on whether soil contamination is radionuclide or non-radionuclide contamination. Soil accelerated actions will remove soils above the plutonium and americium RSALs to at least three feet below the surface.

- Accelerated action determinations for the subsurface consider the mechanisms by which subsurface soil and/or ground water may pose a risk to the wildlife refuge worker at the surface. In particular, the mechanisms by which subsurface contamination may cause exposure to a surface receptor are considered. Risks to ecological receptors, which could occur from subsurface or surface contact with contaminants, are also considered.

[31] The RFCA Parties note that since the time Colorado adopted the current plutonium and americium standard of 0.15 pCi/L, the cancer slope factors have been updated. Using the updated slope factors there is technical justification to raise the plutonium standard to 0.35 pCi/L and the americium standard to 0.46 pCi/L.

- There will be areas of the Site with residual contamination requiring controls. These areas will be safe for the anticipated future land use with some controls, but may pose unacceptable risks for unrestricted use, depending upon the type and location of the contamination.

  - Some areas of the Site will contain closed RCRA/CHWA units that contain hazardous wastes.

  - Clean up of ground water contamination may not be achieved for many years.

  - Some areas of residual contamination may preclude certain uses or activities that cause soil disturbance.

  While these areas are in relatively discrete locations, the RFCA Parties have delineated a contiguous area of the Site that contains all of the known or projected discrete areas of concern. Recognition that institutional controls will be used as appropriate for such areas to help inform and further guide accelerated action determinations.

- Finally, because leaks from Original Process Waste Lines would be the most likely source of high concentrations or large areas of subsurface radionuclide contamination, a specific, depth based characterization approach is proposed. The results of the characterization will trigger removal if levels are above proposed upper concentration or area limits. If contamination from leaks is below proposed limits, accelerated action determinations will be made based upon the soil risk screen.

The following subsections provide additional information and discussion related to the implementation of the proposed modifications.

3.6.1 Soil Removal Depths for Radionuclides and Non-Radionuclides

While a calculated $1x10^{-5}$ risk from plutonium soil contamination is the same as a calculated $1x10^{-5}$ risk from arsenic soil contamination, the RFCA Parties understand that plutonium and americium contamination is perceived by the community as posing a special risk requiring special consideration during cleanup. Also, because the half-life of plutonium is very long, the long lasting nature of the hazard is of special concern (even though some other hazardous substances, such as arsenic and lead, never decay away).

In response, the RFCA Parties propose that the subsurface risk-based approach for plutonium and americium will be applied only after plutonium and americium contamination above the RSALs within 3 feet of

the surface are removed as part of any triggered accelerated action. Although uranium is proposed to be addressed with non-radionuclides because of its toxicity and relative solubility, uranium radionuclide contamination levels will be used to calculate the sum-of-ratios to determine if the plutonium or americium RSAL is exceeded. If the contamination extends below 3 feet, or originates below 3 feet, accelerated actions will be determined based upon the proposed Soil Risk Screen.

In addition, the proposed OPWL characterization approach, discussed in section 3.6.1, will be used to identify plutonium and americium soil contamination within six feet of the surface and to trigger accelerated action determinations. This approach is based upon the following factors relevant to the wildlife refuge land use.

Intrusion into the upper 3 feet of soil may be possible with little effort using hand tools or may be the result of routine operations such as post hole digging, vegetation management, reseeding or vehicle use. Contamination brought to the surface under these circumstances would not exceed the RSALs.

Human intrusion into the subsurface below 3 feet would normally require planning and the use of excavating equipment. Therefore, inadvertent intrusion is not likely. Burrowing animal, i.e., prairie dog, intrusion is possible to depths of 6 feet.[32] The amount of contaminated soil excavated by a prairie dog would be limited, and would include considerable mixing with clean soil above 3 feet.

The model used by the RFCA Parties in considering the impact of prairie dog excavation of soils is contained in Appendix B of this Technical Basis Document.

Accelerated actions for uranium radionuclides (for risk) and total uranium (for toxicity) are proposed to be determined using the non-radionuclide accelerated action determination process. This is because surface uranium contamination is found at the Site primarily in small "hot spots". Uranium is soluble in ground water and surface water at the Site, and since other ground water contaminants (primarily volatile and semi-volatile organic compounds and nitrates) are being addressed with barriers and treatment cells, risks from uranium can be effectively be addressed in the same manner as the non-radionuclide contaminants. Tritium was released at the Site in 1973 and has been found in some subsurface soil samples (essentially in soil moisture) and in some ground water wells and in

[32] Information from US Fish and Wildlife staff based upon experience at Rocky Mountain Arsenal National Wildlife Refuge. Also see, *Proceedings of the Symposium on Management of Prairie Dog Complexes for the Reintroduction of the Black-Footed Ferret,* Biological Report 13, July 1993, Fish and Wildlife Service, U.S. Department of the Interior.

surface water samples. Detected concentrations of tritium are at levels well below surface water standards and infrequent, and it has not been detected at surface water points of compliance for many years. Tritium, which has a relatively short half-life of 12.3 years, behaves similar to volatile organic compounds and is soluble in ground water. Like uranium, risks from tritium can be effectively addressed in the same manner as the non-radionuclide contaminants.

Non-radionuclide contamination above soil action levels that originates on the surface (i.e., found in surface soil samples, which are taken in the top 6 inches of soil) will trigger an accelerated action to remove the surface contamination. If the contamination extends below 6 inches, or originates below 6 inches, accelerated actions will be determined based upon the Soil Risk Screen.

The RFCA Parties believe that this approach for non-radionuclide soil contamination reflects an appropriate balancing of community interest in reducing risks posed by near surface americium and plutonium.

3.6.2 The Soil Risk Screen for Subsurface Soil Accelerated Actions

The Soil Risk Screen guides accelerated action determinations for subsurface soil contamination that is above the soil action levels. Subsurface soil removal will not be required if the risk is below $1x10^{-5}$ to a wildlife refuge worker. For non-radionuclides, the Soil Risk Screen is applied to contamination below 6 inches from the surface.

The Soil Risk Screen is applied when soil contamination exceeds a soil action level. The Soil Risk Screen will be used in conjunction with any accelerated action determination already triggered and taken. For example, if plutonium and americium contaminated soils have been removed to 3 feet and the remaining contamination is above the RSALs, the Soil Risk Screen will be applied to the remaining subsurface soils contamination. It will also be applied to determine whether an accelerated action must be taken. For example, if volatile organic compound soil contamination above the action levels is found 3 feet below the surface, the Soil Risk Screen will guide the determination.

The Soil Risk Screen takes into consideration the following pathways/receptors for subsurface contamination:

- landslide/high erosion that could expose soil to the surface;[33]
- for plutonium and americium, burrowing animals down to 6 feet that could bring soil to the surface;

[33] These areas were determined based upon the "100 Year Average Erosion Map", Figure 17, in the, *Report on Soil Erosion and Surface Water Sediment Transport Modeling for the Actinide Migration Evaluation for the Rocky Flats Environmental Technology Site. 00-RF-01823*, Kaiser-Hill Company, L.L.C., August 2000.

- ground water contamination that could reach surface water; and,
- access to subsurface by ecological receptors.

3.6.3 New RFCA Attachment 14, Original Process Waste Lines (OPWL)[34] Subsurface Soil Approach

Plutonium and americium contamination from OPWLs above the RSALs, and all OPWLs within three feet of the surface will be removed. Valve vaults associated with OPWLs are also proposed to be removed to at least 6 feet below the surface, and to lower depths as practicable. It is proposed that remaining valve vault structures and any remaining OPWL will be grouted or foamed. These steps are intended to break any preferential ground water pathways.

A specific OPWL characterization strategy to depths of 6 feet below the surface is proposed in a new RFCA Attachment 14. Between 3 to 6 feet, based on considerations discussed in section 3.6.1, OPWL will be characterized at known and suspected leak locations specified in proposed new RFCA Attachment 14. Soils in the proximity of the other portions of the OPWL between 3 and 6 feet are proposed to initially be characterized using a biased sampling approach that is based upon the material of construction of the various sections. That is, samples will be spaced along pipe lengths assuming weaker materials could have deteriorated (closer spaced samples) while robust materials (e.g., stainless steel) were unlikely to deteriorate.

Characterization of IHSSs in accordance with the *Industrial Area Sampling and Analysis Plan* that are not yet characterized and that overlay OPWLs will provide adequate characterization of soil contamination from OPWLs under 6 feet below the surface. In addition, the Site groundwater monitoring network provides analytical data on the presence and mobility of subsurface soil column contaminants.

If contamination above 3 nCi/g is located at the initial sampling locations, additional locations "stepped out" 10 meters in both directions along the pipe and 2 meters in both directions perpendicular to the pipe will be taken. This will be done to determine the extent of contamination above 3 nCi/g. Further samples would be taken if necessary based upon a statistical sampling approach consistent with the *Industrial Area Sampling and Analysis Plan*. If contamination above 10 nCi/g is located at the initial sampling locations, "stepped out" samples will not be required (although samples may be taken for planning purposes), since this level of contamination will trigger an accelerated action, as discussed below.

[34] The Original Process Waste Lines, IHSS 121 of former OU-9, is a network originally consisting of approximately 35,000 feet of pipeline. Parts of the OPWL were converted to New Process Waste Lines, or other systems. The OPWL system now consists of approximately 30 valve vaults and 29,000 feet of pipeline.

To limit possible wildlife refuge worker surface user risk to $1x10^{-5}$ should these soils be brought to the surface, and to meet the decommissioning rule dose based standards to the extent practicable, subsurface soil contamination above10 nCi/g located between 3 and 6 feet below the surface will trigger an accelerated action to remove the soils to concentrations less than 3 nCi/g. Soils below 1 nCi/g will not trigger an accelerated action. Such contamination, if brought to the surface, would not pose an unacceptable risk as discussed below.

Soils greater than 3 nCi/g that extend more than 80 square meters between 3 and 6 feet below the surface will be removed to a concentration of less than 3 nCi/g to limit possible annual radiation dose to a wildlife refuge worker or a rural resident surface user to meet decommissioning rule dose-based standards[35] and to prevent unacceptable risk to a wildlife refuge worker. An evaluation will be triggered for soils between 3 nCi/gm and 10nCi/gm that are limited in areal extent and an accelerated action determination will be made based upon consultation between the RFCA Parties and the community. In addition, if extensive contamination is detected from 1 nCi/g to 3 nCi/g, then the RFCA Parties will also use the consultative process to evaluate human health and environmental risks and implement actions as appropriate. The principle of ALARA will be applied such that if additional excavation incidental to removal of soil contamination already triggered will result in significant additional source removal (for example, reducing levels below 3 nCi/g to 1 nCi/g or to background) then additional removal will occur.

The proposed concentrations of soil contamination in the 3 to 6 foot subsurface interval are based on the estimated amount of soil a prairie dog would bring to the surface in digging a burrow, the estimated concentration of burrows in a colony and the areal extent of a colony. The conceptual model for the risks posed by hypothetical burrowing prairie dogs is in Appendix B of this Technical Basis Document.

Contaminated soil brought to the surface by a prairie dog would create a hot spot of about one-half square meter. Based on the conceptual model for 80 square meters of subsurface soil area a multiplication factor of 60 can be applied to the RSAL to calculate allowable soil hot spots. The resulting 3nCi/g for plutonium 239/240 is therefore proposed to guide accelerated action decisions at depths between 3 and 6 feet below the surface, as described above.

[35] Although the RSALs are calculated to meet the 25 mrem/yr limit for a rural resident surface user scenario, as more fully explained in the analysis of the decommissioning rule in the Task 1 Report, the rule also has an upper limit of 100 mrem/yr to an unrestricted user should restricted use cease.

However, additional consideration of CERCLA risk criteria and relevant and appropriate dose criteria is warranted. Based upon the Task 3 Report results, a uniform surface soil plutonium/americium concentration at the typical 0.18 activity ratio, approximately 1 nCi/g (1,000 pCi/g) plutonium 239/240 would result in an approximate risk of $1x10^{-4}$ and an approximate annual dose of 25 mrem to a wildlife refuge worker. This concentration would also result in an approximate annual dose to a rural resident of 100 mrem/yr (see footnote 35). However, the hot spot would gradually disperse over a larger area, reducing the actual surface concentration. If 1,000 pCi/g over a large surface area is protective based on lifetime excess cancer risk and annual dose criteria, a hot spot concentration greater than this concentration can be derived.

In accordance with the *Industrial Area Sampling and Analysis Plan,* section 5.3 methodology, a hot spot concentration three times a limiting concentration is acceptable when applied to a (much larger) unit area. This factor is recommended to reduce the possibility that very small, but very high concentration, hot spots, which may pose an unacceptable risk in some land use scenarios, would occur. Therefore, a one-half square meter 3 nCi/g hot spot would not pose an unacceptable concentration, because when averaged over the larger undisturbed area (approximately 160 square meters) the resulting surface concentration will be well below 1 nCi/g.

While the foregoing estimates are not precise, the RFCA Parties believe that this analysis gives an approximation of the upper bounds of risks (and dose rates) that might be posed by these concentrations in the subsurface. Therefore, it is reasonable to require accelerated action determinations to be triggered based upon these estimates.

3.6.4 RCRA/CHWA Interim Status Units

Hazardous waste interim status units are subject to specific RCRA/CHWA closure requirements. In 1998, EPA amended the RCRA regulations[36] to allow regulated units with releases into the environment to be closed under a risk-based approach, if other Solid Waste Management Units (SWMUs) have or are likely to have contributed to the release. This change allows RCRA/CHWA regulated unit closures to be accomplished consistent with CERCLA remedy risk range criteria when a CERCLA response and RCRA/CHWA corrective actions/closures are taking place at the same Site.

Certain of the RFCA covered interim status units at RFETS are located within areas of releases from SWMUs. This alternative approach allows contamination from such units to be evaluated holistically as one area of

[36] See, 40 CFR.265.110 (d). The Colorado Hazardous Waste Regulations incorporated this change in 1999. See, 6 CCR 1007-3, Section 265.110(d).

concern, and the interim status unit to be closed if residual hazardous waste contamination does not pose an unacceptable risk to human health and the environment. Therefore, closure can be accomplished without requiring a prescriptive RCRA/CHWA cap or cover in those instances where residual hazardous waste contamination has not been removed down to levels that would allow unrestricted use. The RFCA parties propose that Attachment 10, *RCRA Closure for Interim Status Units,* be modified consistent with the regulatory changes to allow closure in accordance with the proposed integrated risk-based approach modifications. Accelerated action evaluations will be triggered if soil contamination exceeds soil action levels and action determinations will be made in accordance with the Soil Risk Screen methodology.

3.7 Long Term Stewardship and Institutional Controls

The cleanup of hazardous substances at the Site will not result in the removal of all hazardous substances at the Site. Consequently, other actions, such as environmental monitoring, remedy maintenance, information management, and remedy review will be needed after Site closure. These and other, similar activities are known as "long term stewardship." One class of long-term stewardship activities is referred to collectively as "institutional controls." Institutional controls are mechanisms used to restrict inappropriate uses of land, facilities and environmental media by limiting exposure to residual contaminants left behind as part of a CERCLA or RCRA remedy.

The types of institutional controls listed in RFCA Attachment 5 are meant to protect future Site users from the kinds of residual contamination that are expected to remain at RFETS. A prohibition on construction and use of buildings in contaminated areas will prevent exposure to contaminant via an indoor air pathway. Prohibition on drilling into contaminated groundwater will prevent ingestion of contaminants via drinking water, and will help ensure that groundwater flow pathways on which remedy designs are based will not be altered. Restrictions on intrusion into areas of subsurface soil contamination will prevent exposure that would be caused by bringing these contaminants to the surface. The parties agree that limitations should be placed on soil disturbance in areas where there is low-level residual surface contamination from plutonium and americium. Finally, the Parties recognize that engineered controls like covers, groundwater barriers and treatment cells, as well as monitoring systems, will require protections to ensure their continued effectiveness. In addition, CDPHE has a policy preference to require cleanups to unrestricted use levels. Where that is not possible or appropriate, the CDPHE policy requires use of institutional controls to achieve a 1×10^{-6} excess lifetime cancer risk to the anticipated future user.[37] CDPHE intends that the institutional controls described above will be applied in a manner that is consistent with its policy.

[37] See, CDPHE's, *Proposed Soil Remediation Objectives Policy Document,* December, 1997 and, *Interim Final Policy and Guidance on Risk Assessments for Corrective Action at RCRA Facilities,* 1993. DOE and CDPHE have not reached agreement on the application of these policies and while they may agree on the

Attachment 5, Figure 1, presents an aggregate approximation of where one or more of the aforementioned institutional controls may be following Site closure. The outline in Figure 1 subsumes the following areas:

- the Industrial Area, east of the Building 130 complex;
- the Original Landfill, Present Landfill, and Ash Pits;
- areas where there are groundwater contamination plumes;
- the North Walnut Creek, South Walnut Creek, and Woman Creek drainages upstream of the terminal ponds in each drainage; and,
- areas east of the 903 Pad where plutonium concentrations in surface soils are between 5 and 10 pCi/g.

The Parties also presume that there will be no residential development at Rocky Flats, consistent with its future use as a National Wildlife Refuge. Institutional controls and other long-term stewardship requirements at Rocky Flats will ultimately be contained in all final CAD/RODs, any post-closure CHWA permit, and in any modified RFCA agreement that would be in effect after Site closure.

Finally, the Parties have noted that they have not reached agreement on the applicability of the State's environmental covenants law (C.R.S. Section 25-15-320) to the federal government.

3.8 Proposed Changes for Surface Water Tritium Monitoring and Groundwater Tritium Action Levels

As noted in section 3.6.1, tritium has not been detected at surface water points of compliance for many years. For this reason, the RFCA Parties propose to remove the requirement in RFCA Attachment 5, section 2.2.C.1, which establishes points of compliance for tritium. This will eliminate monitoring for tritium at points of compliance. Also, tritium is not identified as either a Site-wide or Potential IHSSs-Specific COC. The annual review process for the RFCA *Integrated Monitoring Plan* will evaluate whether tritium monitoring should be conducted in the future and where such monitoring should take place.

In addition, in 2000, the EPA promulgated a dose-based drinking water standard (MCL) for tritium of 20,000 pCi/L.[38] RFCA Attachment 5, Table 2, *Ground Water Action Levels,* is proposed to be changed to include the new standard. Thus, the Tier II action level is proposed to change from 666 to 20,000 pCi/L and the Tier I action level (100 times the Tier II action level) is proposed to change from 66,600 to 2,000,000 pCi/L.

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set of controls and restrictions discussed in this section, they may have a different basis for the need for the controls and restrictions.

[38] See, 40 CFR 161.66(d)(2). The basis for the new standard is a whole body annual dose of 4 mrem from 2 liters per day drinking water intake.

4.0 Guide to the Proposed Changes to RFCA Attachments

The following information provides a guide to the proposed modifications for current RFCA Attachments 5 and 10, and to the proposed new Attachment 14. To assist the reader, the proposed changes to the current text are highlighted in the following manner:

Text proposed for deletion is lined through (e.g., ~~deleted language~~)

New text is shown in bold (e.g., **bold).**

Where an entire section, figure or a large portion or entire Table is proposed to be deleted, it has been removed from the proposed modifications and any new section, figure, etc. inserted for simplicity. In this case, the new proposed text, figure or table is not shown in bold.

4.1 Attachment 5, The Action Levels and Standards Framework for Surface Water, Ground Water and Soils

Modifications are proposed for each of the five sections in RFCA Attachment 5 and the tables for soil action levels. Two tables are proposed to be deleted as unnecessary, the Summary Table and Table 3, *Tier II Ground Water Wells.* Figure 1, *Conceptual RFETS Land Uses* also is modified and a new Figure 2 depicting stream segments, and a new Figure 3, "Soil Risk Screen" are added. Finally, Tables 4 and 5, which list the subsurface and surface soil action levels are replaced with a new Table 3, *Soil Action Levels.* The following is a section-by-section guide to the major changes:

4.1.1 Section 1.0, General Background

Section 1.1 changes replace the current five conceptual land uses with one reasonably anticipated future land use - a wildlife refuge. This section also contains changes related to "put-back levels". Section 1.2 contains new provisions to recognize that certain institutional controls and long term stewardship activities will be employed at the Site.

4.1.1.1 Figure 1, Conceptual Land Uses at RFETS

Figure 1 is modified to replace the current assumed boundaries for the five conceptual land uses. A new boundary is indicated for the area of the Site within which institutional controls will be used to prevent unacceptable exposure from residual contamination. The areas of the Site where landslide potential exists are also shown.

4.1.2 Section 2.0, Surface Water

Because Figure 1 is proposed to be modified, a narrative description of the stream segments has been added to section 2.1. The point of compliance for tritium in section 2.2.C.1 is proposed to be eliminated. Section 2.2 C.2 adds a description of the Point of Evaluation at the outfall of the sewage treatment plant, as agreed in relation to the renewal of the discharge permit. Section 2.2.C.4 describes the proposed change to the measuring

period for plutonium and americium for the on-Site Points of Compliance. Section 2.2.C.5 clarifies that specific surface water performance monitoring points may be implemented in addition to identified Points of Evaluation or Points of Compliance.

4.1.2.1 Figure 2, Sketch of Stream Segments 4a/4b and 5

This is a new Figure to accompany the narrative description in section 2.1.

4.1.2.2 Proposed Change to Monitoring Period On Site

In accordance with proposed section 2.2.C.4, CDPHE has notified the Water Quality Control Commission of the proposed change.[39]

4.1.3 Section 3.0, Groundwater

Section 3.2.B.4 is changed to eliminate Table 3, which identified Tier II well locations for designated groundwater measurement. This Table is no longer needed, since these well locations are identified in the Integrated Monitoring Plan.

4.1.3.1 Change to Tritium Drinking Water Standard

The Table 2 Tier II ground water action level for tritium is proposed to change from 666 to 20,000 pCi/L and the Tier I action level (100 times the Tier II action level) is proposed to change from 66,600 to 2,000,000 pCi/L.

4.1.4 Section 4.0, Non-Radionuclide Contaminated Soils

This Section is a complete rewrite because the proposed modifications do not implement a uniform subsurface soil depth for accelerated actions.

4.1.4.1 Uranium Addressed With Non-Radionuclides

Note that uranium soil contamination follows the action determination process in Section 4.0. Uranium is the only radionuclide that has both a risk-based RSAL and a toxicity limiting action level.

4.1.4.2 Table 3, Soil Action Levels

A new Table 3 replaces Tables 4 and 5, *Subsurface Soil Action Levels* and *Surface Soil Action Levels*, respectively, because the risk screening methodology, rather than an action level for the subsurface, is proposed.

4.1.4.2.1 Single Tier

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[39] See, *Hazardous Materials and Waste Management Division Interoffice Communication*, to the Water Quality Control Commission, dated 10/2/02.

The two-tier action level approach is eliminated in the proposed modifications. The Soil Risk Screen methodology and lower proposed RSALs are intended to simplify the accelerated action determination and make a tier approach for soil contamination unnecessary. Despite the elimination of Tier II action levels, contamination levels below the action level may still require remediation, as described in Attachment 5 section 4.2.F.

4.1.4.2.2 Site-Wide Contaminants of Concern

Specific Site wide Contaminants of Concern are delineated at the beginning of Table 3. These contaminants are proposed as the uniform analytes of interest for all soil samples. Other contaminants in Table 3 will be investigated and used in accelerated action determinations based upon process knowledge considerations or statistically significant identification in analytical samples.

4.1.4.3 Figure 3, Soil Risk Screen

A new Figure 3, *Soil Risk Screen*, is proposed. This is a key element to implement the proposed integrated risk-based approach.

4.1.5 Section 5.0, Soils Contaminated With Radioactive Materials

This Section is a complete rewrite because the proposed modifications do not implement a uniform subsurface soil depth for accelerated actions. Uranium is accounted for in any sum-of-ratios calculation in accordance with section 5.2.B. Changes that parallel those in section 4 are proposed.

4.2 Attachment 10, RCRA Closure for Interim Status Units

A new Part IV is proposed to allow for risk-based closure of certain RCRA/CHWA units in accordance with the proposed integrated risk-based approach. Part III recognizes the determination that OPWLs are not interim status units.

4.3 New Attachment 14, Original Process Waste Lines Subsurface Soil Approach

This proposed new Attachment provides specific information about the location of initial the characterization samples to be taken. It also describes the removal of OPWLs and associated valve vaults and the steps to be followed for soil removal determinations between 3 and 6 feet below the surface based upon the results of characterization activities.

5.0 Administrative Record

A list of the documents, in addition to this Technical Basis Document, that constitutes the administrative record file for the proposed modifications is contained in Appendix C. After completion of the public comment period, all comments received from the public

regarding the proposed modifications to RFCA Attachments 5 and 10 and the new proposed Attachment 14, the comment responsiveness summary prepared by the RFCA Parties, and correspondence related to EPA and CDPHE approval of final modifications, will be incorporated into the administrative record file.

Appendix A - Public Involvement Summary

RSALs Review

TASK	COMMENTS	RESPONSES
1 Regulatory Analysis	Peer reviewer 2 comments dated 2/12/01.	Response by DOE, EPA and CDPHE dated 3/22/01.
	Peer reviewer 1 comments dated 2/16/01.	Response by DOE, EPA and CDPHE dated 3/22/01.
	LeRoy Moore, Rocky Mountain Peace & Justice Center, comments dated 1/20/01.	Response by Tim Rehder, EPA, dated 4/25/01.
2 Computer Model Selection	LeRoy Moore, Rocky Mountain Peace & Justice Center, comments dated 5/24/01.	Response by DOE, EPA and CDPHE dated 6/6/01.
	Peer reviewer comments dated 4/13/01.	Response by DOE, EPA and CDPHE dated 6/6/01.
	Peer reviewer comments dated 5/7/01.	Response by DOE, EPA and CDPHE dated 6/6/01.
	Victor Holm, Citizens Advisory Board, comments dated 9/12/00.	Response by Russell McCallister, DOE, dated 9/28/00.
3 Calculation of Surface RSALs	See *Response to Comments on RSAL Task 3 Report* (attached to the Task 3 report) for a consolidated list of comments.	*Response to Comments on RSAL Task 3 Report*, attached to the Task 3 report.
4 New Scientific Information	City of Westminster comments dated 5/22/01.	Response by DOE, EPA and CDPHE dated 8/14/01.
5 Determining Cleanup Goals at Radiologically Contaminated Sites	LeRoy Moore, Rocky Mountain Peace & Justice Center, comments dated 1/26/01.	Written response not required. Comments were considered for the final version of Task 5.
General	Radionuclide Soil Action Level Oversight Panel recommendation dated 2/10/00.	No written response was prepared. The recommendation was responded to by: 1) forming the RFCA Stakeholder Focus Group and 2) beginning the RSALs review process in 2000 to recalculate the RSAL values.
	Rocky Flats Citizens Advisory Board recommendation dated 12/7/00.	Response by DOE, EPA and CDPHE dated 1/8/01.

Appendix A - Public Involvement Summary

TASK	COMMENTS	RESPONSES
	Rocky Flats Citizens Advisory Board recommendation dated 10/19/01.	Response by Barbara Mazurowski, DOE, dated 12/17/01. Response by Tim Rehder, EPA, dated 11/27/01. Response by Steve Gunderson, CDPHE, dated 12/21/01.

RFCA Stakeholder Focus Group

GENERAL DISCUSSION TOPICS REFLECTED IN MEETING MINUTES	MEETING DATE
RSALs – General	8/2/00, 9/13/00, 9/27/00, 10/11/00, 11/8/00, 11/29/00, 12/13/00, 1/3/01, 1/17/01, 1/31/01, 2/14/01, 2/28/01, 3/13/01, 4/11/01, 5/9/01, 6/6/01, 6/20/01, 7/11/01, 10/3/01, 11/14/01
RSALs – Task 1	11/8/00, 11/29/00, 12/13/00, 1/3/01, 1/31/01, 2/14/01, 2/28/01, 4/11/01, 6/6/01, 7/11/01
RSALs – Task 2	12/13/00, 1/3/01, 6/6/01
RSALs – Task 3	1/17/01, 1/31/01, 2/14/01, 7/11/01, 8/8/01, 8/22/01, 9/5/01, 10/3/01, 10/17/01, 11/14/01, 12/12/01, 1/9/02, 2/6/02, 2/20/02, 3/20/02, 4/17/02
RSALs – Task 4	1/17/01, 5/9/01
Risk based approach/proposed RFCA changes	6/29/00, 7/19/00, 8/2/00, 8/16/00, 8/30/00, 9/13/00, 9/27/00, 10/11/00, 11/8/00, 1/3/01, 1/17/01, 4/11/01, 5/9/01, 6/6/01, 6/20/01, 7/11/01, 8/8/01, 11/28/01, 12/12/01, 1/9/02, 2/6/02

RFCA Stakeholder Focus Group meeting minutes can be found at:
http://www.rfets.gov/PublicItems/stakefocusgroup/meeting_resources.htm

Appendix A - Public Involvement Summary

Citizens Advisory Board (CAB)

GENERAL DISCUSSION TOPICS REFLECTED IN MEETING MINUTES	MEETING DATE
RSALs – General	10/5/00, 6/7/01, 8/2/01, 9/6/01, 1/10/02, 2/7/02
RSALs – Task 1	10/5/00, 11/2/00, 2/1/01, 4/5/01, 9/6/01
RSALs – Task 2	10/5/00, 12/7/00
RSALs – Task 3	1/4/01, 7/12/01, 8/2/01, 8/15/01, 11/1/01
RSALs – Task 5	12/7/00
Risk based approach/proposed RFCA changes	2/7/02, 3/7/02, 4/4/02, 5/2/02, 6/6/02, 7/11/02, 8/1/02, 9/5/02

Citizens Advisory Board meeting minutes can be found at:
http://www.rfcab.org/Minutes.HTML

Rocky Flats Coalition of Local Governments (RFCLOG)

GENERAL DISCUSSION TOPICS REFLECTED IN MEETING MINUTES	MEETING DATE
RSALs – Task 3	11/5/01, 4/1/02
Risk based approach/proposed RFCA changes	7/10/00, 9/11/00, 9/10/01, 1/7/02, 4/1/02, 5/6/02, 6/3/02, 7/1/02, 8/5/02

Rocky Flats Coalition of Local Governments meeting minutes can be found at:
http://rfclog.org/meetmn.html

COMMENTS	RESPONSE
Rocky Flats Coalition of Local Governments recommendation on proposed risk based approach dated 9/9/02.	Response by DOE, EPA and CDPHE dated 10/28/02.

APPENDIX B

SUBSURFACE SOIL CONCEPTUAL MODEL

This white paper provides the technical basis for development of an equation that computes a risk-based subsurface soil radionuclide concentration using a risk-based surface soil radionuclide concentration and other model parameters. The model is based on potential human exposure to subsurface soil that is brought to the surface by a burrowing animal.

HUMAN EXPOSURE PATHWAY MECHANISM TO SUBSURFACE SOIL

A primary mechanism by which a human could be exposed in the future to subsurface soil at RFETS is through contact with subsurface soil that has been brought to the surface by burrowing animals, i.e., prairie dogs. The subsurface soil would occur at the surface in small isolated areas surrounding the burrows (the prairie dog mound). In effect, the prairie dog mound represents a localized area of soil with radionuclide activities potentially higher than the surrounding soils, i.e., a hot spot. This mechanism forms the basis for the equation that is used to evaluate the risk posed by radionuclides in the subsurface soil.

DEVELOPMENT OF THE SUBSURFACE SOIL EQUATION

This section presents prairie dog colony model parameters, model assumptions, and development of the equation that computes the risk-based subsurface soil radionuclide concentration.

Selected Parameters and Assumptions for a Prairie Dog Colony Model

White and Carlson (1984) evaluated the effects of the black-tailed prairie dog activity on soil mixing. These prairie dogs occupy short- and mixed-grass prairies in a belt that runs north-south along the eastern side of the Rocky Mountain range, and are thus relevant to RFETS. The key parameters that were used in their study and that are applicable to development of a prairie dog colony model are as follows:

- There are 62 burrows per hectare (6.2 burrows per 1000 m^2).
- The average mound diameter is 0.6 m (area = 0.28 m^2).

Three conservative assumptions have also been used for the prairie dog colony model:

- The area disturbed by the prairie dog in the subsurface is equal to the average area surrounding a burrow (1000 m^2/6.2 burrows = 160 m^2 per burrow).
- All of the subsurface soil brought to the surface comes from the depth where contaminated subsurface soil is encountered. The dilution of the subsurface soil with clean subsurface soil that is removed at more shallow (or deeper depths) has been ignored to provide a wide margin of error to accommodate the uncertainties in this analysis.
- The entire area of subsurface radionuclide contamination at the Site is overlain by prairie dog colonies. This is a very conservative assumption.

Equation Development

The equation that relates a risk-based subsurface soil radionuclide concentration ($CONC_{subs}$) to a risk-based surface soil radionuclide concentration ($CONC_{surf}$) is derived from the following considerations:

1. human exposure to the small area of subsurface soil that is brought the surface (the "hot spot") is a fraction of the exposure to the surrounding surface soil [application of an Area Factor (AF)], and
2. the possibility exists that, at the depth where contamination is found, the area of contamination may be less than the area disturbed by the prairie dog, i.e., the subsurface soil

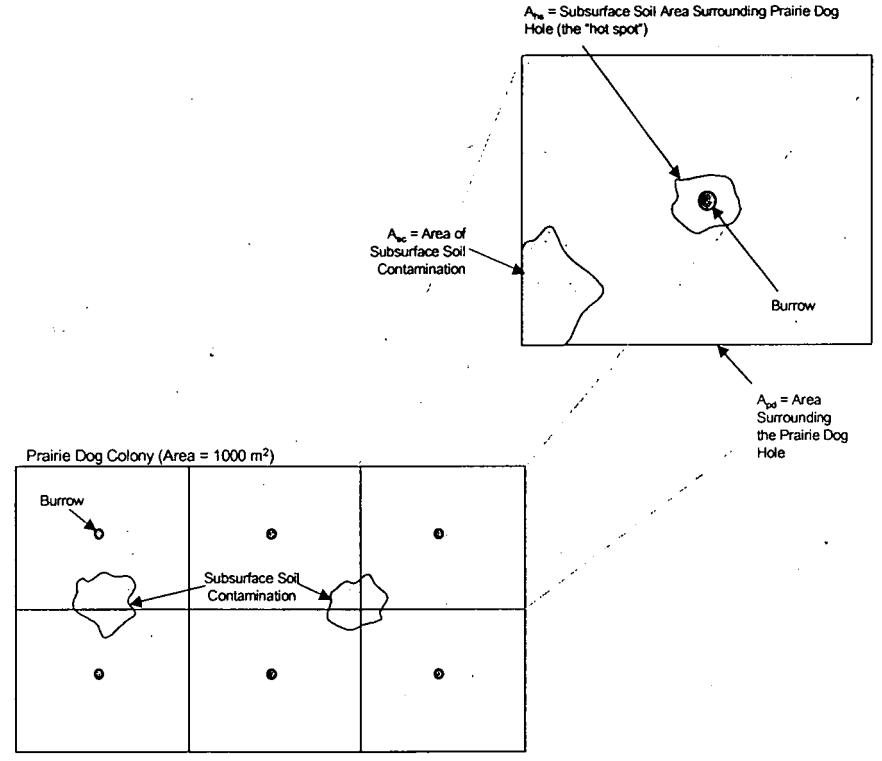
that is brought to the surface from a specific depth is a mixture of contaminated and non-contaminated soil from that depth [application of a Dilution Factor (DF)].

Given the above considerations, the equation is as follows:

$CONC_{subs} = CONC_{surf} \times AF \times DF$ **(Equation 1)**

where AF is a function of the prairie dog mound area, i.e., the "hot spot" (A_{hs}), and DF is a function of the total area disturbed by the prairie dog (A_{pd}) and the area of subsurface contamination within this disturbed area (A_{sc}). The area terms are defined in Figure 1.

Figure 1 Terminology for Calculation of the Risk-Based Subsurface Soil Radionuclide Concentration



AF is established per DOE guidance (DOE 2002)[1]. This guidance provides a method for determining if soil hot spots with radionuclide activities significantly higher than the authorized release limit are protective of individuals. For this application, the authorized limit is $CONC_{surf}$.

In the guidance, AF is applied as follows:

$C_{hs} = CONC_{surf} \times AF$ **(Equation 2)**

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1 The guide provides assistance in determining the disposition of property under the requirements of DOE 5400.5, Radiation Protection of the Public and Environment, and its proposed successor, 10 CFR 834, "Radiation Protection of the Public and the Environment. The Area Factor (AF) is based on authorized release limits derived from a 25 mrem/yr dose, and ensures that unlikely exposure to the hot spot would not cause this primary dose to be exceeded. AF further assumes the hot spot areas are equal to or less than 25 m^2, and 100 m^2 is the averaging area for compliance with the authorized limit.

where C_{hs} is the maximum allowable hot spot concentration.

AFs are a function of the area of the hot spot (A_{hs}) and the DOE guidance provides a table (Table 1 in DOE (2002)) for selection of an AF for a given A_{hs}. Application of the table and guidance indicates that AF is 30 for a hot spot with an area of 0.28 m^2 (A_{hs}), i.e., the prairie dog mound area[2].

Since DF = A_{pd}/A_{sc} = $160/A_{sc}$, substituting this term and AF equal to 30 into Equation 1 gives

$CONC_{subs} = 4800 \times CONC_{surf}/A_{sc}$ (Equation 3)

Where A_{sc} is in square meters.

Equation 3 is the equation that relates the $CONC_{subs}$ to $CONC_{surf}$ and the area of subsurface contamination (A_{sc}). In effect, a factor is applied to the $CONC_{surf}$ to arrive at the $CONC_{subs}$ for a given area of subsurface soil contamination. The resulting factors are shown in tabular form in Table 2.

Table 2 – Factors Applied to $CONC_{surf}$ to Compute $CONC_{subs}$

A_{sc} (m^2)	Factor
24	200
48	100
80	60

As can be seen, as the area of contamination increases, the factor decreases. The factor range of 60 to 200 and the associated areas are proposed for identifying subsurface soil radionuclide concentrations that will trigger an evaluation and an accelerated action determination.

REFERENCES

White, E. M., and D. C. Carlson. 1984. Estimating Soil Mixing by Rodents. Proceedings of the South Dakota Academy of Sciences 63:34-37.

DOE 2002. Draft Implementation Guide, Control and Release of Property with Residual Radioactive Material for use with DOE 5400.5, Radiation Protection of the Public and Environment. U.S. Department of Energy.

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2 The DOE guidance table notes that hot spot areas less than 1 m^2 are to be averaged over a 1 m^2 area, and the average shall not exceed 10 times the authorized limit (AL) for the property. [The notation in this paper has been changed from AL to CONC to avoid confusion with RFCA action levels.] As noted previously, the prairie dog mound ("hot spot") has an area of 0.28 m^2 (A_{hs}). Because this area is smaller than 1 m^2, the average radionuclide concentration in surface soil over a 1 m^2 area can not exceed 10 times $CONC_{surf}$. Calculation of this average and equating it to 10 times the $CONC_{surf}$ is shown below.

Average Radionuclide Concentration over 1 m^2 = $CONC_{surf} \times 10 = A_{hs} * C_{hs} + (1 - A_{hs}) * C_s$

Where C_s is the radionuclide concentration surrounding the hot spot.

Given A_{hs} = 0.28 m^2 and assuming that C_s is zero (i.e. significantly below C_{hs}), C_{hs} cacluates to be $CONC_{surf}$ x 36, i.e., AF is 36 (see Equation 2). However, DOE Order 5400.5 requires reasonable efforts to be made to remove any radionuclide source that exceeds 30 times the appropriate limit. This effectively limits AF to 30.

APPENDIX C

Administrative Record
Applicable to a Proposed New Attachment and Modifications to Existing Rocky Flats Cleanup Agreement (RFCA) Attachments

November 12, 2002

The RFCA Parties used the following documents as the basis for the proposed modifications to RFCA Attachments:

- *Results of the Interagency Review of Radionuclide Soil Action Levels*, consisting of:
  - Task 1 Report, undated: *Regulatory Analysis*
  - Task 2 Report, March 22, 2001: *Model Evaluation*
  - Task 3 Report and Appendices, September 30, 2002: *Calculation of Surface Radionuclide Soil Action Levels for Plutonium, Americium, and Uranium*
  - Task 4 Report, Revision 3, October 22, 2001: *New Scientific Information*
  - Task 5 Report, April 2002: *Determining Cleanup Goals at Radioactively-Contaminated Sites*

  (www.rfets.gov; click on *Public Comment* button on the Navigations bar)
- *Rocky Flats Cleanup Agreement (RFCA)*, July 19, 1996 (including the relevant Attachments and Appendices to the Implementation Guidance Document and the current Radionuclide Soil Action Levels)
- *Technical Basis Document and Appendices*, DOE, CDPHE and EPA, November 12, 2002
- *Actinide Migration Evaluation – Pathway Analysis Summary Report*, April 2002, and supporting research documents
- Rocky Flats National Wildlife Refuge Act, December 28, 2001
- EPA guidance (www.epa.gov/oswer/)
- *Interim Final Policy and Guidance on Risk Assessments for Corrective Actions at RCRA Facilities*, CDPHE, November 16, 1993 (www.cdphe.state.co.us/hm/riskplcy.pdf)
- *Proposed Soil Remediation Objectives Policy Document*, CDPHE, December 1997 (www.cdphe.state.co.us/hm/)
- *Remedial Investigation/Feasibility Study (RI/FS) Work Plan*, March 11, 2002
- *Surface Water Technical Memorandum*, August 20, 2002
- *Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation*, March 15, 2002
- *Industrial Area Sampling and Analysis Plan*, approved June 18, 2001
- *Buffer Zone Sampling and Analysis Plan*, approved March 13, 2002
- Original Process Waste Lines description document, date?
- Munn, L.C., *Proceedings of the Symposium on Management of Prairie Dog Complexes for the Reintroduction of the Black-footed Ferret*, Biological Report 13, July 1993
- White, E.M., and D.C. Carlson, *Estimating Soil Mixing by Rodents*, Proceedings of the South Dakota Academy of Sciences 63:34-37, 1984
- *Draft Implementation Guide, Control and Release of Property with Residual Radioactive Material for use with DOE 5400.5, Radiation Protection of the Public and Environment,* U.S. Department of Energy, 2002

PART II

PROPOSED MODIFICATIONS TO ATTACHMENT 5 – ACTION LEVEL FRAMEWORK FOR SURFACE WATER, GROUND WATER, AND SOILS

November 12, 2002

Draft RFCA Modifications
Attachment 5
November 12, 2002

Rocky Flats Environmental Technology Site Action Levels and Standards Framework for Surface Water, Ground Water, and Soils

Table of Contents

points will be designated and will consider ground water in stream alluvium. **The need for and location of POEs and performance monitoring points will be addressed as necessary in the CAD/ROD.**

2.4 Action Determinations

A. When contaminant concentrations exceed the Table 1 standards at a POC, source evaluation and mitigating action will be required. Specific remedial actions will be determined on a case-by-case basis, but must be designed such that surface water will meet applicable standards at the POCs. If standards are exceeded at a POC, DOE will inform the CDPHE and EPA of such exceedances within 15 days of gaining knowledge of the exceedances. In addition, DOE will, within 30 days of gaining knowledge of the exceedances, submit to CDPHE and EPA a plan and schedule for source evaluation for the exceedance, including a preliminary plan and schedule for mitigating action. Final plans and schedules for mitigating actions will be developed and implemented by DOE, in consultation with CDPHE and EPA, following completion of the source evaluation. Nothing in this paragraph, however, shall preclude DOE from undertaking timely mitigation once a source has been identified. Once an initial notification, source evaluation, and mitigating action have been triggered for a particular exceedance, additional exceedances from the same source would not require separate notifications or additional source evaluations or mitigation. The Standley Lake Protection Project (SLPP) Operations Agreement addresses conditions and timing of storage and releases of waters in the Woman Creek Reservoir. Consistent with the SLPP Operations Agreement, it is the intent of the Parties that waters which meet the standards at the Indiana Street POC are acceptable for any use.

B. During active remediation, when contaminant concentrations in Segment 5 exceed the Table 1 action levels, source evaluation will be required. If mitigating action is appropriate, the specific actions will be determined on a case-by-case basis, but must be designed such that surface water will meet applicable standards at the POCs. In the case of action level exceedances in Segment 5, DOE will inform the CDPHE and EPA of such exceedances within 15 days of gaining knowledge of the exceedances. In addition, DOE will, within 30 days of gaining knowledge of the exceedances, submit to CDPHE and EPA a plan and schedule for source evaluation for the exceedance, including a preliminary plan and schedule for mitigating action. Final plans and schedules for mitigating actions will be developed and implemented by DOE, in consultation with CDPHE and EPA, following completion of the source evaluation. Nothing in this paragraph, however, shall preclude DOE from undertaking timely mitigation once a source has been identified. Once an initial notification, source evaluation, and mitigating

action (if appropriate) have been triggered for a particular exceedance, additional exceedances from the same source would not require separate notifications or additional source evaluations or mitigation.

C. Exceedances of water quality standards at a POC may be subject to civil penalties under sections 109 and 310(c) of CERCLA. In addition, failure of DOE to notify CDPHE and EPA of such exceedances, or to undertake source evaluations or mitigating actions as described in paragraph 2.4.A, above, shall be enforceable consistent with the terms of Part 16 of the RFCA.

D. Exceedances of action levels in Segment 5 shall not be subject to civil penalties. However, failure of DOE to notify CDPHE and EPA of such exceedances, or to undertake source evaluations or mitigating actions (if appropriate) as described in paragraph 2.4.B above, shall be enforceable consistent with the terms of Part 16 of the RFCA.

2.5 Surface Water Monitoring Network

A. Surface water monitoring will continue as currently established unless subsequent changes are agreed to by all Parties. Surface water monitoring will be consistent with the Integrated Monitoring Plan which will be reviewed and revised on an annual basis.

B. All parties will receive quarterly surface water monitoring reports which will highlight any exceedances of surface water standards or action levels and any significant changes to surface water flow conditions.

RFCA Attachment 5 Proposed Modification

3.0 Ground Water

3.1 Basis of Action Levels

At the time RFCA was signed, three ground water classifications applied at RFETS: Domestic Use Quality, Agricultural Use Quality, and Surface Water Protection. Effective March 2, 1997, the WQCC removed the domestic use and agricultural use classifications since direct use of ground water will be prevented at the Site through institutional controls. Surface water protection was retained as the only use classification for ground water at RFETS. During the period of active remediation; ground water action levels will apply and must be protective of surface water standards and quality as well as of ecological resources. Since no other human exposure to on-site ground water is foreseen, ground water action levels are based on surface water and ecological protection. This framework for ground water action levels assumes that all contaminated ground water emerges to surface water before leaving the RFETS.

3.2 Action Level Strategy

The strategy for ground water is intended to prevent contamination of surface water by applying MCLs as ground water action levels. MCLs have been established by EPA for many chemical contaminants and represent the maximum permissible level of a contaminant in drinking water. MCLs are listed at 40 CFR 141.61 and 141.62. Where an MCL for a particular contaminant is lacking, the residential ground water ingestion-based ~~P~~PRG value will apply. Ground water action levels are based on a two-tier approach. Tier I action levels consist of near-source action levels for accelerated cleanups, and Tier II are action levels **that** ~~which~~ are protective of surface water.

A. Tier I
   1. Action levels consist of 100 x MCLs (see Table 2).
   2. Designed to identify high concentration ground water "sources" that should be addressed through accelerated actions.

B. Tier II
   1. Action levels consist of MCLs (see Table 2).
   2. Designed to prevent surface water from exceeding surface water standards/action levels by triggering ground water management actions when necessary.
   3. Situations where ground water is contaminating or could contaminate surface water at levels above surface water standards/action levels will trigger a Tier II action.
   4. Tier II Action Levels are to be measured in designated wells **as identified**

~~Tier II wells have been selected by all parties from the existing monitoring network where practical. New wells have been proposed where apparent gaps exist. Designated Tier II wells are listed in Table 3.~~

a. Tier II wells are either currently uncontaminated or contaminated at levels less than MCLs. In general, Tier II wells are located between the down gradient edge of each plume and the surface water towards which the plume is most directly migrating.

b. If the proposed new wells are shown to be contaminated or if additional plume information dictates, new or alternate wells will need to be chosen.

3.3 Action Determinations

A. Tier I

1. If Tier I action levels are exceeded, an evaluation is required to determine if remedial or management action is necessary to prevent surface water from exceeding standards. If this evaluation determines that action is necessary, the type and location of the action will be delineated and implemented as an accelerated action. This evaluation may include a trend analysis based on existing data. Accelerated action priority will be given to plumes showing no significant decreasing trend in ground water contaminant concentrations over 2 years.

2. Additional ground water that does not exceed the Tier I action levels may still need to be remediated or managed through accelerated actions or CAD/RODS to protect surface water quality or ecological resources and/or prevent action level exceedances at Tier II wells (e.g., lower-level, but fast-moving contamination). The plume areas to be remediated and the cleanup levels or management techniques utilized will be determined on a case-by-case basis.

B. Tier II

1. If concentrations in a Tier II well exceed MCLs during a regular sampling event, as specified in the Integrated Monitoring Plan, monthly sampling in that well will be required. Three consecutive monthly samples showing contaminant concentrations greater than MCLs will trigger an evaluation. This will require a ground water remedial action, if modeling, which considers mass balancing and flux calculations and multiple source contributions, predicts that surface water action levels will be exceeded in surface water. These actions will be determined on a case-by-case basis and will be designed to treat, contain, manage, or mitigate the contaminant

plume. ~~Such actions will be incorporated into the ER Ranking (RFCA Attachment 4) in which they will be given weight according to measured or predicted impacts to surface water.~~

2. Ground water contaminated at levels above ground water action levels currently exists at several locations. Each of these situations will be addressed according to appropriate decision documents.

3. Any contamination in ground water resulting from releases from a unit at RFETS subject to RCRA interim status requirements will be addressed through this ALF and through remedial actions rather than through RCRA closure (see Attachment 10 to RFCA, RCRA Closure for Interim Status Units). This would include ground water containing nitrates from the Solar Ponds plume. Addressing the nitrates through this framework will allow these waters to be managed in a more cost-effective and flexible manner.

C. Other Considerations

1. Efficient, cost-effective, and feasible actions that are taken to remediate or manage contaminated ground water may not necessarily be taken at the leading edge of plumes; but rather at a location within the plume. Factors contributing to this situation could include technical impracticability at the plume edge, topographic or ecological problems at the plume edge, etc. This situation may result in a portion of a plume that will not be remediated or managed. This plume portion may cause exceedance of MCLs at Tier II wells or exceedance of surface water standards/action levels. When an up-gradient ground water action is taken that results in this situation, DOE and its subcontractor may request relief from the ground water and/or surface water standards. CDPHE and EPA will evaluate the request and may grant temporary relief or a change to the standards/action levels for a specific area. Soil or subsurface soil source removals will not be considered as the sole justification for the changed standard/action levels. In addition, such changes will be determined such that surface water use classifications are not jeopardized and surface water quality does not exceed standards at POCs.

2. Ground water plumes that can be shown to be stationary and do not therefore present a risk to surface water, regardless of their contaminant levels, will not require remediation or management. They will require continued monitoring to demonstrate that they remain stationary.

3. Where background levels exceed action levels, more frequent sampling and remedial actions will not be triggered. For those constituents where high background levels exist, a modified action level considering background will be developed.

4. ~~When groundwater action levels for volatile organic compounds (VOCs) are exceeded in the vicinity of buildings designated for reuse, human-health risks due to inhalation of indoor accumulations of those VOCs must be considered. When such an exceedance occurs in the Industrial Use Area, the evaluation which is triggered must include a comparison against the appropriate PPRGs which have been calculated for office worker exposure to indoor air.~~

3.4 Ground Water Monitoring Network

A. Ground water monitoring will be consistent with the Integrated Monitoring Plan, which will be reviewed on an annual basis.

B. All ground water monitoring data as well as changes in hydrologic conditions and exceedances of ground water action levels will be reported quarterly and summarized annually to all parties.

C. If quarterly reporting shows that previously uncontaminated wells are contaminated above ground water action levels, the sampling frequency will be increased to monthly. Three consecutive monthly samples showing exceedances will trigger an evaluation to determine if a remedial or management action is necessary. If three consecutive monthly samples then show no exceedances, the sampling frequency will revert back to the frequency specified in the Integrated Monitoring Plan.

D. All ground water plumes that exceed ground water action levels must continue to be monitored until the need for institutional controls is mitigated.

E. All ground water remedies, as well as some soil remedies, will require ground water performance monitoring. The amount, frequency, and location of any performance monitoring will be based on the type of remedy implemented and will be determined on a case-by-case basis within decision documents. The remedy should also consider that surface water quality will be acceptable for all uses after active remediation.

SUBSTANTIALLY REVISED – REDLINE VERSION NOT CREATED

4.0 ~~Subsurface Soil~~ Non-Radionuclide Contaminated Soils

4.1 ~~Basis for~~ Action Levels and Basis

A. Action levels are the concentrations in soils of non-radioactive contamination listed in Table 3 Soil Action Levels.

B. Action levels have been calculated to be protective of:

1. Human exposure appropriate for wildlife refuge worker land use:

   a. By protecting the wildlife refuge worker to a lifetime excess cancer risk of $1x10^{-5}$ (These action levels also equate to an excess lifetime cancer risk to a hypothetical rural resident of less than $1x10^{-4}$) and;

   b. By providing that the concentration of contaminants in surface soil achieve a Hazard Index (HI) of 1 for a wildlife refuge worker; and

2. Ecological resources.

C. These action levels result in a lifetime excess cancer risk of $1x10^{-5}$ to a wildlife refuge worker.

4.2 Action Determinations

The Site will undergo characterization in accordance with the Industrial Area Sampling and Analysis Plan (IA SAP) or the Buffer Zone SAP (BZ SAP). Non-radionuclide soil contamination will be evaluated for Action Determinations as described in A-H, below.

A. Actions will be determined on a case-by-case basis and may include any or a combination of removal, treatment, institutional controls, or engineering controls. (For volatile organic compounds, where VOC contamination levels approach free product concentrations, such as at IHSS 118.1, a combination of contaminated soil source removal and groundwater treatment may be selected as the appropriate accelerated action.)

B. Where characterization data indicate that soil contamination exceeds action levels to a depth of 6 inches, DOE will propose to remove the

contamination, unless this is not appropriate considering Sections 4.3 and 4.4.

C. Where soil contamination is identified below 6 inches in depth, the Soil Risk Screen, Figure 3, will be used to evaluate the potential risk of exposure and the need for further action.

D. Additional soil contamination may need to be remediated or managed to protect surface water quality in accordance with Section 2.

E. Where soil contamination exceeds the ecological action levels in Table 3, *Soil Action Levels*, DOE will consider the target species and the exposure unit for that species, and the location, areal extent, and concentration of contamination in evaluating and determining appropriate accelerated actions necessary to protect ecological resources. Accelerated actions to protect ecological resources may include the use of biota barriers, soil removal or target species management actions.

F. Following accelerated actions soils with residual contamination will be evaluated in the RFI-RI/CMS-FS and an appropriate response action will be documented in the CAD/ROD. It is anticipated that institutional controls or a combination of institutional controls and engineered controls will generally be used to manage these lower risk sites.

G. Where a concrete slab or asphalt, concrete or other man-made material at existing surface grade covers the soil surface, the basis for action will be determined with the material removed.

H. Soils beneath "below-grade" structures, e.g., basements, valve vaults, pits, etc., will be addressed through the application of the Soil Risk Screen in Figure 3.

4.3 Factors to be considered for all Action Determinations

A. Actions will be developed in an integrated manner with other actions being taken;

B. Actions will be consistent with best management practices; and

C. **Remediation and/or management actions will be implemented to protect ecological resources where those actions can be implemented without damaging other ecological resources.**

4.4 Isolated Data Points

A. **Single geographically isolated data points of contamination greater than action levels will be evaluated using the data aggregation methodology outlined in the IA SAP and the BZ SAP, and action will be taken as warranted.**

B. **These single data points will not trigger a source removal, remedial, or management action, in the absence of the source evaluation.**

5.0 ~~Surface Soil~~ Soils Contaminated with Radioactive Materials

5.1 Basis for Action Levels:

A. Action levels are the concentrations of radioactive materials contamination in soils that have been selected from levels provided in *Results of the Interagency Review of Radionuclide Soil Action Levels*, September 30, 2002.

B. Action level concentrations result in a calculated annual radiation dose, under conditions of unrestricted land use, that does not exceed the annual dose limits in the Colorado Radiation Control Regulations, *Radiological Criteria for License Termination*, 6 CCR 1007-1 RH 4.61, which is a potentially relevant and appropriate requirement for any final remedy.

C. Action levels have been calculated to be protective of:

1. human exposure appropriate for a wildlife refuge worker land use;

2. rural resident land use, in the event the land use is not restricted to a Wildlife Refuge; and

3. ecological resources (action levels for radioactive contamination that are protective of human health are lower than concentrations of radioactive contamination that are protective of ecological resources).

5.2 Action Levels

A. Radioactive soil contamination exceeding action levels in Table 3, Soil Action Levels, will be evaluated for Action Determinations as described in 5.3, below. These action levels result in a lifetime excess cancer risk of $1x10^{-5}$ to a wildlife refuge worker. (These action levels also equate to an excess lifetime cancer risk to a hypothetical rural resident of less than $1x10^{-4}$ and result in a radiation dose of less than 25 mrem/year to either a wildlife refuge worker or a rural resident).

B. The total risk from multiple radionuclides will be accounted for by the sum-of-ratios method.

5.3 Action Determinations

The Site will undergo characterization in accordance with the Industrial Area Sampling and Analysis Plan (IA SAP) or the Buffer Zone SAP (BZ SAP). Actions will be determined on a case-by-case basis and may include any or a combination of removal, treatment, institutional controls, or engineering-controls consistent with A–G, below.

A. Where characterization data show that plutonium and/or americium soil contamination originating at the surface exceeds the action level, DOE will remove sufficient radionuclide contamination to at least meet the action level within the top 3 feet. If plutonium and/or americium soil contamination greater than the action level extends below 3 feet in depth, the Soil Risk Screen, Figure 3, will be used to evaluate the potential risk of exposure and the need for further action.

B. Where characterization data show that uranium soil contamination originating at the surface exceeds the action level, DOE will remove sufficient contamination to at least meet the action level within the top 6 inches. If uranium soil contamination greater than the action level extends below 6 inches in depth, the Soil Risk Screen, Figure 3, will be used to evaluate the potential risk of exposure and the need for further action.

C. Where plutonium and/or americium soil contamination greater than the action level is present at a depth of less than 3 feet, but did not originate at the surface, soil contamination will be removed unless, after consultation with the Lead Regulatory Agency, it is decided that the concentration and aerial extent is such that removal is not warranted.

D. Plutonium and/or americium soil contamination found in the 3-6 foot depth interval will be addressed as follows:

1. If during characterization of soils between three and six feet total plutonium/americium contamination is found at an activity concentration of greater than 3nCi/g, "step out" sampling will be performed to determine the areal extent of contamination. Based upon the results of the "step out" sampling, a removal action may be triggered depending on the areal extent of the contamination. If plutonium/americium soil contamination is found in the 3-6 foot depth

interval that exceeds 3 nCi/g, and the areal extent of the contamination is found to be greater than $80m^2$, it will be removed to an activity concentration less than 3 nCi/g.

2. If plutonium/americium soil contamination is found in the 3-6 foot depth interval at activity concentrations greater than 10 nCi/g, it will be removed to an activity concentration less than 3 nCi/g without additional sampling to determine the areal extent.

3. The principle of ALARA will be applied such that if incidental additional excavation will result in significant additional source removal, (such as reducing the contamination level from 3nCi/g to 1 nCi/g or even background) then the additional removal will occur. Application of ALARA will be most appropriate when the extent of contamination is defined by a sharp concentration gradient; areas of diffuse contamination may not benefit from ALARA principals. If extensive contamination is detected from 1nCi/g – 3nCi/g, then the RFCA Parties and the communities will use the consultative process to evaluate human health and environmental risks and implement actions as appropriate.

4. Original Process Waste Lines (OPWLs) and associated radionuclide contaminated soils are addressed through the OPWL characterization approach described in Attachment 14.

E. Additional soil contamination may need to be remediated or managed to protect surface water quality in accordance with Section 2.X.

F. Following accelerated actions soils with residual contamination will be evaluated in the RFI-RI/CMS-FS and an appropriate response action will be documented in the CAD/ROD. It is anticipated that institutional controls or a combination of institutional controls and engineered controls will generally be used to manage these lower risk sites.

G. Where a concrete slab or asphalt, concrete or other man-made material at existing surface grade covers the soil surface, the basis for action will be determined as if the material had been removed.

H. Factors to be considered for all Action Determinations:
   1. Actions will be developed in an integrated manner with other actions being taken;

   2. Actions will be consistent with best management practices;

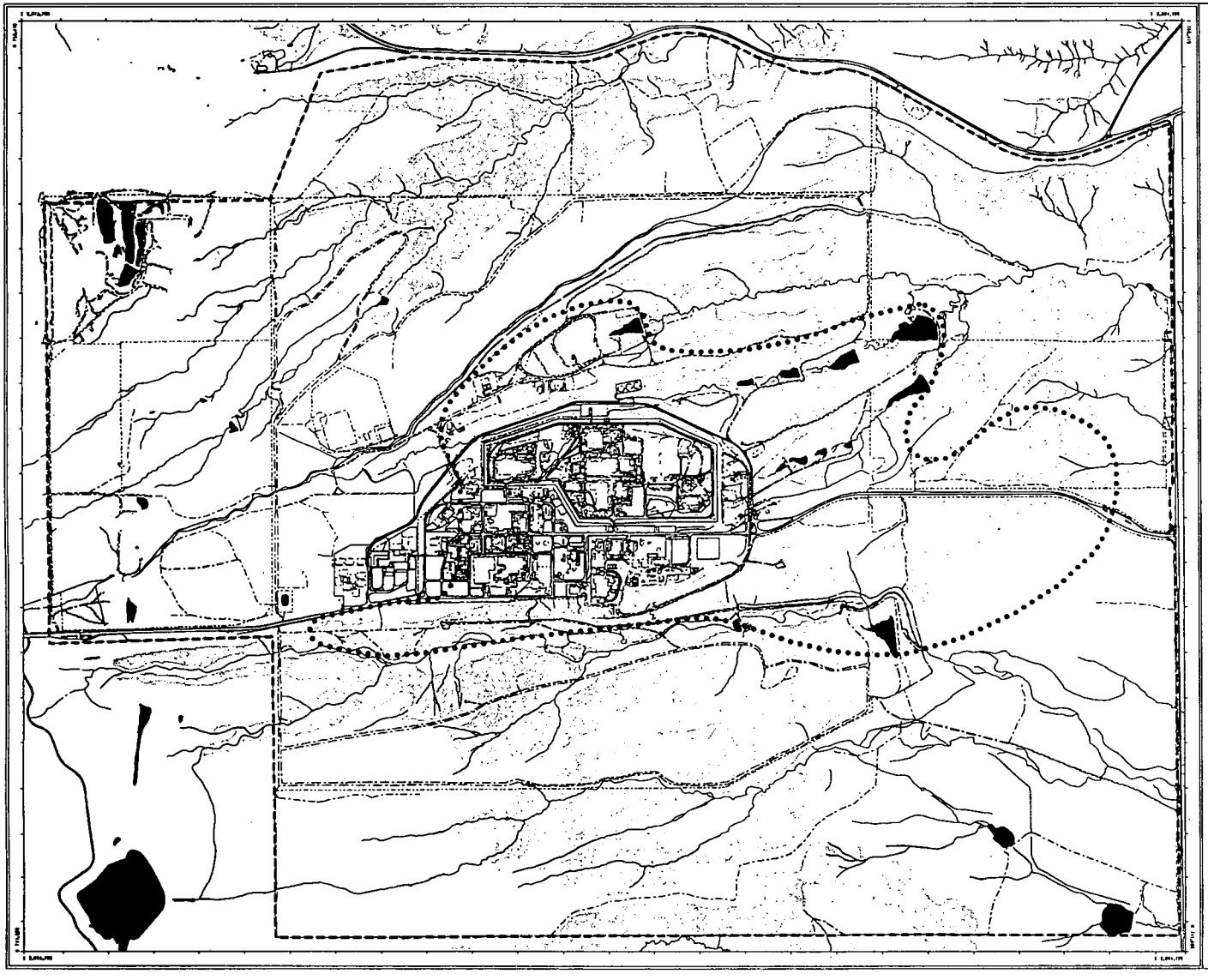
3. **Actions may be accomplished by means of an interim or final action; and**

4. **Remediation and/or management actions will be implemented to protect ecological resources where those actions can be implemented without damaging other ecological resources.**

I. Isolated Data Points

1. **Single geographically isolated data points of contamination greater than the action levels will be evaluated using the data aggregation methodology outlined in the IA SAP and the BZ SAP, and action will be taken as warranted.**

2. **These single data points will not trigger a source removal, remedial, or management action, in the absence of the source evaluation.**



RFCA
Attachement 5
Figure 1

EXPLANATION

Areas of landslides and high erosion. Contaminated sites within these areas must be evaluated per Risk Screen 2 of Figure 3.

The anticipated boundary of areas that will be subject to institutional controls is subject to modification based upon characterization, future response actions, the results of the comprehensive risk assessment, and the final remedial/corrective action decision in the final CAD/ROD.

Standard Map Features

- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Rocky Flats Environmental Technology Site boundary
- Paved roads
- Dirt roads

Scale = 1 : 33530
1 inch represents approximately 2794 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

November 05, 2002

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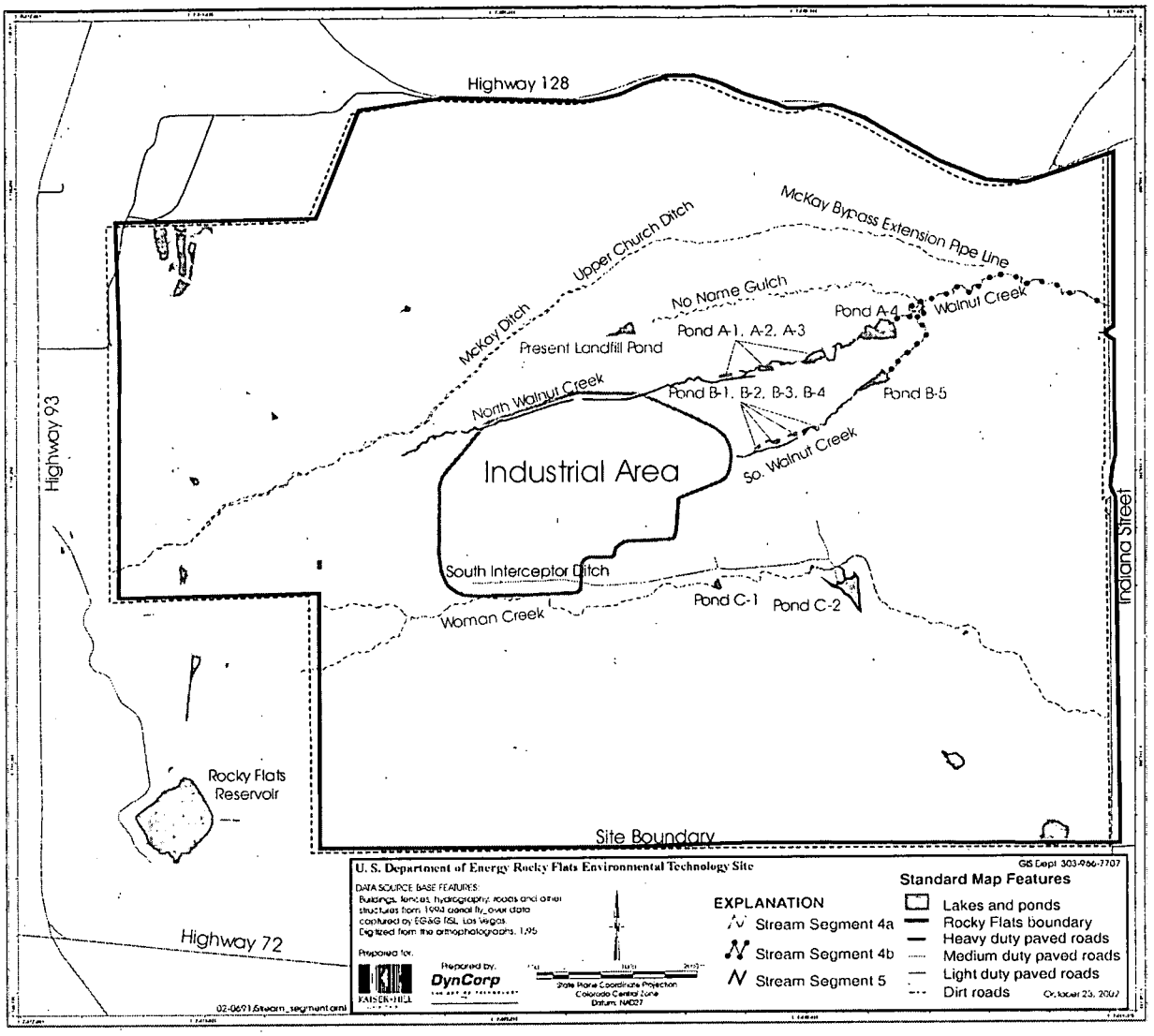
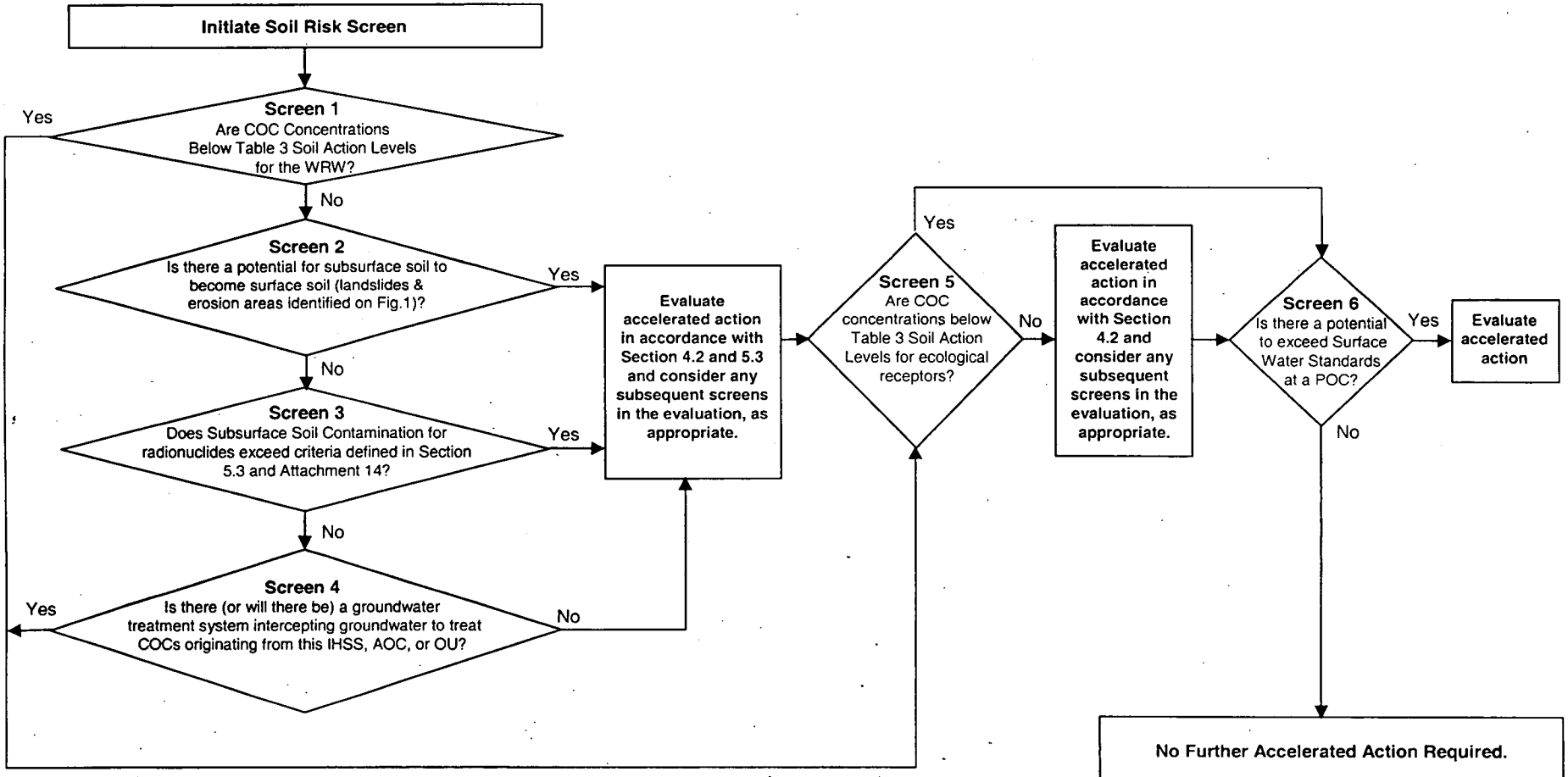


Figure 2. Sketch of Stream Segments 4a/4b and 5.

RFCA Attachment 5
Figure 3: Soil Risk Screen



ACRONYMS
COC - contaminant of concern
IHSS - Individual Hazardous Substance Site
AOC - Area of Concern
OU - Operable Unit
POC - Point of Compliance

Table 3 - Soil Action Levels

Analyte	CAS Reference Number	Wildlife Refuge Worker [a]	Ecological Receptor [b]
Site-Wide Contaminants of Concern (COCs) [c]			
NON-RADIONUCLIDES		(mg/kg)	(mg/kg)
Acetone	67-64-1	1.02E+05* [d]	2.11E+02
Arsenic	7440-38-2	2.22E+01	
Beryllium	7440-41-7	9.21E+02*	8.71E+00
Cadmium (food)	7440-43-9	9.62E+02*	
Carbon tetrachloride	56-23-5	8.15E+01*	
Chloroform	67-66-3	1.92E+01*	
Lead	7439-92-1	1.00E+03[e]	9.77E+01
Methylene chloride (dichloromethane)	75-09-2	2.53E+03	3.95E+01
Tetrachloroethene	127-18-4	6.15E+02	
Trichloroethene	79-01-6	1.96E+01	
Vinyl chloride	75-01-4	4.12E+01	4.31E-01
RADIONUCLIDES [f]		(pCi/g)	(pCi/g)
Americium-241	14596-10-2	7.60E+01	
Plutonium-239/240	10-12-8	5.00E+01/ 1.16E+02 **[g]**	
Uranium-234	11-08-5	3.00E+02	
Uranium-235	15117-96-1	8.00E+00	
Uranium-238	7440-61-1	3.51E+02	
Potential IHSS-Specific COCs [h]		(mg/kg)	(mg/kg)
Acenaphthene	83-32-9	4.08E+04*	
Acetone	67-64-1	1.02E+05*	2.11E+02
Aldrin	309-00-2	1.62E+00	
Aluminum	7429-90-5	2.28E+05*	
Ammonium (as Ammonia)	7664-41-7	> 1E+06 [i]*	
Anthracene	120-12-7	2.04E+05*	
Antimony	7440-36-0	4.09E+02*	
Aroclor 1016	12674-11-2	4.64E+01*	
Aroclor 1221	11104-28-2	1.24E+01	
Aroclor 1232	11141-16-5	1.24E+01	
Aroclor 1242	53469-21-9	1.24E+01	
Aroclor 1248	12672-29-6	1.24E+01	
Aroclor 1254	11097-69-1	1.24E+01	
Aroclor 1260	11096-82-5	1.24E+01	
Arsenic	7440-38-2	2.22E+01	
Barium	7440-39-3	2.64E+04*	
Benzene	71-43-2	2.05E+02	
alpha-BHC	319-84-6	5.24E+00	
beta-BHC	319-85-7	1.84E+01	
gamma-BHC (Lindane)	58-89-9	2.55E+01	
Benzo(a)anthracene	56-55-3	3.49E+01	
Benzo(a)pyrene	50-32-8	3.49E+00	
Benzo(b)fluoranthene	205-99-2	3.49E+01	
Benzo(k)fluoranthene	207-08-9	3.49E+02	
Benzoic Acid (at pH 7)	65-85-0	> 1E+06*	

Analyte	CAS Reference Number	Wildlife Refuge Worker [a]	Ecological Receptor [b]
Benzyl Alcohol	100-51-6	3.07E+05*	
Beryllium	7440-41-7	9.21E+02*	8.71E+00
Bromodichloromethane	75-27-4	6.17E+02	
Bromoform	75-25-2	3.73E+03	
Bromomethane (methyl bromide)	74-83-9	1.93E+02*	
2-Butanone (methyl ethyl ketone)	78-93-3	1.92E+05*	4.33E+02
Butylbenzylphthalate	85-68-7	1.47E+05*	
Cadmium (food)	7440-43-9	9.62E+02*	
Carbon disulfide	75-15-0	1.51E+04*	
Carbon tetrachloride	56-23-5	8.15E+01*	
alpha-Chlordane	5103-71-9	9.44E+01	
beta-Chlordane	5103-74-2	9.44E+01	
gamma-Chlordane	12789-03-6	9.44E+01	
4-Chloroaniline	106-47-8	2.95E+03*	
Chlorobenzene	108-90-7	6.09E+03*	
Chloroethane (ethyl chloride)	75-00-3	1.32E+04	
bis(2-chloroethyl)ether	111-44-4	3.48E+01	
Chloroform	67-66-3	1.92E+01*	
bis(2-chloroisopropyl)ether	39638-32-9	5.47E+02	
Chloromethane (methyl chloride)	74-87-3	3.71E+02	
2-Chloronaphthalene	91-58-7	8.18E+04*	
2-Chlorophenol	95-57-8	5.11E+03*	
Chromium III	16065-83-1	> 1E+06*	
Chromium VI	18540-29-9	2.68E+02	
Chrysene	218-01-9	3.49E+03	
Cobalt	7440-48-4	1.55E+03*	
Copper	7440-50-8	4.09E+04*	
Cyanide	57-12-5	2.04E+04*	
4,4-DDD	72-54-8	1.43E+02	
4,4-DDE	72-55-9	1.01E+02	
4,4-DDT	50-29-3	1.00E+02	
Dibenz(a,h)anthracene	53-70-3	3.49E+00	
Dibenzofuran	132-64-9	2.95E+03*	
Dibromochloromethane	124-48-1	3.29E+02	
Di-n-butylphthalate	84-74-2	7.37E+04*	
1,2-Dichlorobenzene (o-)	95-50-1	3.12E+04*	
1,4-Dichlorobenzene (p-)	106-46-7	8.40E+02	
3,3-Dichlorobenzidine	91-94-1	6.13E+01	
1,1-Dichloroethane	75-34-3	2.25E+04*	
1,2-Dichloroethane	107-06-2	1.06E+02	
1,1-Dichloroethene	75-35-4	1.70E+01	
1,2-Dichloroethene (total)	540-59-0	9.20E+03*	
2,4-Dichlorophenol (at pH 6.8)	120-83-2	3.07E+03*	
1,2-Dichloropropane	78-87-5	3.45E+02*	
cis-1,3-Dichloropropene	10061-01-5	2.50E+02	
trans-1,3-Dichloropropene	10061-02-6	2.50E+02	
Dieldrin	60-57-1	1.72E+00	

Analyte	CAS Reference Number	Wildlife Refuge Worker [a]	Ecological Receptor [b]
Diethylphthalate	84-66-2	5.90E+05*	
2,4-Dimethylphenol	105-67-9	2.04E+04*	
Dimethylphthalate	131-11-3	> 1E+06*	
4,6-Dinitro-2-methylphenol (4,6-dinitro-o-cresol)	534-52-1	1.02E+03*	
2,4-Dinitrophenol	51-28-5	2.04E+03*	
2,4-Dinitrotoluene	121-14-2	5.63E+01	
2,6-Dinitrotoluene	606-20-2	5.63E+01	
Di-n-octylphthalate	117-84-0	1.47E+04	
Endosulfan I	959-98-8	4.42E+03*	
Endosulfan II	33213-65-9	4.42E+03*	
Endosulfan sulfate	1031-07-8	4.42E+03*	
Endosulfan (technical)	115-29-7	4.42E+03*	
Endrin (technical)	72-20-8	2.21E+02*	
Ethylbenzene	100-41-4	4.25E+03	
bis(2-ethylhexyl)phthalate	117-81-7	1.97E+03	
Fluoranthene	206-44-0	2.72E+04*	
Fluorene	86-73-7	4.08E+04*	
Fluoride (as fluorine)	7782-41-4	6.13E+04*	
Heptachlor	76-44-8	6.12E+00	
Heptachlor epoxide	1024-57-3	3.03E+00	
Hexachlorobenzene	118-74-1	1.72E+01	
Hexachlorobutadiene	87-68-3	1.47E+02*	
Hexachlorocyclopentadiene	77-47-4	3.50E+03*	
Hexachloroethane	67-72-1	7.37E+02*	
Indeno(1,2,3-cd)pyrene	193-39-5	3.49E+01	
Iron	7439-89-6	3.07E+05*	
Isophorone	78-59-1	2.91E+04	
Lead	7439-92-1	1.00E+03[e]	9.77E+01
Lithium	7439-93-2	2.04E+04*	
Manganese	7439-96-5	3.48E+03*	
Mercury (elemental)	7439-97-6	2.52E+04*	
Methoxychlor	72-43-5	5.11E+03*	
Methylene chloride (dichloromethane)	75-09-2	2.53E+03	3.95E+01
2-Methylnaphthalene [c]	91-57-6	2.04E+04*	
4-Methyl-2-pentanone (methyl isobutyl ketone)	108-10-1	1.64E+04*	
2-Methylphenol (o-cresol)	95-48-7	3.69E+04*	
4-Methylphenol (p-cresol)	106-44-5	3.69E+03*	
Molybdenum	7439-98-7	5.11E+03*	
Naphthalene	91-20-3	3.09E+03*	
Nickel (soluble)	7440-02-0	2.04E+04*	
Nitrate	14797-55-8	> 1E+06*	
Nitrite	14797-65-0	1.02E+05*	
2-Nitroaniline	88-74-4	1.67E+04*	
Nitrobenzene	98-95-3	3.32E+02*	
4-Nitrophenol	100-02-7	8.18E+03*	
n-Nitrosodiphenylamine	86-30-6	7.81E+03	
n-Nitrosodipropylamine	621-64-7	5.47E+00	

Analyte	CAS Reference Number	Wildlife Refuge Worker [a]	Ecological Receptor [b]
Pentachlorophenol	87-86-5	1.62E+02	
Phenol	108-95-2	6.13E+05*	
Pyrene	129-00-0	2.21E+04*	
Selenium	7782-49-2	5.11E+03*	
Silver	7440-22-4	5.11E+03*	
Strontium	7440-24-6	6.13E+05*	
Stryene	100-42-5	1.23E+05*	
1,1,2,2-Tetrachloroethane	79-34-5	1.00E+02	
Tetrachloroethene	127-18-4	6.15E+02	
Tin	7440-31-5	6.13E+05*	
Toluene	108-88-3	3.13E+04*	3.29E+02
Toxaphene	8001-35-2	2.50E+01	
1,2,4-Trichlorobenzene	120-82-1	9.23E+03*	
1,1,1-Trichloroethane	71-55-6	7.97E+04*	
1,1,2-Trichloroethane	79-00-5	2.36E+02	
Trichloroethene	79-01-6	1.96E+01	
2,4,5-Trichlorophenol	95-95-4	1.02E+05*	
2,4,6-Trichlorophenol	88-06-2	3.47E+03*	
Uranium (Total)		2.75E+03*[j]	
Vanadium	7440-62-2	7.15E+03*	2.92E+02
Vinyl acetate	108-05-4	9.63E+05*	
Vinyl chloride	75-01-4	4.12E+01	4.31E-01
Xylene (total)	1330-20-7	> 1E+06*	
Zinc	7440-66-6	3.07E+05*	

Notes:

[a] Values are based on PRG calculations for a wildlife refuge worker (see RFCA Appendix 3, Implementation Guidance Document Appendix N). Values represent either a 1 x 10-5 lifetime excess cancer risk or a HQ=1 for non-cancer toxicity. An "*" indicates that the value for the wildlife refuge worker is based on HQ=1 for non-cancer toxicity. All toxicity factors used in the calculations are from IRIS, from HEAST, or are approved by the NCEA.

[b] Values are based on PRG calculations for ecological receptors (see RFCA Appendix 3, Implementation Guidance Document Appendix N). Ecological receptor action levels were only calculated for compounds originally identified by the Ecological Risk Working Group as being of Site-wide potential concern to ecological receptors. The ecological receptor action levels that are listed above are only those that are lower than the wildlife refuge worker action levels. The ecological receptor action levels are based on Lowest-Observed-Adverse-Effects Level (LOAEL) end points. The action level listed is the lowest action level above Site backgound levels that was calculated for each of the five selected wildlife receptors: Preble's meadow jumping mouse and black tailed prairie dog (fossorial (burrowing) small mammals), mourning dove (small ground-feeding bird), terrestrial invertebrate (multiple species), and American kestrel (avian predator). Action levels for other IHSS-specific ecological COCs will be determined as necessary and in the same manner used to calculate the values listed in the table.

[c] Characterization data will be collected for the Site-wide COCs; however, data for other analytes in the analytical categories represented by the COCs will be collected because they are captured by the analytical method, e.g., other volatile organic compounds and metals.

[d] The scientific notation used in this table indicates the power of ten by which the two-decimal place number is multiplied (e.g., 2.52E-02 = 2.52 x 10-2 = 0.0252)

[e] U.S. Environmental Protection Agency (EPA). 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. Office of Solid Waste and Emergency Response. Washington, D.C. Directive 9355.4-12

[f] Wildlife refuge worker values are from the Task 3 Report and Appendices: Calculation of Surface Radionuclide Soil

Action Levels for Plutonium, Americium, and Uranium (September 30, 2002). The values are for individual radionuclides and are based on a 1x10-5 excess cancer risk and the 5th percentile of the RSAL distribution. In order to account for the total dose from the multiple radionuclides, sum-of-ratios calculations will be applied to all radionuclides which are present above background. Actual values that trigger actions will therefore likely be lower than the values listed in this table. Action levels for other radionuclides will be determined as necessary and in the same manner used to calculate the values listed in this table.

[g] Although the Pu-239 calculated value at 1 X 10-5 risk is 116 pCi/g, the RFCA parties have agreed that accelerated actions are required for soil with Pu activity levels above 50 pCi/g.

[h] IHSS-specific COCs will be identified because Site-wide COCs may not accurately reflect the COCs for a particular IHSS. Note: IHSSs also include PACs and UBCs.

[i] > 1E+06 indicates the action level has a calculated value greater than 1.00E+06 mg/kg (1,000,000 mg/kg).

[j] The action level for total uranium in units of mg/kg accounts for the non-cancer risk. If uranium contamination reported in pCi/g is collocated with plutonium and/or americium contamination, the radiological action levels for uranium isotopes will be included in sum-of-ratios calculations. If uranium concentrations exceeds either action level, an action determination in accordance with ALF Sections 4.2 and 5.3 is triggered.

PART III

PROPOSED MODIFICATIONS TO ATTACHMENT 10 – RCRA/CHWA CLOSURE FOR INTERIM STATUS UNITS

November 12, 2002

PUBLIC REVIEW DRAFT – REDLINE VERSION

RFCA Attachment 10 Proposed Modification

REVISION KEY: Redline changes from 1996 Original.

RCRA/CHWA Closure for Interim Status Units

I. For closure of the Solar Evaporation Ponds (IHSS 101) and the Present Landfill (IHSS 114), which are both subject to RCRA/CHWA interim status requirements, and which will be closed in-place, DOE must, at a minimum:

A. Place a cap/cover over the unit using two design criteria:
   1. "design concentration limits (DCLs)" calculated to be protective of the most directly impacted surface water using the water quality standards listed in Table 1 of Attachment 5.
      - o DCLs would be calculated on a unit-specific basis for ground water passing the downgradient unit boundary. Since closure remedies must last beyond the period of active remediation, DCLs would be back-calculated from the surface water quality standards listed in Table 1 of Attachment 5.
      - o DCLs assume an ongoing release from the unit, but at levels that are protective of human health and the environment, consistent with the RFETS Vision.
      - o DCLs, as a cap/cover design criteria for closure, will be presented within the appropriate decision documents.
   2. for units with existing ground water contamination, the cap/cover must be designed to control any remaining source to the extent that further contaminant contribution to the plume from the unit is not capable of enlarging the plume or increasing contaminant concentrations within the plume. The parties recognize that existing plumes may continue to migrate or expand independent of continued source contamination loading. As a design criteria for a cap/cover, the unit/source must have its rate of continuing release controlled to the extent necessary to prevent enlarging the plume or increasing contaminant concentrations.

B. After the cap/cover has been installed, points of compliance (POCs) for each unit will be determined. The POCs will generally be at the unit boundaries, but may:
   1. utilize existing monitoring wells to the greatest extent possible, and
   2. utilize "waste management areas" (see CHWR, Section 264.95(b)(2)). For the Solar Ponds, the waste management area would be the area prescribed by a line circumscribing all five surface impoundments, including the area covered by the outermost berms of each. For the Present Landfill, the waste management area would be the entire area in which waste has been placed. If waste management areas are used, POCs may be chosen at the downgradient limit of the area rather than the downgradient limit of each individual unit.

C. At the POCs, compliance would be based on:
   1. non-exceedance of "alternate concentration limits (ACLs)" at units/areas with either no ground water contamination or levels of contamination less than the ACLs.

2. generally declining contamination levels for units/areas with pre-existing ground water contamination levels greater than the ACLs (this assumes placement of a DCL cap/cover is in place).
3. As with DCLs, ACLs would be calculated on a unit/area specific basis for ground water passing the POCs. Since closure remedies must last beyond the period of active remediation, ACLs would be back-calculated from the surface water quality standards listed in Table 1 of Attachment 5 so as to be protective of the most directly impacted surface water. To the extent that points of compliance are unit boundaries, the ACLs should equal the DCLs for those units. ACLs may be different from the DCLs when several units have been consolidated within a waste management area.
4. The POCs and ACLs will be designated within the appropriate decision document and approved by the regulators when the decision document is approved after appropriate public review and comment.

D. Closure requirements will not extend to remediation or management of existing ground water contamination from these units except as delineated in B.2 above. Existing ground water contamination will be addressed through coordinated RCRA corrective action/CERCLA remedial action, as described in RFCA.

E. Other large-scale remedial actions taken at RFETS may enhance the ability to comply with closure requirements. For instance, units that can benefit from large-scale dewatering or ground water diversion projects may be able to demonstrate ACL compliance with a minimal non-standard cover/cap.

~~F. All closures will be performed in consideration of the Environmental Restoration Ranking (Attachment 4).~~

F. Any materials generated during implementation of a closure action that are also generated as part of a corrective action will be considered "remediation wastes" for the purpose of CAMU utilization.

G. All post-closure requirements, including monitoring, maintenance, access control, and security requirements, will be delineated in the Closure Plan, IM/IRA, or CAD/ROD decision document for the unit or waste management area.

II. To meet the RCRA/CHWA closure requirements for all other IHSSs subject to interim status requirements (portions of the former OU 9, OU 10 and OU 13 consisting of tanks, ancillary equipment, and storage pads --See Attachment 3), DOE must, at a minimum:

A. Remove all wastes from the units.

B. If the units have not had a release, close the units and associated ancillary equipment. For the tanks and storage areas that make up this universe of units at RFETS, this should be able to be accomplished via:

1. decontamination of the unit and any ancillary equipment, and/or

2. removal and appropriate disposition/disposal of the unit and any ancillary equipment.

Closure via 1. or 2. above should result in "clean" closure (i.e., no ongoing responsibility for post-closure care) and DOE may obtain complete closure certification.

C. If the units have had a release, DOE should proceed through the activities outlined II.B above. However, DOE must also remove all contaminated soil affected by the unit unless a demonstration can be made that the contaminated soil cannot practicably be removed (265.197(a)). If this demonstration can be made and soil contaminated by a release from any of these units is left in place, the unit must close as a landfill (265.197(b)). In addition, back-filling a tank and its ancillary equipment with material that effectively and permanently immobilizes any remaining contaminants would be an acceptable means of closure in place. If either contaminated soil or a back-filled tank is left in place, Section I of this attachment, including post-closure requirements, would apply. If the contaminated soils and the tank can be practicably removed and the requirements of II.B.1 or II.B.2 have been accomplished, the unit can be "clean" closed with no ongoing responsibility for post-closure care and DOE may obtain complete closure certification.

D. Closure requirements will not extend to remediation or management of existing ground water contamination from these units except as delineated in I.B.2 above. Existing ground water contamination will be addressed through coordinated RCRA corrective action/CERCLA remedial action, as described in RFCA.

~~E. All closures will be performed in consideration of the Environmental Restoration Ranking (Attachment 4).~~

E. After initially removing hazardous waste inventory from the units, all wastes generated during implementation of a closure action will be considered" remediation wastes" for the purpose of CAMU utilization.

F. All post-closure requirements, including monitoring, maintenance, access control, and security requirements, will be delineated in the Closure Plan, IM/IRA, or CAD/ROD decision document for the unit or waste management area.

III. CDPHE and DOE agree that past decisions regarding IHSSs (or portions thereof) at RFETS subject to closure requirements shall be reviewed (See Attachment 3). Based upon this review, and in consideration of more complete information, it is the expectation of the CDPHE and DOE that several of these IHSSs may not be subject to interim status closure requirements.

CDPHE and DOE have reviewed the information related to the Original Process Waste Lines (OPWL), IHSS 121 of former OU-9. The OPWL network originally consisted of

approximately 35,000 feet of pipeline. Parts of the OPWL were converted to New Process Waste Lines, or other systems. The OPWL system now consists of approximately 29,000 feet of pipeline. CDPHE and DOE agree that the OPWL system was abandoned and not used after November 19, 1980 and therefore is not subject to interim status closure requirements.

IV. CDPHE agrees that tank system interim status units identified in Part II of this Attachment may qualify for closure in accordance with standards that are alternative to the requirements specified in Part II of this Attachment, as provided in revisions to the Colorado Hazardous Waste Regulations, 265.110 (d). CDPHE also agrees that IHSS 101 and/or IHSS 114 identified in Part I of this Attachment may qualify for closure in accordance with these alternative requirements, but more information is needed to make a determination. Because the alternative requirements in 265.110(d) will protect human health and the environment, such qualified interim status units are eligible to be closed in accordance with the performance standard in 265.111 (a) and (b) in lieu of the requirements specified in Parts I and II of this Attachment. Closure in accordance with these alternative requirements will meet the following:

A. Be protective of the wildlife refuge worker to a lifetime excess cancer risk of $1x10^{-5}$ and;

B. Provide that the concentration of contaminants do not result in a Hazard Index (HI) of greater than 1 for a wildlife refuge worker and;

C. Assure that contaminants that exceed the ecological action level for target species, listed in Table 3, Soil Action Levels, in Attachment 5 do not pose an unacceptable hazard considering the target species and the exposure unit for that species, and the location, areal extent, and concentration of contamination.

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PART IV

PROPOSED NEW ATTACHMENT 14 – ORIGINAL PROCESS WASTE LINES SUBSURFACE SOIL APPROACH

November 12, 2002

ORIGINAL PROCESS WASTE LINES (OPWL) SUBSURFACE SOIL APPROACH

The characterization and removal approach for the contaminated soil associated with reported or suspected OPWL leaks and associated valve vaults is defined below.

I. GENERAL

All OPWLs within 3 feet of the surface will be removed. Soil contaminated at concentrations above the surface soil action level for plutonium and americium by any leaks from OPWLs within 3 feet of the surface will be removed to a depth of 3 feet. To minimize the risk of mobilizing and transporting contaminants into subsurface soil, flushing of the OPWL lines is not anticipated or required.

A. All soils associated with OPWLs that are between 3 and 6 feet deep with reported leak locations identified in Section B herein will be directly sampled at the reported leak location. Sampling will consist of biased sampling directly into the soils surrounding the reported leak location. If initial sampling indicates contamination >3nCi/g plutonium, then subsequent sampling locations will be approximately two meters to either side of the reported or suspected leaks and perpendicular to the direction of the piping run, and approximately ten meters on either side of the reported or suspected leaks in the direction of the piping (Step-out sampling approach). Additional soil sampling will be designed to adequately characterize soil contamination to implement the soil risk screen in Attachment 5, "RFETS Action Levels and Standards Framework for Surface Water, Ground Water and Soils" (ALF), Figure 3, based on the initial sample results.

B. OPWL sections where leaks are suspected to have occurred between 3 and 6 feet below the surface but where specific leak locations are not identified in the 700 area will be characterized as outlined in Section C herein. Sample locations are based on OPWL structures with higher leak potential and material of construction. The sampling strategy for Original Process Waste Line (OPWL) Leaks in the 700 Area less than six feet deep with uncertain leak locations is based on the Operable Unit 9

Final Phase I RCRA Facility Investigation/ Remedial Investigation (RFI/RI) Work Plan Dated February 1992. Site walks and interviews were conducted under this work plan in 1994-1995. These identified sampling locations based on the rationale in the RFI/RI work plan. The same locations will be used for sampling sections of the pipeline where the exact location of the leak could not be ascertained. The sections for sampling were selected only in the 700 area because process knowledge supports that these process waste lines were generally the only ones to carry plutonium. Specific sections of OPWL in the 700 area where leaks are suspected are listed in Section C below. The number of initial samples based on the sampling rationale are listed are provided. Additional sample locations will be determined based on the initial sample results and the sampling strategy in accordance with Item 1 above.

C. Characterization in accordance with this attachment and in accordance with the Industrial Area Sampling and Analysis Plan (IA SAP), of under building contamination (UBC), potential areas of contamination (PACs), other Individual Hazardous Substance Sites (IHSSs), and areas between IHSS's that are not yet characterized that overlies OPWLs will provide adequate characterization of soils for all other OPWLs. In addition, the RFETS groundwater monitoring network required by ALF Section 3.4 provides analytical data on the presence and mobility of subsurface soil column contaminants. Action determinations for groundwater contamination are made in accordance with ALF Section 3.3.

D. If plutonium concentration is >10nCi/g between 3 and 6 feet below the surface, after initial sampling, DOE shall propose to remove sufficient radionuclide contamination to at least meet the lesser of excess lifetime cancer risk of $1x10^{-5}$ to the wildlife refuge worker or 3 nCi/g plutonium without additional sampling unless, after consultation, the Lead Regulatory Agency determines that such levels are not reasonably achievable through removal. For soil contaminated with plutonium at concentrations between 3 and 10 nCi/g at depths between 3 and 6 feet below the

surface, the "step-out" sampling approach described in Section I.A will be used to characterize the extent of soil contamination. An accelerated action would be triggered if plutonium contamination exceeds 3nCi/g plutonium in an areal extent in excess of 80 m^2.or if contamination from other contaminants of concern pose a lifetime excess cancer risk greater than $1x10^{-5}$or a Hazard Index >1.

E. An attempt will be made to perform plutonium speciation in the soil contaminated by OPWL leaks at each of 3 locations where known leaks have occurred. This will be done to determine the mobility profile of plutonium in the soil directly around the leaks.

F. DOE will remove valve vaults down to a minimum of 6 feet below the surface. Valve vaults deeper than 6 feet below the surface will be removed to the extent practicable giving due consideration to the safety of workers (there are approximately 30 total valve vaults). DOE will follow the ER RSOP Notification process for valve vault removal. Practicality is based on three aspects, listed in order of priority - safety, technical, and cost/benefit. These aspects are not necessarily independent. For example, while a condition may arise that makes removing a valve vault unsafe or not technically feasible using normal methods, safety or engineering measures could be implemented to complete the job safely. However, the cost may be prohibitive when weighed against the potential benefit to the refuge worker and the environment. Safety considerations are predominantly associated with confined spaces and working in deep excavations. Technical feasibility includes prohibitions of layback due to other structures and groundwater level. The practical approach includes the following:

1. Evaluate conditions for valve vaults deeper than 6 feet to determine if the potential benefit to the refuge worker and the environment justifies the cost. If costs do not justify complete removal, remove the valve vault to a depth of at least 6 feet.

2. Evaluate the need for grouting and back filling the remaining portion of the vault and any associated OPWLs.

G. Once an OPWL or associated valve vault is opened, and where safe and practical, the pipe will be grouted or foamed to minimize the possibility of mobilizing contamination inside the OPWL.

II. Characterization of Original Process Waste Line Reported Leaks - Less Than 6 Feet Deep

700 Area Leaks:

1) **Leak Designation:** P14-1
Material of Construction/Diameter: 3-inch Saran lined steel pipe inside a 10-inch vitrified clay pipe
Depth: Approximately 3 feet
Leak Description: Acid leaks at Intersection of P-12 and P-14.

2) **Leak Designation:** P-19-1
Material of Construction/Diameter: 3-inch stainless steel
Depth: Approximately 3.5 feet
Leak Description: Valve vault northeast of Building 707 identified as location of a leak.

3) **Leak Designation:** P-20-1
Material of Construction/Diameter: 3-inch stainless steel
Depth: Approximately 4 feet
Leak Description: Reported Release at intersection of P-20 and P-21

4) **Leak Designation:** P-20-2
Material of Construction/Diameter: 3-inch stainless steel
Depth: Approximately 4 feet
Leak Description: Valve vault northeast of Building 707 identified as location of a leak.

5) **Leak Designation:** P-23-1
Material of Construction/Diameter: 10-inch fiberglass or stainless steel pipe
Depth: Approximately 5 feet
Leak Description: Reported release at Tank T-8

6) **Leak Designation:** P-27-1
Material of Construction/Diameter: 3-inch cast iron pipe
Depth: Approximately 6 feet
Leak Description: Reported release at intersection of P-27 and P-28.

7) **Leak Designation:** P-27-5
Material of Construction/Diameter: 3-inch cast iron pipe
Depth: Approximately 6 feet
Leak Description: Leak south of road on July 21, 1980. Process wastewater flowed through a 30 foot culvert along fence and around to north side of Building 774 where it ended up in Bowman's Pond. Approximately 1,000 gallons leaked. Sampling

indicated 2,500 pCi/L total alpha, 4,000 pCi/L total beta, 10,000 mg/L nitrate and a pH of 12.

8) **Leak Designation:** P-29-1
Material of Construction/Diameter: 4-inch cast iron and 4-inch stainless steel pipe
Depth: Approximately 5 feet
Leak Description: Area around Tanks T-14 and T-16 reported as area of release.

9) **Leak Designation:** P-34-1
Material of Construction/Diameter: 4-inch stainless steel or steel pipe
Depth: Approximately 3.5 feet
Leak Description: Reported release at intersection of P-33 and P-34.

10) **Leak Designation:** P-34-2
Material of Construction/Diameter: 4-inch stainless steel or steel pipe
Depth: Approximately 3.5 feet
Leak Description: Reported release at intersection of P-25 and P-34.

11) **Leak Designation:** P-34-3
Material of Construction/Diameter: 4-inch stainless steel or steel pipe
Depth: Approximately 3.5 feet
Leak Description: Reported release in area of T-15 and T-17.

12) **Leak Designation:** P-36-1
Material of Construction/Diameter: 3-inch PVC and stainless steel pipe
Depth: Approximately 4 feet
Leak Description: Release reported at intersection of P-36 and P-20.

13) **Leak Designation:** P-36-2
Material of Construction/Diameter: 3-inch PVC and stainless steel pipe
Depth: Approximately 4 feet
Leak Description: Release reported at valve vault west of Pond 207A

14) **Leak Designation:** P-37-3
Material of Construction/Diameter: 3-inch steel, PVC, and vitrified clay pipe (might be two lines)
Depth: Approximately 4.5 feet
Leak Description: Valves north of Building 777 were found to be leaking at a rate of 25 gallons per hour at 20 psig during leak testing.

15) **Leak Designation:** P-42-1
Material of Construction/Diameter: 3-inch cast-iron or stainless steel pipe
Depth: Approximately 3.5 feet
Leak Description: Reported release at intersection of P-42 and P-37.

16) **Leak Designation:** P-42-3
Material of Construction/Diameter: 3-inch cast-iron or stainless steel pipe
Depth: Approximately 3.5 feet
Leak Description: Valves on south side of Tank T-29 (207) were reported to be leaking.

17) **Leak Designation:** P-43-1
Material of Construction/Diameter: 3-inch stainless steel pipe
Depth: Approximately 3.5 feet
Leak Description: Leak reported at valve vault north of Tank T-29 (207)

18) **Leak Designation:** P-43-2
Material of Construction/Diameter: 3-inch stainless steel pipe
Depth: Approximately 3.5 feet
Leak Description: Leak reported at valve vault southwest of Tank T-29 (207)

Leaks Outside of 700 Area:

19) **Leak Designation:** P-4-1
Material of Construction/Diameter: 4-inch cast iron
Depth: Approximately 3.5 feet
Leak Description: Leak at intersection of P-4 and Tank T-3

20) **Leak Designation:** P-4-2
Material of Construction/Diameter: 4-inch cast iron
Depth: Approximately 4 feet

Leak Description: Leak at intersection of P-4 and P-6. There is a manhole at this location that is eight feet deep.

21) **Leak Designation:** P-4-8
Material of Construction/Diameter: 4-inch cast iron
Depth: Approximately 3.5 feet
Leak Description: Leak 30 feet east of driveway south of Building 441

22) **Leak Designation:** P-4-12
Material of Construction/Diameter: 4-inch cast iron
Depth: Approximately 3.5 feet
Leak Description: Leak at check valve south of Building 441

23) **Leak Designation:** P-4-18
Material of Construction/Diameter: 4-inch cast iron
Depth: Approximately 3.5 feet
Leak Description: Leak 31 feet east of driveway behind Building 441. This cis likely in the same area as P4-8 above and could be the same leak.

24) **Leak Designation:** P-4-19
Material of Construction/Diameter: 4-inch cast iron
Depth: Approximately 3.5 feet
Leak Description: Leak reported 94 feet east of driveway behind Building 441

25) **Leak Designation:** P-5-1
Material of Construction/Diameter: 4-inch cast iron
Depth: Approximately 3.5 feet
Leak Description: Leak occurred 8 feet inside fence towards Building 444

26) **Leak Designation:** P-5-2
Material of Construction/Diameter: 4-inch cast iron
Depth: Approximately 3.5 feet
Leak Description: Possible leak found from leak test eight feet out from Building 444.

27) **Leak Designation:** P-40-2
Material of Construction/Diameter: 6-inch fiberglass line
Depth: Approximately 5 feet
Leak Description: Leak reported at settling tank near B-2 pond. This line has been removed in this area.

C. Characterization of Original Process Waste Line Suspected Leaks in the 700 Area Less Than Six Feet Deep

Leaks at Uncertain Locations

The following locations represent leaks that could not be concisely located.

1) **Leak Designation:** P14-2, P-14-4
Material of Construction/Diameter: 3-inch Saran lined steel pipe inside a 10-inch vitrified clay pipe
Depth: Approximately 3 feet

Leak Description:
P-14-2: Acid leaks at intersection of P-12 and P-14

P-14-4: Substantial leaks at elbow connections during use as a result of expansion from steam condensate from Building 881

Initial Sampling Locations: 2

2) **Leak Designation:** P14-3, P14-7
Material of Construction/Diameter: 3-inch Saran lined steel pipe inside a 10-inch vitrified clay pipe
Depth: Approximately 3 feet

Leak Description:
P-14-3: Entire line has been reported as an area of a reported release.
P-14-7: 1,350 gallons of laboratory and laundry waste including enriched uranium and nitrate lost during a transfer from Building 881

Initial Sampling Locations: 7

3) **Leak Designation:** P14-5
Material of Construction/Diameter: 3-inch Saran lined steel pipe inside a 10-inch vitrified clay pipe
Depth: Approximately 3 feet

Leak Description: Leak occurred during relocation of the line for the construction of Building 777. Excavation was completed in parking lot 776 (Building 707). Spilled wastewater was pumped into a ditch.

Initial Sampling Locations: 1

4) **Leak Designation:** P14-6
Material of Construction/Diameter: 3-inch Saran lined steel pipe inside a 10-inch vitrified clay pipe
Depth: Approximately 3 feet

Leak Description: A substantial leak occurred on December, 1958 at south elbow and flowed through containment to north 45-degree elbow and into a ditch. Location of north 45-degree elbow is not known.

Initial Sampling Locations: 0 (This will be sampled with No. 1 above)

5) **Leak Designation:** P-26-1, P-26-2
Material of Construction/Diameter: 1.5- inch PVC or stainless steel and a second PVC Pipe of unknown diameter
Depth: Approximately 3 feet

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Leak Description:
P-26-1: Entire Pipeline reported as an area of known release.
P-26-2: Contractor broke a plastic line running form Solar Ponds to Building 774.

Initial Sampling Locations: 8

6) **Leak Designation:** P27-2, P-27-3, P-27-4
Material of Construction/Diameter: 3-inch cast iron pipe
Depth: Approximately 6 feet

Leak Description:
P-27-2: Entire line was identified on a map as an area of a reported release.
P-27-3: A leak of 14 gallons per hour was measured. Some leaking was attributed to leaky valves. Test probing for nitrous oxide leaks revealed several major leaks.
P-27-4: An investigation of the process waste line revealed that bell and spigot joints failed because of road excavation activities.

Initial Sampling Locations: 5

7) **Leak Designation:** P-29-2
Material of Construction/Diameter: 4-inch cast iron and 4-inch stainless steel pipe
Depth: Approximately 5 feet

Leak Description: A leak of 45 gallons per hour at a pressure of 20 psig detected during a 1971 leak test.

Initial Sampling Locations: 1

8) **Leak Designation:** P-37-2
Material of Construction/Diameter: 3-inch steel, PVC, and vitrified clay pipe (might be two lines)
Depth: Approximately 4.5 feet

Leak Description: North half of line west of Pond 207A has been reported as an area of release.

Initial Sampling Locations: 3

9) **Leak Designation:** P-41-1
Material of Construction/Diameter: 2 and 3-inch vitrified clay, black-iron, and stainless steel pipe
Depth: Approximately 5 feet

Leak Description: Pipeline west of Building 779 identified as an area where a release occurred.

Initial Sampling Locations: 3

10) **Leak Designation:** P-42-2
Material of Construction/Diameter: 3-inch cast-iron or stainless steel pipe
Depth: Approximately 3.5 feet

Leak Description: Area around Building 779 was reported to have a pipeline release.

Initial Sampling Locations: 2

11) **Leak Designation:** P-44-3
Material of Construction/Diameter: 3-inch steel pipe
Depth: Approximately 3.5 feet

Leak Description: Pipeline in area east of Building 703 reported to have a leak.

Initial Sampling Locations: 2

12) **Leak Designation:** P-45-1
Material of Construction/Diameter: 6-inch vitrified clay pipe
Depth: Approximately 3.5 feet

Leak Description: Releases have been reported on west end of pipe.

Initial Sampling Locations: 4

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Figures

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PUBLIC REVIEW DRAFT – REDLINE VERSION

RFCA Attachment 5 Proposed Modification

Revision Key:

- ✓ Text proposed for deletion is lined through (e.g., ~~deleted text~~).
- ✓ New text is shown in bold, (e.g., **bold**).
- ✓ Where entire section, figure or table is proposed for deletion it has been removed, rather than lined through, for simplicity.
- ✓ Pagination does not match original.

1.0 GENERAL BACKGROUND

1.1 Goal of Action Levels and Standards Framework

During negotiations that resulted in the Final Rocky Flats Cleanup Agreement (RFCA), a working group consisting of the Department of Energy (DOE), the Environmental Protection Agency (EPA), the Colorado Department of Public Health and Environment (CDPHE), and Kaiser-Hill teams was formed to develop a consensus proposal for the appropriate cleanup standards **for surface water** and action levels **for all media** that should apply to the Rocky Flats Environmental Technology Site (RFETS **or Site**). **The working group developed** this Action Levels and Standards Framework for Surface Water, Ground Water, and Soil (ALF) **as its** final recommendation **in 1996 and several modifications were subsequently proposed, approved and incorporated into ALF. ALF was** developed in a manner generally consistent with the Rocky Flats Vision (Vision) and Rocky Flats Cleanup Agreement (RFCA) Preamble Objectives. In some cases, the working group found it necessary to more precisely define aspects of the objectives so that applicability of action levels and required mitigating actions could be completely defined.

The goal of the ALF is to:

- provide a basis for future decision-making;
- define the common expectations of all parties; and
- incorporate land- and water-use controls into Site cleanup.

The Parties have determined that a National Wildlife Refuge is the reasonably anticipated future land use for the purpose of making cleanup decisions. This determination is based upon the assumption that a National Wildlife Refuge will be established in accordance with the Rocky Flats National Wildlife Refuge Act of 2001 (Refuge Act). This determination is also consistent with the RFCA Preamble and RFCA Vision land use assumptions. As a National Wildlife Refuge, the Parties assume that the Site will remain in federal ownership, and the surface will be managed as a

Refuge where possible. Residential use is not recognized as a reasonably anticipated future land use. However, the rural resident exposure scenario was evaluated for the purposes of establishing risk-based surface soil action levels for plutonium, americium and uranium. A rural resident exposure scenario was also used to calculate the annual radiation dose under unrestricted land use conditions in order to ensure that the risk-based action levels meet radiation control standards.

This ALF establishes action levels for groundwater and soil, action levels and cleanup standards for surface water and put-back levels for soil. Action levels are numeric levels that, when exceeded, trigger an action determination evaluation in accordance with ALF Sections 2-5 and an appropriate accelerated response action. In some cases, concentrations of contaminants below action levels may also trigger an accelerated action (e.g., cleanup of soils contamination that is below soil action levels, but that may impact surface water quality).

A standard is an enforceable narrative and/or numeric restriction established by regulation and applied so as to protect one or more existing or potential future uses. Within this framework, standards are associated with surface water use classifications and applied at points of compliance (POCs). Surface water standards are not being directly applied to ground water or soils; instead, contaminated soils and groundwater are evaluated to determine whether they may adversely impact surface water quality.

Put-back levels apply to soils that contain contaminants at levels that do not trigger an accelerated action, but that are excavated incidental to the conduct of accelerated actions. Put-back levels also apply to soils that have been treated to remove contaminants to below action levels as provided in an accelerated action decision document. DOE is allowed to replace these soils back into the ground if the contaminant concentration does not exceed the action levels listed in Table 3. Soils may be replaced into the ground only in the same Operable Unit (OU), as identified in RFCA Attachment 1, *Operable Unit Consolidation Plan* table of Proposed OU's for consolidation, in which they originated. DOE may, with LRA approval after appropriate consultation, replace excavated soils with contaminant concentrations greater than the put-back levels. In such cases decision factors to be considered include remedy effectiveness and protectiveness, reasonably anticipated future land uses, contaminant levels in surrounding soils, potential for contaminants to affect surface water quality, and costs. Decisions resulting in soil put-back will be recorded in the appropriate closeout report.

Action levels are risk-based and risk is considered additive when multiple **contaminants** are present. **Radiological and non-radiological effects** will be assessed independently on a project-specific basis using methodology that is protective of human health and the environment. The cumulative **radiological and non-radiological** effects will be assessed on a project-specific basis if the **concentrations** are near their respective action levels.

Following implementation of accelerated actions, final remedial/corrective action decisions, including final cleanup levels will be determined in a Corrective Action Decision/Record of Decision (CAD/ROD). The final remedial/corrective actions specified in a CAD/ROD may require additional work based on the final cleanup levels to ensure an adequate remedy.

1.2 Programmatic Assumptions

The working group developed this framework using the following inter-related programmatic or Site-Wide assumptions:

- The framework must be consistent with the Vision and RFCA Preamble;
- Implementation of the framework must protect human health and the environment; and
- Implementation of the framework must protect surface water uses and quality.

Institutional controls will be part of the final remedy as appropriate to ensure protection of human health and the environment. The need for, and extent of, specific institutional controls and other activities that have collectively become known as "long term stewardship" will be analyzed in the RCRA Facility Investigation-Remedial Investigation/Corrective Measures Study-Feasibility Study. These other activities include such things as monitoring, maintenance, information management, and remedy review. Appropriate requirements for institutional controls and other long-term stewardship activities will be described as part of the preferred alternative in the Proposed Plan. Such requirements will be contained in all final CAD/ROD(s), in any post-closure CHWA permit that may also be required and in any modified RFCA agreement, consistent with RFCA Paragraph 286.

While the selection of individual institutional controls is dependent upon the final remedy selected, and therefore cannot be known at this time, the following institutional controls will be used as appropriate to protect human health and the environment:

- **prohibition of construction and use of buildings in contaminated areas;**
- **prohibition on drilling wells for water use into contaminated groundwater, the use of contaminated groundwater and/or pumping groundwater that could adversely affect the remedy;**
- **restrictions on excavation in areas above subsurface contamination or intrusion into subsurface contamination;**
- **restrictions on activities that cause soil disturbance in areas with surface soil contamination; and**
- **other restrictions to protect engineered controls (such as covers, groundwater barriers and treatment cells) and monitoring systems.**

The anticipated extent of areas with institutional controls at closure is shown in Figure 1. The anticipated boundary of areas that will be subject to institutional controls depicted in Figure 1 is subject to modification based upon characterization, future response actions, the results of the comprehensive risk assessment, and the final remedial/corrective action decision in the final CAD/ROD. The Parties additionally presume that there will be no residential development at Rocky Flats.

Section 25-15-320, C.R.S., requires an environmental covenant under certain conditions. As of October 2002, the Parties have not reached agreement on the applicability of this statute to the federal government. Failing an agreed-upon resolution, each Party reserves its rights as provided in RFCA Part 18.

1.3 Action Prioritization and Implementation

Accelerated actions will be **supportive of the** Intermediate and Long-Term Site Conditions as discussed in the RFCA Preamble **and to the extent practicable, will contribute to the efficient performance of any anticipated long-term remedial actions.** Protection of all surface water uses with respect to fulfillment of the Intermediate and Long-Term Site Conditions will be the basis for making soil and ground water **accelerated action** decisions. **Accelerated** actions will **also** be designed to prevent adverse impacts to ecological resources and ground water consistent with the ALF. Because the ALF does not address the inherent value of ground water, any residual effects on ground water not addressed through this Framework will be addressed under a Natural Resources Damage Assessment (NRDA).

Response action decisions may be implemented by means of an accelerated action (Proposed Action Memorandum [PAM], Interim Measure/ Interim Remedial Action [IM/IRA], or RFCA Standard Operating Protocol [RSOP]) or addressed as necessary in the CAD/ROD for the affected area. Actions will be

developed in an integrated manner with other actions being taken and will be consistent with best management practices.

2.0 SURFACE WATER

2.1 Basis for Standards and Action Levels

Protection of surface water will be a basis for making soil and groundwater **accelerated response action decisions pursuant to ALF Sections 3-5**, so that at the completion of all cleanup activities, surface water leaving RFETS should be of sufficient quality to support all uses. The surface water standards this framework is designed to protect are found in the WQCC Regulation No. 31: Basic Standards and Methodologies for Surface Water (5 CCR 1002-31) ("Basic Standards") and the site-specific water quality standards in the WQCC Regulation No. 38 (5 CCR 1002-38) ("Site-Specific Standards").

The Colorado Water Quality Control Commission (WQCC) determines water quality standards throughout Colorado. Local municipalities, including Westminster, Broomfield, Thornton, and Northglenn, have been and will be involved and consulted in surface water decisions, including recommendations to the WQCC.

- **Surface water exists in creeks and ponds on RFETS as well as immediately offsite. These surface waters are part of Segments 4a/4b and 5 of Big Dry Creek as follows:**
- **Segment 4a – Mainstem and all tributaries to Woman Creek and Walnut Creeks from the sources to Standley Lake and Great Western Reservoir, except for specific listings in Segments 4b and 5;**
- **Segment 4b – North and South Walnut Creek and Walnut Creek, from the outlet of Pond A-4 and B-5 to Indiana Street;**
- **Segment 5 – Mainstems of North and South Walnut Creek, including all tributaries, lakes, and reservoirs, from their sources to the outlets of Ponds A-4 and B-5, on Walnut Creek, and Pond C-2 on Woman Creek.**

See Figure 2, *Sketch of Stream Segments 4a, 4b, and 5.*

~~Surface water exists in Areas 2,3, and 4 on Figure 1, as well as immediately off-site. The standards, action levels, and POCs are based on the following refinement of land uses (assuming current pond water transfer configurations):~~

- ~~Area 2 (restricted open space) will include all surface water down to, and including, the terminal ponds (Ponds A-4 and B-5) in Walnut Creek. For Woman Creek, only Pond C-2 is in Area 2. Therefore, the surface water in Area 2 is consistent with Segment 5 of Big Dry Creek.~~

- ~~Areas 3 and 4 (unrestricted open space and restricted open space due to low levels of surficial plutonium contamination, respectively) will include the streams from the terminal ponds to the plant boundary in Walnut Creek and all of Woman Creek except Pond C-2. The surface water in Areas 3 and 4 is part of Segment 4a/4b of Big Dry Creek.~~

2.2 Numeric Levels During Active Remediation (Near-Term Site Condition)

During the period of active remediation, the Table 1 values will apply as standards in Segment 4a/4b of Big Dry Creek and as action levels in Segment 5.

A. Non-radionuclides

1. The numeric values that will apply throughout both stream segments are based on Colorado surface water use classifications consistent with the uses described in the RFCA Preamble:
   - Water Supply;
   - Aquatic Life - Warm 2;
   - Recreation 2; and
   - Agricultural.
2. Numeric values will be derived from the following:

   a. For metals, the site-specific standards or the basic standards apply, except where temporary modifications apply. If the basic and site-specific standards differ for a particular metal, the site-specific standard applies.
   b. For inorganics, the site-specific standards apply or the basic standards apply, except where temporary modifications apply. If the basic or site-specific standards differ for a particular inorganic, the site-specific standard applies.
   c. For organic chemicals, the more stringent of the basic standards or the site-specific standards applies, except where temporary modifications apply.
3. Effective March 2,1997, MCLs were adopted as temporary modifications for six organic compounds in Segment 5. These temporary modifications of surface water standards were granted through the year 2009 by the WQCC and must be re-examined every three years. Other temporary modifications to the numeric values during active remediation may be developed through subsequent working group efforts.

   a. The basis for proposing the temporary modifications may include one or more of the following:

- A determination of ambient conditions in a manner consistent with the Basic Standards (5 CCR 1002-3 1);
- A mass-balance equation that calculates maximum influent concentrations in Segment 5 that will be protective of numeric values at Segment 4a/4b POCs without allowing treatment within waters of the State; and
- Some other methodology agreed to by all Parties.

b. These temporary modifications should be developed together with other stakeholders (i.e., the local municipalities that are impacted by surface water from the RFETS).

4. Any contamination in surface water resulting from releases from a unit at RFETS subject to RCRA interim status requirements will be addressed through this ALF and through remedial actions rather than through RCRA closure (see Attachment 10 to RFCA, RCRA Closure for Interim Status Units). This would include surface water containing nitrates that has been impacted by the Solar Ponds ground water plume. Addressing the nitrates through this framework will allow these waters to be managed in a more cost-effective and flexible manner. The Parties recognize that changes in the management of nitrates may cause the surface water to more routinely approach the current 10 mg/L standard at the POC.

5. Due to detention and batch release operations of Pond A-4 and Pond B-5 waters, exceedance of the numerical pH of 9.00 occurs. Both the wastewater treatment plant effluent and storm water inflows to the ponds have pH values within the numerical range of 6.5 to 9.00 prior to detention in Pond B-5 and A-4; however, the nutrient loading to the ponds promotes algae growth which can shift carbonate equilibria. These conditions cause pH exceedance above 9.00 (with a calculated 85th percentile value of 9.10). All parties agree that aquatic use is likely not impacted by pH exceedances; however, the DOE will strive to control pH in the pond waters through prudent pond water management.

B. Radionuclides

1. Numeric values for plutonium and americium for Segments 4a/4b and 5 are risk-based ($1x10^{-6}$ **lifetime excess cancer risk** from direct exposure including consumption). These values are the statewide basic standards, effective March 2, 1997, as set by the WQCC.

2. Both radionuclides will be analyzed separately, and compared to the numeric value below:
   - 0.15 pCi/L for plutonium and

- 0.15 pCi/L for americium.

There is no total pCi/L limit.

3. The Parties agree that in the event that the plutonium and americium numerical standards are exceeded, the DOE will make every effort to identify the source of the exceedance. This will include documenting: hydrologic characteristics; preventive actions, terminal pond operational parameters; and any abnormal conditions and occurrences. Further, specific decisions regarding the terminal pond operations and the release of water will be guided by the Pond Operations Plan. This plan includes specific responses for identified circumstances and preserves dam safety. DOE shall have the burden to demonstrate prudent pond water management and strive to maintain the lowest detained volume practicable in the terminal ponds.

4. In Segments 4a/4b and 5, numeric values for gross alpha, gross beta, tritium and uranium will be the site-specific standards found in Table 2 of 5 CCR 1002-8-38. Numeric values for radium and strontium are based on the statewide Basic Standards (5 CCR 1002-31.11). The Parties will re-examine these values based upon conditions in the basins and will propose alternative values if appropriate.

C. POCs/~~Action Level Measuring Points~~ **Points of Evaluation (POEs)**

1. In Segment 4a/4b, POCs will be placed at the existing sampling locations for the outfalls of the terminal ponds (Ponds A-4, B-5, and C-2) in both Walnut Creek and Woman Creek. Additional POCs for plutonium **and** americium ~~and tritium~~ will be established near where Indiana Street crosses Walnut and Woman Creeks. In the event that exceedances simultaneously occur for either plutonium **or** americium ~~or tritium~~ at both the Indiana Street POC and the associated Terminal Pond POC, then this occurrence will be treated as a single enforcement action. As conditions at the RFETS change, the locations of the POCs may need to change. Such changes can be made by agreement of the Parties pursuant to Part 9 of RFCA.

2. In Segment 5, exceedance of action levels will be measured ~~in the ponds~~ **at POEs** upstream in the main stream channel at existing gauging/sampling stations or at additional sampling locations in the main stream channel as necessary. **POEs will be identified in the Integrated Monitoring Plan. A POE in Segment 5 will be established below the v-notch weir following the Sewage Treatment Plant disinfection process. At the POE below the v-notch weir, plutonium, americium and**

uranium will be monitored. When Sewage Treatment Plant operations cease, this POE will be eliminated.

3. Compliance will be measured using a 30-day moving average for those contaminants for which this is appropriate. When necessary to protect a particular use, acute and chronic levels will be measured differently as described in the current Integrated Monitoring Plan.

4. **Compliance will be measured for plutonium and americium using an annual average at the existing POCs at the outfalls of the terminal ponds (Ponds A-4, B-5, and C-2) in both Walnut Creek and Woman Creek contingent upon WQCC adoption of an annual average period. CDPHE shall take action to obtain WQCC adoption of the annual average period. During active remediation, compliance will continue to be measured for plutonium and americium using a 30-day moving average at the existing POCs near where Indiana Street crosses Walnut and Woman Creeks.**

5. **Performance monitoring points are Segments 4a/4b and 5 in-stream locations identified in any accelerated action decision document and/or in any CAD/ROD where surface water is sampled to determine whether the concentration of any contaminant identified for sampling in the response action meets specified water quality objectives. Such performance monitoring may be incorporated into the Integrated Monitoring Plan after the response action is implemented.**

2.3 Numeric Levels After Active Remediation (Intermediate and Long-Term Site Conditions)

When the Intermediate Site Condition is achieved following completion of active remediation, the surface water must be of sufficient quality to support any surface water use classification in both Segments 4a/4b and 5. All final remedies must be designed to protect surface water for any use as measured at the nearest and/or most directly impacted surface water in Segments 4a/4b and 5. Interim remedies will be consistent with this as a goal. Any temporary modifications will be removed. POCs will be at the outfalls of the terminal ponds and near where Indiana Street crosses both Walnut and Woman Creeks. **Compliance will be measured for plutonium and americium using an annual average at the existing POCs at the outfalls of the terminal ponds (Ponds A-4, B-5, and C-2) in both Walnut Creek and Woman Creek. However, compliance will be measured for plutonium and americium using a 30-day moving average at the existing POCs near where Indiana Street crosses Walnut and Woman Creeks.** If the terminal ponds are removed, new monitoring and compliance