RFCA Stakeholder Focus Group
Meeting Agenda

When: **November 8, 2000, 4:30 - 6:30 p.m.**

Where: **Broomfield Municipal Hall, Bal Swan and Zang's Spur Rooms**

4:30 Introductions and Agenda Review

4:40 RSALs Process Review - Reed Hodgin

4:50 RSALs Regulatory Framework Presentation - Tim Rehder

5:10 Understanding the RSALs Regulatory Framework - Group Discussion

6:00 ALARA Concepts and Agency Understandings - Agencies

6:10 How Will the Water Discussion Proceed? - Steve Gunderson

6:20 Topics for Upcoming Meetings

6:30 Adjourn

RFCA Stakeholder Focus Group
Attachment A

Title:	Agenda for November 8, 2000 Focus Group Meeting
Date:	October 23, 2000
Author:	C. Reed Hodgin AlphaTRAC, Inc.
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

ADMIN RECORD

S[redacted]

RFCA Stakeholder Focus Group
November 8, 2000
REVISED Meeting Minutes

INTRODUCTION AND ADMINISTRATIVE

Reed Hodgin began the meeting explaining that the meeting room would again be arranged as an open square table to foster better communication among the participants. Those who wished to join the conversation were asked to sit around the table; those who attended the meeting to answer technical questions or to observe were seated behind and around the square.

A participants list for the November 8, 2000 RFCA Stakeholder Focus Group meeting is included in this report as Appendix A.

Reed reviewed the Focus Group purpose.

The October 11, 2000 RFCA Stakeholder Focus Group meeting minutes were reviewed and approved.

Reed presented the schedule of Focus Group meetings to address the Radioactive Soil Action Level (RSAL) Review (Appendix B). The RSAL review will dominate the agendas for the Focus Group through mid-May, 2001.

Reed reviewed the agenda for this meeting. Mary Harlow, City of Westminster, asked for time to make a presentation of the proposed Rocky Flats Cleanup Agreement (RFCA) project peer review process that she had developed at the request of the Focus Group. The Focus Group agreed.

RFCA PROJECT PEER REVIEW PROCESS

Mary Harlow, City of Westminster, presented a proposed peer review process for the RFCA regulators' review of the interim RSALs for Rocky Flats (Appendix C). The draft process had been developed with the assistance and concurrence of several other Focus Group members.

1/11

Mary proposed that the peer review panel review five technical documents to be prepared by the regulators:

- Regulatory Analysis,
- Model Evaluation,
- Parameter Evaluation,
- New Scientific Information, and
- Draft RSAL Document.

She presented a draft review process, in which the peer reviewers and the RFCA Focus Group would receive draft documents in parallel for review. The review period would be 30 days for most documents. The peer review panel would submit written comments to the regulators, which would respond in writing. The comments and responses would be discussed at subsequent RFCA Focus Group meetings.

Mary proposed that an honorarium be provided to each peer reviewer, with half of the remuneration at the beginning of the review and half at the end. She also proposed that penalties be assessed for missed deadlines, and that incidental expenses be paid as additional direct costs.

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- Competence in the specific task areas,
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Mary recommended that five scientists who conducted a review of the Risk Assessment Corporation review of RSALs be considered as candidates. Mary will send resumes for these scientists to any interested Focus Group members.

Mary suggested as a next step that the draft review process be designed in detail and that contracts be issued through the Rocky Flats Citizens Advisory Board. Mary asked that if anyone was interested or knows of anyone interested in participating in the peer review process, to give the name and contact information to Christine Bennett of AlphaTRAC, Inc.

A group discussion followed Mary's presentation.

John Marler (RFCLOG) indicated that the peer review might be more useful during the analysis of As Low As Reasonably Achievable (ALARA) provisions, since there would be more latitude for choices in this area as opposed to the requirements analysis.

It was suggested that, in addition to the technical reviewers, a technical advisor might be needed for the Focus Group. This advisor would attend Focus Group meetings and act as an independent source of information about the RSAL review.

The Focus Group agreed that a peer review process should be put into place. Mary asked that a working group be put together to draft a peer review scope of work and submit names of scientists who may want to join the panel. The following Focus Group members volunteered to prepare the detailed plan:

- Tim Rehder
- John Marler
- Ken Korkia
- Mary Harlow
- Tom Marshall
- **Victor Holm**
- Shirley Garcia
- Carol Lyons
- LeRoy Moore
- Jeremy Karpatkin

Jeremy Karpatkin indicated that the schedule for the peer review process may necessitate extending the overall schedule for the RSAL review. Joe Legare stated that the U. S. Department of Energy (DOE) would provide funding for the peer review.

RSALS REGULATORY FRAMEWORK

Tim Rehder, EPA, presented a draft analysis of the regulatory framework for the RSALs (Appendix D). His presentation included six topics:

- Draft EPA Rule,
- Rationale Behind Current RSAL,
- Change in Regulatory Landscape,
- Land Use and Institutional Controls,
- ALARA, and
- Options.

Tim summarized the draft EPA rule (since withdrawn) on which the interim RSAL were based:

- Sites to be cleaned up so that dose to public <= 15 mRem/yr
- If institutional controls play a part in the remedy, then residual contamination must be reduced so that dose to public is <= 85 mRem/yr in the event of control failure.

Tim then discussed the rationale behind the interim RSAL now in place. Anticipated future land use scenarios were developed (an office worker in a commercial reuse setting and an open space user). An unanticipated future land user was also hypothesized (suburban resident). Doses from contaminated soil were modeled using the RESRAD dispersion model to project soil contamination levels that would produce the limiting doses. The results were summarized as:

- 15 mRem Dose to Anticipated Future User
  - Office Worker (562 pCi/g)
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- Suburban Resident (651 pCi/g)

Tim indicated that there had been three major changes in the regulatory framework since the interim RSAL was instituted. The EPA rule was withdrawn. The U. S. Nuclear Regulatory Commission (NRC) promulgated a relevant rule:

- Clean sites so dose to public is <= 25 mRem/yr (plus ALARA)
- Residual contamination reduced so dose to public <= 100/500 mRem/yr in the event of Institutional Control failure. Residual Contamination is ALARA

The U. S. Environmental Protection Agency (EPA) provided guidance:

- Dose limits in the NRC Rule may not be protective.
- CERCLA Risk Range of 10-4 to 10-6 should be used for developing action levels.
- If a dose limit is used to develop action level, it should generally be 15 mRem/yr.
- Cleanups must protect human health and the environment and must comply with ARARs

Tim then discussed land use and institutional controls. He presented three perspectives – institutional controls as envisioned within RFCA, the EPA policy, and the Perspective in the NRC rule:

- RFCA envisioned Institutional Controls to assure the anticipated land user (reuse worker, and open space user).
- EPA Policy: cleanup levels consistent with reasonably anticipated future land use (with an emphasis on "reasonably anticipated").
- NRC Rule prefers unrestricted use, but allows for restricted release in conjunction with institutional controls.

Next discussed was the concept of ALARA, brought into the picture through the NRC rule. Tim made four points with regard to ALARA:

- Historically the concept has been applied to worker safety.

- NRC has draft guidance for how ALARA should be used in cleanup applications.
- Some precedent at other sites.
- RFCA Vision states "where possible the site will be cleaned to maximum extent feasible".

Tim stated that applying the ALARA principle to cleanup sites is a relatively new concept in regulatory practice. One approach has been to apply a dollar value to each unit of dose averted.

Tim stated that the RFCA parties had identified four draft options for an RSAL regulatory framework at Rocky Flats:

1. 25 mRem to anticipated future user/100 mRem to unanticipated future user
2. Single value in risk range for anticipated future user compared to 25 mRem to anticipated future user
3. 25 mRem to unanticipated future user
4. 15 mRem to anticipated future user.

Option 1 is based on the approach used in the draft EPA rule that formed the basis for the interim RSAL.

In option 2, a single value would be chosen from the CERCLA risk range. An RSAL would be determined that was equivalent to this risk level. The more restrictive of RSALs based on the risk value or 25 mRem to the anticipated future user would be adopted.

Option 3 develops an RSAL based on a 25 mRem dose to an unanticipated future user (the suburban resident), while Option 4 is based on a 15 mRem dose to an anticipated future user (the open space user).

UNDERSTANDING THE RSALS REGULATORY FRAMEWORK – GROUP DISCUSSION

Reed asked the RFCA Parties to define desired outcomes from the group discussion on the RSALS regulatory framework. Each agency responded:

DOE:
- Feedback on specific elements of the regulatory analysis
- Points of clarification
- Are we on track? Did we bring the discussion home?
- Were there key areas that you're aware of that we failed to address?
- Next draft is 1/3/01. What do we need to know to make it better?

CDPHE
- Are we addressing the right issues in this draft?
- Have we failed to cover some?
- We have to examine the feasibility of cleanup to protect an unrestricted suburban resident scenario.
- If there are errors in the draft, we need to identify where they are, what they are, and why they are wrong.

EPA
- Our needs are covered above - nothing to add.

David Abelson and Ken Korkia presented a list of questions and issues regarding the RSAL Regulatory Analysis. They identified the following questions and issues:

1) ARARs:

- What is the distinction between applicable, relevant and appropriate?
- Is there a hierarchy among these three concepts, i.e., is applicable something you **must** consider, whereas relevant and appropriate are things you have **discretion** to consider?

- **Scenario Development:** *The NRC rule clearly states a preference to cleaning up sites to a level that allows for unrestricted use. The rule provides that the agency*

must clean up to 25 mRem with institutional controls if cleanp to unrestricted use is not feasible.

- Do the RFCA parties agree with this interpretation of the NRC rule?
- Why do the agencies appear to reject this precept by not endorsing the third option outlined in EPA's regulatory analysis?
- How do the agencies justify selectively not considering this as part of the NRC rules?
- Is there an interpretation of ARARs that justifies this decision?

3) Risk vs Dose:

1. What methodology will be used to determine which approach is best?

- If a risk approach is used, how will decisions be made to select a value within the 10^{-4} to 10^{-6} risk range?
- Why is EPA Region VIII considering the 25 mRem number, when EPA as a whole appears to disagree with the number?

4) ALARA:

- How will ALARA analysis be used?
- What is NRC's interpretation of ALARA?
- What does CERCLA have to say about ALARA?
- What is DOE and the regulators' interpretation of ALARA?
- Is ALARA analysis something discretionary, and if so, how do the agencies justify such an interpretation through the ARARs?
- How will a cost/benefit analysis be conducted under ALARA?
- What will be the collective group that receives the benefit in the cost/benefit calculation?
- If an ALARA analysis is completed and the numbers do show an advantage to further cleanup under ALARA, what is the next step?
- If further cleanup is not enforceable under the regulations, will it happen if it is justified by the ALARA analysis?

During the following discussion, members of the Focus Group identified the following additional issues and questions that should be addressed as part of the RSAL regulatory framework:

- Should NRC approach be applied to non-radiological contaminants?
- Specific interpretation of NRC rule for RFETS
- How to choose point in risk range
- What is dose level for unrestricted use?
- CERCLA interpretation of the risk range
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- What are the provisions for revisiting institutional controls?
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- 10 CFR834 - anything useful?
- Do you apply ARAR in whole or select portions?
- EPA: Is there a difference between the terms: reasonably maximum exposed individual in CERCLA and average member of a critical group in NRC rule?

The Focus Group then discussed the regulatory framework for RSALS.

A member of the focus group asked if the analysis would start with Option 3 (25 mRem to unanticipated future user), then move toward Option 4 (15 mRem to anticipated future user). EPA answered that the NRC rule would drive toward considering Option 3 first because of its preference for unrestricted land use. Option 4 would come into play if Option 3 were unfeasible or as part of ALARA.

It was asked how to access rules 1549 and 4006. These rules are available via Internet and will be posted on the RFCA web site.

One member recommended that a target range in the middle of the CERCLA risk range be selected to avoid automatically slipping to the bottom of the allowed risk range.

A member of the Focus Group asked what the dose level would be for unrestricted use under the NRC rule. The answer was: 25 mRem plus ALARA.

A member of the group suggested that time be added to the Focus Group schedule for review of the final approach when it is developed. Reed mentioned that there are two open dates that could be used for this purpose.

A member of the Focus Group asked if the NRC rule was just focused on nuclear reactors. EPA answered that the rule was intended to apply more broadly, for instance to uranium mills.

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Reed asked that the RFCA parties answer the questions brought up in this discussion and those presented by Ken Korkia and David Abelson in the next RFCA meeting packet. They agreed to answer those questions that were possible to address in the time allowed.

HOW WILL THE WATER DISCUSSION PROCEED

Steve Gunderson stated that, while the Focus Group discussion on surface water protection had been set aside for a time, much work on this issue would be continuing. Examples of ongoing efforts in the next few months include the site water balance and land figuration studies. Information produced in these and other water-related studies will be issued in Focus Group packets as it becomes available. The Focus Group will decide when it should commence surface water discussions again.

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Participants List

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Appendix B
Draft RSAL Public Process Proposed Schedule

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Appendix C
Mary Harlow: Proposed RFCA Peer Review Process

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Appendix D
Tim Rehder: Regulatory Analysis Framework

Name	Company / Organization
David Abelson	RFCLOG
Christine Bennett	AlphaTRAC, Inc.
Ray Betts	RFCAB
Laura Brooks	Kaiser-Hill Company, LLC
Kimberly Chleboun	RFCLOG
John Ciolek	AlphaTRAC, Inc.
John Corsi	Kaiser-Hill Company, LLC
Robert Darr	Kaiser-Hill, Ltd
Gerald DePoorter	RFCAB
Rick DiSalvo	US DOE - RFFO
Shirley Garcia	City of Broomfield
Joe Goldfield	RFSALOP
Steve Gunderson	CDPHE
Mary Harlow	City of Westminster
Jerry Henderson	RFCAB
Reed Hodgin	AlphaTRAC, Inc.
Victor Holm	RFCAB
Jeremy Karpatkin	US DOE - RFFO
Paul Kilburn	JCNA
Roman Kohler	Homesteaders
Ken Korkia	RFCAB
Joe Legare	DOE
Carol Lyons	City of Arvada
Tom Marshall	Rocky Mountain Peace and Justice Center
Russell McCallister	DOE-RFFO
Dan Miller	Office of Attorney General Ken Salazar
LeRoy Moore	RMPJC
Diane Niedzwiecki	CDPHE
Nancy Peters	
Rex Raimond	CDPHE
Karen Reed	EPA
Tim Rehder	US EPA
Rick Roberts	RMRS
Kathy Schnoor	City of Broomfield
Joan Seeman	CCANWI
Dave Shelton	Kaiser-Hill Company, LLC
Carl Spreng	CDPHE
Noelle Stenger	RFCAB
Honorable Hank Stovall	
George Vancil	City of Arvada

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Attachment B

Title:	Meeting Minutes for November 8, 2000 Focus Group Meeting
Date:	November 20, 2000
Author:	C. Reed Hodgin AlphaTRAC, Inc.
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

ADMIN RECORD

Name	Company / Organization
David Abelson	RFCLOG
Christine Bennett	AlphaTRAC, Inc.
Ray Betts	RFCAB
Laura Brooks	Kaiser-Hill Company, LLC
Kimberly Chleboun	RFCLOG
John Ciolek	AlphaTRAC, Inc.
John Corsi	Kaiser-Hill Company, LLC
Robert Darr	Kaiser-Hill, Ltd
Gerald DePoorter	RFCAB
Rick DiSalvo	US DOE - RFFO
Shirley Garcia	City of Broomfield
Joe Goldfield	RFSALOP
Steve Gunderson	CDPHE
Mary Harlow	City of Westminster
Jerry Henderson	RFCAB
Reed Hodgin	AlphaTRAC, Inc.
Victor Holm	RFCAB
Jeremy Karpatkin	US DOE - RFFO
Paul Kilburn	JCNA
Roman Kohler	Homesteaders
Ken Korkia	RFCAB
Joe Legare	DOE
Carol Lyons	City of Arvada
Tom Marshall	Rocky Mountain Peace and Justice Center
Russell McCallister	DOE-RFFO
Dan Miller	Office of Attorney General Ken Salazar
LeRoy Moore	RMPJC
Diane Niedzwiecki	CDPHE
Nancy Peters	
Rex Raimond	CDPHE
Karen Reed	EPA
Tim Rehder	US EPA
Rick Roberts	RMRS
Kathy Schnoor	City of Broomfield
Joan Seeman	CCANWI
Dave Shelton	Kaiser-Hill Company, LLC
Carl Spreng	CDPHE
Noelle Stenger	RFCAB
Honorable Hank Stovall	
George Vancil	City of Arvada

RFCA Stakeholder Focus Group
November 8, 2000 Meeting
Participants List

ADMIN RECORD

RFCA Stakeholder Focus Group
Attachment C

Title:	Draft conceptual site use model
NOTE:	**THE ATTACHED IS A WORKING PRODUCT AND PRELIMINARY DRAFT**
Date:	October 25, 2000
Author:	Diane Niedzwiecki CDPHE
Phone Number:	(303) 692-2651
Email Address:	diane.niedzwiecki@state.co.us

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1) **ARARs:**

- What is the distinction between applicable, relevant and appropriate?

- Is there a hierarchy among these three concepts, i.e., is applicable something you **must** consider, whereas relevant and appropriate are things you have **discretion** to consider?

2) **Scenario Development:** ***The NRC rule clearly states a preference to cleaning up sites to a level that allows for unrestricted use. The rule provides that the agency must clean up to 25 mrem with institutional controls if cleanup to unrestricted use is not feasible.***

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- Do the RFCA parties agree with this interpretation of the NRC rule?
- Why do the agencies appear to reject this precept by not endorsing the third option outlined in EPA's regulatory analysis?
- How do the agencies justify selectively not considering this as part of the NRC rules?
- Is there an interpretation of ARARs that justifies this decision?

3) Risk vs Dose:

- What methodology will be used to determine which approach is best?
- If a risk approach is used, how will decisions be made to select a value within the 10^{-4} to 10^{-6} risk range?

- Why is EPA Region VIII considering the 25 mrem number, when EPA as a whole appears to disagree with the number?

4) ALARA:

- How will ALARA analysis be used?
- What is NRC's interpretation of ALARA?
- What does CERCLA have to say about ALARA?
- What is DOE and the regulators' interpretation of ALARA?

- Is ALARA analysis something discretionary, and if so, how do the agencies justify such an interpretation through the ARARs?

- How will a cost/benefit analysis be conducted under ALARA?

- What will be the collective group that receives the benefit in the cost/benefit calculation?

- If an ALARA analysis is completed and the numbers do show an advantage to further cleanup under ALARA, what is the next step?

- If further cleanup is not enforceable under the regulations, will it happen if it is justified by the ALARA analysis?

GOALS

Are we on track?

Other issues / topics to include in draft

Where clarification needed

Any errors

Any additional information needed

ISSUES

Risk Factors

- Should NRC approach be applied to non-radiological contaminants?
- Specific interpretation of NRC rule for RFETS
- How to choose point in risk range
- What is dose level for unrestricted use?
- CERCLA interpretation of the risk range
- CERCLA language regarding cleanup
- NRC rule - for how long does 100 mRem limit apply?
- What are the provisions for revisiting institutional controls?
- Enforcement of institutional controls
- 10 CFR834 - anything useful?
- Do you apply ARAR in whole or select portions?

Questions put before the agencies:

EPA: Is there a difference between the terms: reasonably maximum exposed individual in CERCLA and average member of a critical group in NRC rule? (Noel Stenger)

Option 3 of Tim Rehder's document: Option 3: Radiologicals or all?

CDPHE: Interpret NRC rule.

Actual language regarding the 10-4 and 10-6 in CERCLA.

NRC language states: "indefinite acceptance or a limit exposure." If there's a limit, what is it?

If institutional controls are used, what are the provisions to revisit them?

If the community revises them, can RFCA be changed?

Is there a mechanism for enforcing institutional controls?

RFCA Stakeholder Focus Group
Attachment D

Title:	Information on NRC review of RESRAD 6.0
NOTE:	**THE RFCA PARTIES ARE WORKING TO GET MORE INFORMATION REGARDING THE RESRAD 6.0 COMPUTER MODEL. IN THE MEANTIME, PLEASE SEE THE WEBSITE FOR A DOWNLOADABLE MODEL: http://www.nrc.gov/ RES/rescodes.htm**
Date:	October 27, 2000
Author:	Dave Shelton Kaiser-Hill Company, LLC
Phone Number:	(303) 966-9877
Email Address:	Dave.Shelton@rfets.gov

ADMIN RECORD

RFCA Stakeholder Focus Group
Attachment E

Title:	Copy of a newspaper article regarding dust problems after the fire at the Idaho National Engineering and Environmental Laboratory
Date:	October 25, 2000
Author:	Dave Abelson RF CLOG
Phone Number:	(303) 4121200
Email Address:	dabelson@rfclog.org

ADMIN RECORD

RFCA Stakeholder Focus Group
Attachment F

Title:	Revised ER Decision Matrix
Date:	October 18, 2000
Author:	John Corsi Kaiser-Hill Company, LLC
Phone Number:	(303) 966-6526
Email Address:	John.Corsi@rfets.gov

ADMIN RECORD

ER Decision Matrix

DRAFT

poc: John Corsi (303) 966-6526

RSALs:

Action levels are numeric levels that, when exceeded, trigger an evaluation, remedial action, and/or management action. Action levels apply to soil, surface water, and ground water. Action levels do not determine what specific action is appropriate. Specific remedial and/or management actions will be decided through a process prescribed by the Rocky Flats Cleanup Agreement (RFCA) and environmental laws that apply to soil cleanup projects.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
3/00	10/00	5/01	7/01	8/01	NA	NA

This schedule reflects this year's annual review of RSALs, as required by RFCA. This review is of greater depth and scope than past reviews, in part to incorporate the work of the RSAL OP and to ensure that these RSALs are used for the remediation of the 903 pad. RFCA requires annual reviews each year until site closure, and through the five year CERCLA review process as well.

Key questions/Issues to be resolved:

- **What RSAL is protective of human health and environment?**
- **Should an anticipated future land use beyond the land uses described in RFCA be evaluated?**
- **What regulatory framework should be used (What is the ARAR? What model to use?)**
- **Whether and how a catastrophic events (e.g., fire, drought) should/could be considered?**
- **What is the value or distribution for key parameters for RSAL calculations (e.g., air resuspension)**

903 Pad:

The 903 Pad Closure Project includes the 903 Pad Drum Storage Area (903 Pad), the 903 Lip Area, and the Americium Zone where soils have been impacted from the outdoor storage of 5,237 drums. A decision document will be prepared to identify appropriate cleanup levels protective of human health of future land users and to meet surface water standards on and off Site.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
8/00	1/02	6/02	8/02	9/02	9/03	11/04

Key questions/Issues to be resolved:

- **Will source removal to the selected RSAL alone, achieve protection of surface water quality?**
- **Will additional source removal beyond the RSAL achieve protection of surface water quality?**
- **Will additional source removal beyond the RSAL affect stewardship issues?**
- **If source removal alone cannot achieve surface water quality, what engineered barriers will help achieve protection of surface water quality?**
- **How will long-term stewardship issues influence remedy selection?**

**These timetables reflect the schedule for developing the interim decision documents under RFCA. All of these decisions are reviewable at the final Record of Decision.*

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- **How do we balance protection of: future land-users, workers, surface water quality, and ecosystems in the short and long term?**

ER RSOP:

This RSOP is the decision document for routine soil and groundwater remediation at RFETS. It will address remediation of soil and associated debris at all Individual Hazardous Substance Sites (IHSSs) Potential Areas of Concern (PACs) and Under Building Contamination (UBC) documented via the Historical Release Report process of RFCA as well as the remedial decision for subsurface contaminant plumes. This RSOP does not address non-routine actions such as closure of the Present Landfill, Original Landfill, Solar Evaporation Ponds, final Site configuration or the design for groundwater remediation systems. The regulators approve the RSOP only once. Initial approval of an RSOP will be accomplished through the IM/IRA process. (RFCA ¶25(bo))

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
10/00	10/00	7/01	9/01	11/01	NA	NA

Key questions/Issues to be resolved:

- **What are the appropriate cleanup levels? (ARARs?)**
- **Will deep subsurface soil contamination require removal if there is no exposure pathway?**
- **If subsurface contamination is not removed what will the stewardship requirements be?**
- **What are the remedial action objectives for surface soil, subsurface soil, and groundwater?**
- **How will remedial actions be tied into the long-term monitoring program?**

Soil Management RSOP:

The management and disposition of remediation soil, investigation-derived material, excavated soil and sediment at the Rocky Flats has been conducted under various regulatory authorities. This has lead to inefficiencies and differences in handling, management, and disposition of soil. The purpose of this RSOP is to streamline the characterization, management and disposition of all disturbed soil at RFETS into a single process designed to protect public health and the environment, regardless of why it was disturbed or excavated.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
10/00	9/00	11/00	1/01	1/01	NA	NA

Key questions/Issues to be resolved:

- **How do RSALs apply to soil disturbance projects around the Site?**
- **Should the put-back level approach in RFCA, Attachment 5, ALF, be applied to all disturbed soil on-site?**
- **Can soils from characterization and construction activities be returned to the point of origin, and be remediated and dispositioned appropriately with the IHSS from which it was generated?**

**These timetables reflect the schedule for developing the interim decision documents under RFCA. All of these decisions are reviewable at the final Record of Decision.*

Industrial Area Sampling Analysis Plan (IA SAP):

SAPs are required to support pre-remedial characterization, waste volume calculations, waste characterization, confirmation of cleanup, and the Comprehensive Risk Assessment. The IA SAP describes the surface and subsurface soil sampling to support these objectives in the IA Operable Unit.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
7/00	10/99	NA	NA	12/00	NA	NA

Key questions/Issues to be resolved:

- **What sampling methodology and approach should be used for the industrial area?**
- **How many samples are sufficient for preremedial characterization and post remedial confirmation?**
- **How many samples are necessary to support the Comprehensive Risk Assessment (CRA) and delisting from the NPL?**

Buffer Zone Sampling Analysis Plan (BZ SAP):

SAPs are required to support pre-remedial characterization, waste volume calculations, waste characterization, verification of cleanup, and the Comprehensive Risk Assessment. The BZSAP describes the surface and subsurface soil sampling to support these objectives in the Buffer Zone.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
12/0	10/00	NA	NA	3/01	NA	NA

Key questions/Issues to be resolved:

- **What sampling methodology and approach should be used for the buffer zone?**
- **How many samples are sufficient for preremedial characterization and post remedial confirmation?**
- **How many samples are necessary to support the comprehensive Risk Assessment (CRA) and delisting from the NPL?**

**These timetables reflect the schedule for developing the interim decision documents under RFCA. All of these decisions are reviewable at the final Record of Decision.*

Present Landfill Remediation Project:

The Present Landfill encompasses approximately thirty acres in the northwest Buffer Zone area and contains six additional IHSSs and PACs within its boundary. The six additional IHSSs and PACs have been proposed as no-further-action. The Present Landfill was operated from 1968 through 1998 and is identified as an interim status unit under RCRA. The landfill received hazardous waste in the past and is required to be closed under the provisions of RFCA Attachment 10. The presumed remedial action for the Present Landfill is closure by an engineered cap. Post-closure monitoring and cap maintenance will be required.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
10/00	10/01	7/02	9/02	10/02	1/04	12/04

Key questions/Issues to be resolved:

- **Is the presumptive remedy of using a cover or cap appropriate?**
- **If a cap is appropriate, what type of cap should be used (e.g., RCRA cap, evapotranspiration cap)**
- **If cap is not appropriate, what other remedy is protective?**
- **What will the long-term stewardship requirements be for maintenance of any caps?**

Original Landfill Remediation Project:

The Original Landfill encompasses approximately 20 acres in the southwest Buffer Zone area and contains an additional IHSS. The landfill operated from 1952 to 1968 and received approximately 2 million cubic feet of general plant wastes including solvents, paints and pesticides. Records indicate that the landfill also received quantities of depleted uranium. The Original Landfill is not a RCRA unit.. Remedial options include closure by a cap, cover or excavation.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
10/00	10/01	8/02	9/02	10/02	11/02	6/05

Key questions/Issues to be resolved:

- **What is the appropriate remedy to protect human health and meet the surface water standards consistent with RFCA and CERCLA?**
- **If a cap is appropriate, what type of cap should be used (e.g., RCRA cap, evapotranspiration cap)?**
- **If cap is not appropriate, what other remedy is protective?**
- **What will the long-term stewardship requirements be for maintenance of any caps?**

**These timetables reflect the schedule for developing the interim decision documents under RFCA. All of these decisions are reviewable at the final Record of Decision.*

Solar Ponds Remediation Project:

The Solar Evaporation Ponds (SEP) encompass approximately 12 acres in the northeastern quadrant of the Industrial Area constructed and operated from 1953 to 1986. The ponds received low-level radioactive wastes contaminated with high levels of nitrate. The SEP is identified as a RCRA interim status unit and is required to be closed under the provisions of RFCA Attachment 10. The RFCA presumed remedial action for the SEP is closure by an engineered cap. Post-closure monitoring and cap maintenance will be required.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
10/00	4/02	2/03	3/03	4/03	8/03	5/05

Key questions/Issues to be resolved:

- **Is the presumptive remedy of using a cover or cap appropriate?**
- **If a cap is appropriate, what type of cap should be used (e.g., RCRA cap, evapotranspiration cap)?**
- **If cap is not appropriate, what other remedy is protective?**
- **What will the long-term stewardship requirements be for maintenance of any caps?**

RFCA Integrating Decision Document (RIDD):

The RIDD is a RFCA decision document that integrates necessary response (accelerated) actions and other critical closure issues and decisions to achieve the final site condition in one document. The RIDD provides the framework, strategy and decisions necessary to complete the Site remediation under RFCA and support the final CAD/ROD. The contract currently calls for an "Interim Final ROD". It is assumed that the RIDD will replace the IROD as a contract requirement.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
8/00	2/01	4/02	6/02	6/03	NA	NA

Key questions/Issues to be resolved:

- **What is the appropriate water standard?**
- **What is the water quality strategy? For example:**
  - ✓ **Will ponds be retained?**
  - ✓ **Will dams be used as part of final Site Configuration etc.?**
- **How and where should on-site water quality be measured?**
- **What is the groundwater remediation strategy?**
- **Can No Further Action Sites previously accepted by the regulators be closed? If not, what additional remedial actions are required?**
- **What will be the stewardship maintenance and repair requirements for any surface systems at the Site as long as they are employed?**
- **How will remedial actions be tied into the long-term monitoring program?**
- **How will long-term groundwater monitoring, as established in the Intregrated Monitoring Plan (IMP), be maintained?**

**These timetables reflect the schedule for developing the interim decision documents under RFCA. All of these decisions are reviewable at the final Record of Decision.*

Site Water Balance Study:

The scope of the site-wide water balance activity is to develop a hydrologic design basis for RFETS closure activities. This includes support for interim remedial actions for closure and long-term stewardship. The objectives of the project are to:

1. Evaluate how the site-wide water hydrology is likely to change from the present to final Site configuration at closure;
2. Assist in predicting surface water impacts from groundwater for present and final Site configuration;
3. Provide hydrologic profiles to support decisions for final Industrial Area configuration to protect surface water quality standards;
4. Assist in determining the final configuration of the Walnut Creek and Woman Creek drainages to protect surface water quality standards and address ecological concerns; and
5. Provide information for the RFCA Integrating Decision Document, the Comprehensive Risk Assessment, and the Final CAD/ROD.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
8/00	7/00	4/02	6/02	6/03	NA	NA

Key questions/Issues to be resolved:

- **What will the water flux (hydrologic regime and characteristics) be at Site Closure?**
- **What is the impact eliminating the importation of water for Site use?**

Land Configuration Study:

The Land Configuration Design Basis will provide the engineering information required to design the final land configuration of RFETS following completion of all remedial actions. This includes support for interim remedial actions for closure and long-term stewardship. The final land configuration will be engineered to protect public health and the environment consistent with future land use. The design basis incorporates all appropriate physical, chemical, and biological information including site-wide water balance, soil erosion and sediment transport modeling, and actinide migration. The design basis includes a conceptual final land configuration that addresses the Industrial Area, the inner Buffer Zone, and the Woman and Walnut Creek drainages. Results will be used in the CRA and CAD/ROD.

Schedule*:

Informal Process	Start Drafting Document	Begin Formal Comment Period	End Comment Period	Final Document	Remediation Start	Project Complete
11/00	10/00	4/02	6/02	6/03	NA	NA

Key questions/Issues to be resolved:

- **What land configuration will lead to a naturally-functioning, low-maintenance environmentally-protective geomorphic system?**
- **What are the potential impacts of long-term erosion? What can we do to minimize any erosion impacts?**
- **What will the final configuration of drainages be?**
- **Will dams be part of the final site configuration?**
- **Will the ponds be retained as part of final site configuration?**
- **What enhancements should be made to any engineered controls?**

**These timetables reflect the schedule for developing the interim decision documents under RFCA. All of these decisions are reviewable at the final Record of Decision.*

RFCA Stakeholder Focus Group
Attachment G

Title:	Meeting Schedule through February 2001
Date:	October 25, 2000
Author:	C. Reed Hodgin AlphaTRAC, Inc.
Phone Number:	(303) 428-5670
Email Address:	cbennett@alphatrac.com

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RFCA Stakeholder Focus Group
Meeting Schedule to February 2001

R E V I S E D

	November, 2000	8
		29
	December	13
	January, 2001	3
		17
		31
Revised:	**February**	**14**
		28

ADMIN RECORD

RFCA Stakeholder Focus Group
Attachment H

Title:	Draft Proposed RFCA Project Peer Review Process
NOTE:	**THE ATTACHED IS A DRAFT**
Date:	October 30, 2000
Author:	Mary Harlow City of Westminster
Phone Number:	(303) 650-1643
Email Address:	mharlow@ci.westminster.co.us

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DRAFT

PROPOSED RFCA PROJECT PEER REVIEW PROCESS

Prepared by: Mary Harlow, Rocky Flats Coordinator, City of Westminster

Date: October 23, 2000

To enhance the quality and credibility of the Rocky Flats Cleanup Agreement regulators current review of the interim radionuclide soil action levels that were adopted in 1996 by the RFCA Regulators, the following process is being suggested for seeking competent individuals to provide peer review of the specific work documents in the following areas:

Action 1 Regulatory Analysis Delivery date 10/27/00 Draft to principals 2/15/00

Action 2: Model Evaluation- Delivery Date 11/20/00 Draft to principals 2/15/00

Action 3: Parameter Evaluation Delivery Date 1/26/01....Draft to principals 5/2/01

Action 4 New Scientific Information Delivery Date 11/3 to principals 2/15/01

Action 5: Draft RSAL Document Delivery Date, 3/15/01 Public comment begins 5/16

Peer Review Term of Work

1. Each reviewer will be asked to review and comment on RFCA regulators draft reports named above.

2. Draft reports, as well as a draft final report will be provided simultaneously to reviewers and to members of the RFCA Stakeholder Focus Group. Peer reviewers and focus group members will be provided a deadline for providing written comments on each draft report. Comment period will be 30 days (could be shortened to three weeks if uncomplicated document). The regulators will provide a formal written response to all comments received to the Focus Group. A discussion will occur at the Focus group meeting following receipt of the regulator response.

3. Honorarium: Each reviewer will be provided a maximum honorarium of $1,500. Each task would have a set dollar amount. Financial penalties will be assessed for missing deadlines. Incidental expenses (e.g. copying, mailing) will be paid as accrued. Half of the honorarium will be paid at the initiation of the project, the remainder, minus penalties at the completion of the project.

4. 4. Project duration – 6 months.

Criteria for selection of Peer review team members

- Positive reputation and credibility in the scientific community

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- Competence in the task areas related above
- Minimal conflict of interest (preferable now working outside the DOE system)
- Ability to meet a set schedule with relatively quick turn around of review with comments in writing.
- Willingness to share with the RFCA Stakeholder Focus Group members any and all correspondence with the reviewer.

Recommend that the peer review team members that performed the review of the Risk Assessment Corporation scientific review of the RSAL's be utilized again if they are available. Four peer reviews are recommended for this task.
(Resumes on file at the CAB office)

Dr. Paula A. Labieniec
Independent Consultant in hazardous waste and contaminated soil risk assessment

Dr. Glenn Paulson, President Paulson and Cooper.
Hazardous and Radioactive waste management

Mr. Allan C. B. Richardson
Consultant on radiation protection and former member of the EPA staff involved in developing much of the EPA radiation standards.

Dr. Steven L. Simon
Board of Radiation Effects Research
National Academy of Sciences.

Dr. Ward Whicker
CSU was the fifth member of the panel

Next Step
The Steering Committee of the RSALOP (includes Ken Korkia), regulators (EPA, CDPHE, DOE) and interested community members set up a meeting to determine who, what, when of the peer review process. The group should select the peer reviewers. Because of the time constraints the selected reviewers would be contacted to determine interest and time availability.

A formal contract would then be initiated. CAB should manage the administration and funding for this process. Peer reviewers will no doubt charge less to the CAB than they would if knew DOE was sponsoring the project. Also, the peer reviewers on this list are familiar with the project and have worked with CAB and RSALOP before. CAB would receive the peer review comments and be responsible for ensuring the administration of the process.

Technical assistance for the public focus group members.

Procuring technical assistance for the RFCA Stakeholder Focus Group members
One or more technical consultants answerable to the citizen participants should enhance understanding of technical matters.

If technical assistance is made available, the citizen participants should make the selection of the individual.

There are probably some local people who could perform the role. They should be compensated.

The process currently in use by the Actinide Migration Technical Review Group for obtaining technical assistance.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
999 18TH STREET - SUITE 500
DENVER, CO 80202-2466
http://www.epa.gov/region08

Ref: 8EPR-F

MEMORANDUM

TO: Whom it may concern

FROM: Tim Rehder, Rocky Flats Team Leader

SUBJECT: Radiation Risk and Radiation Dose, How Do They Relate?

During the long public debate that has surrounded the radiological soil action levels (RSALs) for Rocky Flats, questions have routinely come up on the issues of radiation dose and radiation; questions like what is a safe dose, what risk level does that dose equate to? Unfortunately, the answers to these questions are not always straight forward. The EPA Guidance Document "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination," August 1997, says that a 15 mRem dose/yr is approximately equal to a risk of 3×10^{-4}. This over simplification has lead to much of the confusion stakeholders, public officials and regulators have experienced on this issue. In fact, the level of risk associated with a given dose depends on a number of factors such as: 1) the method used to convert dose to risk, 2) the radionuclide of interest and 3) the route(s) of exposure.

Let's talk first about the methods used to calculate the risk posed by exposure to radioactive materials. There are basically two methods for doing so; 1) calculating the Effective Dose Equivalent (EDE) and then converting that dose into a risk number, or 2) calculating a risk using cancer Slope Factors.

The Dose Conversion Method

The oversight panel is familiar with the concept of dose assessment. It is an assessment performed to answer the question "how much dose will an individual receive when exposed to a specified amount of radioactive materials?" When we talk about dose we are generally referring to the effective dose equivalent (EDE), which is a unit of measure developed by the International Commission on Radiologic Protection (ICRP) to normalize radiation doses by considering the adverse effects on a total body basis for the purpose of regulation of occupational exposure. In theory, if the EDE is calculated correctly, the risk associated with receiving, for example, a 1,000 mRem dose from Plutonium is equal to the risk associated with receiving 1,000 mRem from Radium, Cesium or any other radionuclide. EDE is derived by multiplying a dose conversion factor (DCF) for a given radionuclide by the unit intake of exposure to that radionuclide (i.e. ingestion, inhalation or external exposure). The following factors are considered in the development of dose conversion factors for the various radionuclides:

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- ☐ type of radiation
- ☐ relative strength (or energy) of the radiation
- ☐ different radionuclides will target different organs or tissues
- ☐ different organs or tissues will exhibit different cancer induction rates.

A simple example that illustrates how dose is calculated is a man who breathes 20 m^3 per day and lives year round at a location where the concentration in air of Plutonium is 0.1pCi/m^3. In this scenario the man is neither drinking contaminated water, eating contaminated foodstuffs, nor ingesting contaminated dirt. Assuming all the airborne Plutonium is respirable, and for this example using a DCF for inhalation of Pu of 0.308 mRem/pCi, the equation would look like:

example 1

(365 days/year)(20 m^3/day)(0.1 pCi/m^3)(0.308 mRem/pCi)(30years) = **6750 mRem**

Since different radionuclides have different DCFs, if we changed the radionuclide in the equation above, the resulting dose would be different. Similarly, different routes of exposure have different DCFs. If we considered ingestion rather than inhalation in the equation above, the resulting dose would be different.

Most health physicists don't calculate the risk that is associated with a given dose. They simply compare the dose to accepted national standards : e.g. 100 mRem/yr for public exposure or 5,000 mRem/yr for occupational exposure. However, risks can be calculated using a two-step method. The first step being the dose calculation as demonstrated in example 1 above. The next step is to convert the dose to a risk value using a **probability coefficient**. ICRP has developed probability coefficients that allow dose to be expressed in terms of risk. The 1990 Recommendations of the ICRP says the probability coefficient from fatal cancers, non-fatal cancers and severe hereditary effects is 7.3×10^{-2}/sievert (1 sievert = 100,000 mRem). This risk coefficient is based on low LET (Gamma) radiation and considers all cancers. Using that coefficient, the next step in calculating risk is:

example 1 -step 2

(6750 mRem)(7.3×10^{-2}/sievert) = 5×10^{-3}.

Slope Factor Method

A slope factor is similar to a dose conversion factor, but instead of assigning a unit dose for every unit of exposure (i.e. mRem/pCi) a unit of **RISK** is assigned for every unit of exposure (i.e. probability of adverse effect/pCi). Using an inhalation slope factor for Plutonium of 3.33×10^{-8}/pCi we can go back to the above example and calculate a risk:

example 2

$(365\ \text{days/year})(20\ m^3/\text{day})(0.1\ \text{pCi}/m^3)(3.33 \times 10^{-8}/\text{pCi})(30\ \text{years}) = 7.2 \times 10^{-4}$

Note that this result is lower than the risk calculated in example 1 using the Dose Conversion Method. EPA believes that for internal exposures to alpha and beta emitters, the Slope Factor Method produces a more reliable estimate of risk.

EPA has calculated slope factors for most of the radionuclides and just as different radionuclides have different DCFs, different radionuclides generally have different slope factors. The slope factors also vary depending on route of exposure. Therefore, risk associated with inhaling 1,000 pCi of Uranium is different from that of inhaling 1,000 pCi of Cesium. Also the risk associated with inhaling 1,000 pCi of Radium is different from that of ingesting 1,000 pCi of Radium via drinking water.

Summary

There are two methods for calculating the risk associated with radiation exposure:

1) The Dose Conversion Method where a dose is calculated by multiplying a dose conversion factor (expressed in terms of unit dose/unit intake) for a given radionuclide by the total intake of exposure to that radionuclide (i.e. ingestion, inhalation or external exposure). The dose is multiplied by a probability coefficient to arrive at a risk value.

2) The Slope Factor Method where risk is calculated directly by assigning a unit of **RISK** for every unit of exposure (i.e. probability of adverse effect/pCi), and multiplying that by the total exposure. This method is basically the same method that EPA uses to calculate the risks associated with non-radioactive carcinogens.

EPA believes that the Dose Conversion Method is fine for calculating the risks of exposure to low LET radiation (i.e. gamma radiation), but does not work well for internal exposure to alpha and beta emitting radionuclides. In the case of internal exposure, the Dose Conversion Method tends to overestimate the risk as seen in the two example calculations above.

The risk associated with 15 mRem/year, as stated in recent EPA guidance documents is based on the ICRP risk value of .073/Sv for external low LET radiation. All external low LET radiation can use this value. (A new EPA calculated value is closer to .08/Sv) The calculation for deriving the 3×10^{-4} number is as follows:

$$(15\ \text{mRem/yr})(30\ \text{yrs})(7.3 \times 10^{-2}/\text{sievert}) = 3 \times 10^{-4}$$

Again, EPA believes that this estimate of the risk associated with a 15 mRem/yr dose is only reliable for external low LET radiation (gamma radiation).

NOTE ON COMPARING CALCULATED RISK NUMBERS TO THE ACCEPTABLE RISK RANGE

When making this comparison, EPA generally rounds the number up or down. For example, EPA has gone on record saying 3×10^{-4} (3 in 10,000) is essentially equal to 1×10^{-4} (1 in 10,000). In another case, EPA made the call that 5.7×10^{-4} is **not** equal to 10^{-4}.

RFCA Stakeholder Focus Group
Attachment I

Title:	Radionuclide Soil Action Level Regulatory Analysis
NOTE:	**THE ATTACHED IS A PRE-DECISIONAL DRAFT – NOT ENDORSED BY THE DOE, EPA OR CDPHE – FOR DISCUSSION PURPOSES ONLY**
Date:	November 1, 2000
Author:	Tim Rehder U. S. Environmental Protection Agency
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ADMIN RECORD

RADIONUCLIDE SOIL ACTION LEVEL REGULATORY ANALYSIS

PURPOSE

The Department of Energy (DOE), the Environmental Protection Agency (EPA) and the Colorado Department of Public Health and the Environment (CDPHE) are currently reevaluating the Radionuclide Soil Action levels that will govern much of the cleanup at Rocky Flats. One of the reasons the reevaluation is warranted is that the draft EPA Radiation Sites Cleanup Rule that was used as a basis for the current RSALs is defunct. This paper discusses developments in the regulatory and policy world relevant the Rocky Flats RSAL. It also makes a proposal as to what should form the basis of a new RSAL.

BACKGROUND

In October of 1996 DOE, EPA and CDPHE established an action level for radionuclide contamination in soils at Rocky Flats. An action level is a numeric level that, when exceeded, triggers an evaluation, remedial action, and/or management action. The radionuclide soil action level (RSAL) is expressed in terms of the amount of radioactivity per unit mass of soil; specifically picocuries/gram (pCi/g). Having an RSAL that is protective of human health and the environment is a key element in the overall cleanup of Rocky Flats.

When developing the current RSAL in 1996 DOE, EPA and CDPHE used the draft EPA Radiation Site Cleanup Regulation, 40 CFR 196, as the basis for the action level. At that time, EPA had only announced its intent to propose this regulation; it had not been finalized. However, since all three parties anticipated that it would be finalized and that there was nothing else in existence resembling a national standard for radiation cleanup, DOE, EPA and CDPHE believed the draft regulation was a reasonable basis for an RSAL.

40 CFR 196 stated that a radioactively contaminated site should be cleaned up such that any remaining contamination would result in a radiation dose to a member of the public no greater than 15 millirem/year (mRem/yr). The draft rule went on to say that if institutional controls (i.e. legal controls that restricted Site access) were utilized to meet the 15 mRem/yr limit, the Site must, at a minimum, be cleaned up to levels that ensure individuals do not receive doses greater than 85 mRem/yr in the event the institutional controls failed (e.g. changed or forgotten).

ADMIN RECORD

To determine what soil action level would meet the 15/85 mRem/yr requirements of the draft rule, DOE, EPA and CDPHE used a software program called RESRAD to calculate the amount of radioactivity in the soil that would result in a 15 mRem/yr or 85 mRem/yr dose to the public. In order to make that calculation, assumptions were made as to how the land will be used in the future, because a person who **lives** on a contaminated site will have a much higher dose than a person who **occasionally visits** a contaminated site. The Rocky Flats Cleanup Agreement, signed by DOE, CDPHE and EPA in 1996 envisioned that future use of Rocky Flats would consist of commercial/light industrial activity in the Industrial Area at the center of the site and open space/recreational activity in the surrounding Buffer Zone. Using these land-use assumptions as a guide, the parties calculated the amount of contamination that would result in a 15 mRem/yr dose to an office worker in a commercial setting and a recreational open space user. Since these two future use assumptions were predicated on the idea that legal controls would be put in place precluding other types of land use, the parties had to satisfy the second part of the draft EPA rule: that in the event those legal controls fail, members of the public do not receive a dose in excess of 85 mRem/yr. It was assumed that if there were no restrictions on the use of Rocky Flats, a subdivision similar to Rock Creek would be constructed. So the parties calculated the level of contamination that would equate to an 85 mRem/yr dose to a suburban resident.

The calculated RSALs for these various scenarios are given below:

Scenario	Specific Activity Pu-239[1]
15 mRem/yr Dose to Office Worker	562 pCi/g
15 mRem/yr Dose to Open Space User	4,145 pCi/g
85 mRem/yr Dose to Suburban Resident	651 pCi/g

To set an RSAL for the Industrial Area, the parties compared the office worker at 15 mRem/yr to the hypothetical future suburban resident at 85 mRem/yr, and chose the most conservative value. Similarly, for the Buffer Zone RSAL, the open space user at 15 mRem/yr was compared to the hypothetical future suburban resident at 85 mRem/yr. This is how the current RSALs of 562 pCi/g Pu-239 in the Industrial Area and 651 pCi/g Pu-239 in the Buffer Zone were chosen.

[1] **The specific activity given is a sum of the ratio number that assumes Am-241 is present and the ratio of Am-241 to Pu-239 is 0.18**

DOE, EPA and CDPHE also established a lower tier of RSALs that would trigger a different type of action than the Tier 1 RSALs discussed above. When contaminants are found to exceed the Tier 1 action level, it will generally trigger an action such as removal or stabilization in place. Exceeding the Tier 2 value would generally trigger a less aggressive action which may include "hotspot" removal, capping or access restrictions. The Tier 2 RSAL for Pu-239 is based on a 15 mRem/yr dose to a suburban resident and comes out to 115 pCi/g.

CHANGES IN THE REGULATORY LANDSCAPE SINCE 1996

Due to resistance from the Nuclear Regulatory Commission (NRC), the Office of Management and Budget and DOE Headquarters, the EPA Radiation Sites Cleanup Regulation was never finalized, and has been officially dropped from consideration. This development immediately called the regulatory basis for the current RSALs into question. In the meantime, another national regulation on radiation cleanup was finalized as well as some EPA policy documents on the subject.

In 1997, the NRC promulgated a cleanup regulation (commonly referred to as the Decommissioning Rule) which governs the cleanup of facilities that are regulated by the NRC or States that have had that authority delegated to them. The NRC cleanup regulation states that a site will be considered acceptable for **unrestricted** use if residual radioactivity, distinguishable from background, results in a dose to the public no greater than 25 mRem/yr, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). The rule goes on to say a site will be considered for license termination under **restricted** conditions if:

- Residual levels associated with restricted conditions are ALARA.

- The licensee has made provisions for legally enforceable institutional controls.

- The licensee has provided financial assurance for control and maintenance of the site.

- The licensee has prepared a "License Termination Plan" and has solicited public comment on that plan.

- Residual Radioactivity at the site has been reduced so that if institutional controls were no longer in effect, members of the public will not receive a dose greater than 100 mRem/yr or, under certain circumstances, 500 mRem/yr.

The NRC does not have regulatory authority over a DOE facility such as Rocky Flats so the NRC rule is not directly applicable to Rocky Flats. However, the State of Colorado has adopted the NRC rule as a State regulation and has asserted that while the rule is not applicable to Rocky Flats it is relevant and appropriate, and therefore should be used to govern the cleanup of the site. EPA and DOE agree.

However, while EPA agrees that the Decommissioning Rule is relevant and appropriate to the cleanup at Rocky Flats, it believes that the dose limits in the rule may not, in some circumstances, be sufficiently protective of human health. This concern is discussed in the EPA Guidance Document "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination," August 1997. This document makes the following points relevant to the RSAL debate at Rocky Flats:

- Cleanup actions at Superfund sites such as Rocky Flats must be protective of human health and the environment and comply with applicable or relevant and appropriate requirements (ARARs).

- EPA generally defines "protective of human health" as a level that represents an excess cancer risk to an individual in the range of 10^{-4} to 10^{-6} (1 in 10,000 to 1 in 1,000,000 probability).

- Cancer risks for radioactive contamination should generally be estimated using the slope factor methodology put forth in the EPA risk assessment manual.[2] (Please see attached memo on Radiation Risk and Dose in order to be completely confused on the issues of slope factors and converting dose to risk.)

- EPA has determined that the dose limits in the NRC rule are generally not protective of human health. *The word "generally" is key because each radionuclide has a different cancer slope factor so for some radionuclides the risk associated with a 25 mRem/yr dose will be within the acceptable risk range.*

- The NRC Rule must be met (or waived) at sites where it has been determined to be applicable or relevant and appropriate. Cleanup at these sites will typically

[2] **U.S. EPA, "Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) Interim Final," EPA/540/1-89/002, December 1989. U.S. EPA, "Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals", EPA/540/R-92/003, December 1991.**

have to be more stringent than required by the NRC dose limits. *The word "typically" is key for the reason given in the preceding paragraph.*

If a dose assessment is conducted at the site, as was done at Rocky Flats in setting the current RSALs, 15 mRem/yr should **generally** be the maximum dose limit for humans. This dose limit equates to **approximately** 3×10^{-4} (3 in 10,000) lifetime risk.

Despite these concerns, EPA expects that NRC's implementation of the decommissioning rule will result in cleanups within the Superfund risk range at the vast majority of NRC sites.

LANDUSE AND INSTITUTIONAL CONTROLS

As discussed previously, the assumptions made as to how Rocky Flats will be used in the future are very important considerations in the calculation of an RSAL. The current RSALs were developed under the assumption that the interior of the property would see commercial reuse while the surrounding Buffer Zone supported open space recreation. When DOE, EPA and CDPHE were negotiating the Rocky Flats Cleanup Agreement back in 1995, these two future use scenarios seemed the most likely. At that time, there was a significant level of support in the surrounding communities for these two scenarios. So the parties wrote them into the agreement. The parties also, in drafting the RFCA, designated certain parts of the Industrial Area as "restricted open space," although the Agreement doesn't really discuss the implications of that designation. Now that Senator Allard and Congressman Udall have introduced legislation that would turn Rocky Flats into a wildlife refuge, those future land use assumptions may need to be revised. Now it appears a wildlife refuge worker may be the person most directly impacted by residual contamination at Rocky Flats. If the future land use assumptions need to be changed, it would probably require a revision of the RFCA.

Making decisions on the degree of cleanup based upon the anticipated future land use is consistent with EPA policy. The EPA guidance document "Land Use in the CERCLA Remedy Selection Process," May 25, 1995, says that in general, objectives should be developed that would achieve cleanup levels associated with the reasonably anticipated future land use over as much of the site as possible. This guidance was written, at least partly, in response to criticism that EPA was too often assuming that future use of a contaminated site would be residential. Many contaminated sites being addressed in

the Superfund program were industrial sites in large industrial areas that had little potential for residential redevelopment. So it was often argued that it was not cost effective for those sites to be cleaned up to a degree that would support residential use.

The NRC Decommissioning rule does not discuss developing a cleanup level consistent with the anticipated future land use. Rather, the rule says cleanup levels that allow unrestricted use are generally preferable to levels that require restricted use. It requires that licensees demonstrate that complying with unrestricted dose criterion would be prohibitively expensive, result in net public or environmental harm, or not technically achievable. NRC guidance indicates that a rural farmer future use scenario should be used to calculate unrestricted use levels.

If the amount of residual contamination at a site precludes unrestricted use in the future, institutional controls (legal controls) must be put in place to assure that the anticipated land use doesn't change to an inappropriate one (e.g. residential development of property slated to be industrial). When RFCA was signed, DOE, EPA and CDPHE assumed that controls would be utilized to limit future activities on site to commercial reuse of the industrial area and recreational use of the Buffer Zone. Continued Federal ownership was one of the controls contemplated for making that assurance.

The draft EPA Radiation Sites Cleanup rule anticipated the potential failure of institutional controls when it said if institutional controls were utilized to meet the 15 mRem/yr limit, the site must be cleaned up to levels that ensure individuals are not exposed to doses greater than 85 mRem/yr in the event of institutional controls failure. The Decommissioning Rule addresses the possible failure of institutional controls in a manner similar to the draft EPA rule. It says that a site will be considered for license termination under **restricted** conditions if, in addition to other conditions, residual radioactivity at the site has been reduced so that if institutional controls were no longer in effect, members of the public will not receive a dose greater than 100 mRem/yr or, under certain circumstances, 500 mRem/yr. The anticipation of failure is not required under the Superfund law or any of EPA's policy documents. Instead, the possibility that institutional controls can fail is addressed through the requirement that five year reviews be conducted at any site where contamination is left at levels that don't allow for unrestricted use. Such reviews should analyze the implementation and effectiveness of institutional controls with the same degree of care as other parts of the remedy. EPA also believes emphasis must be placed on starting out with a good set of controls as discussed in the new guidance "Institutional Controls: A Site Manager's Guide to

Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups," EPA, September 2000.

AS LOW AS REASONABLY ACHIEVABLE (ALARA).

The concept of ALARA has been around for many years in the worlds of nuclear power and nuclear weapons. Until recently it was applied exclusively to worker protection. Primarily it was employed in the planning of work and, as the name would imply, was an attempt to reduce radiation exposure as much as possible. An example of the ALARA concept would be a nuclear power plant worker who needs to complete a task in an area near the fuel rod assembly. An analysis of the situation could determine that given the level of radioactivity measured in the area and the length of time necessary for the worker to complete the task, the dose to the worker from performing the task would be well below the occupational limit. The ALARA analysis would ask the question "what additional steps can be taken to further reduce the dose?" For example:

> Is there protective clothing, beyond what is currently in use, that would reduce the worker's dose?
>
> Could the work be sequenced differently to allow the task to be completed quicker?
>
> Could shielding (lead bricks) be placed between the worker and the fuel rod assembly?
>
> Does the worker have the best tools for the job?

Only in recent years has the concept of ALARA been used in association with environmental restoration. The Decommissioning Rule says a site will be considered acceptable for **unrestricted** use, if radioactivity results in a dose no greater than 25 mRem/yr, and the radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). In effect the rule is saying that in addition to meeting the minimum cleanup level, all reasonable steps should be taken to reduce the contamination level even further. In practice this could mean that when DOE has a front end loader digging up a contaminated area at Rocky Flats, they don't halt the excavation as soon the radioactivity falls below the RSAL. Instead, they keep the loader running because for a relatively small increase in cost and time they could remove significant amounts of additional contamination.

Of course the concept is highly subjective; what's reasonably achievable to one may not be to another. An ALARA analysis will have to take a number of issues into consideration:

How much dose could be avoided by doing work beyond that required to meet the RSAL?

How much would the additional work cost?

Is it technically feasible?

What are the risks to workers and to the public of performing additional work?

Will natural resources/habitat be affected?

The rules as to when you do additional work in accordance with ALARA are not hard and fast. The NRC Draft Regulatory Guide DG-4006, "Demonstrating Compliance with the Radiological Criteria for License Determination," does contain formulas for use in ALARA analyses. These formulas try to quantify the benefits of additional cleanup work by assigning a monetary amount to a unit of averted dose (e.g. the benefit of avoiding a dose of 1 Rem is given a value of $2,000). The benefit is then compared to the cost of conducting cleanup beyond that necessary to comply with the RSAL. In general the NRC guidance on ALARA says that additional soil cleanup will not be cost effective if the cleanup already meets the goal of 25 mRem/yr to an unrestricted land use scenario.

The concept of ALARA is consistent with the RFCA Vision which states where possible, the site will be cleaned up to the maximum extent feasible.

WHAT DOES ALL THIS MEAN?

Buried in the verbiage of the Decommissioning Rule and the EPA guidance, are at least three general approaches for developing an RSAL within the current regulatory framework:

1) Calculate an RSAL based on risk instead of dose using the slope factor method as discussed in the EPA guidance document "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination." Use the reasonably

anticipated future scenario and make sure the answer falls within the acceptable risk range of 10^{-4} to 10^{-6}. DOE, EPA and CDPHE were basically going down this road prior to 1996 when the EPA draft rule came into play. One big problem is that there is a lot of room for argument within the acceptable range. In fact the parties calculated a number of risk-based RSALs for Rocky Flats before the current RSALs were established. In 1995 the parties bickered over whether an appropriate RSAL for the Buffer Zone was 60 pCi/g, equating to 10^{-6}, or 6,000 pCi/g, equating to 10^{-4}.

2) Perform a dose assessment using the dose limits in the Decommissioning Rule: 25 mRem/yr to an unrestricted land use, or 25 mRem/yr to restricted land use and 100 or 500 mRem/yr in the event institutional controls fail. This would require an ALARA analysis to determine if actions would be taken beyond those necessary to meet the dose limits. The Decommissioning Rule is of concern to many because of the higher dose limits. The requirement for ALARA could result in lower amounts of residual radioactivity at the site, provided the parties could agree on what reasonably achievable means.

3) Perform a dose assessment using a 15 mRem/yr dose limit in conjunction with the reasonably anticipated future land use. This approach would also be allowable under the EPA guidance document "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination." The current RSAL for the industrial area, 562 pCi/g Pu-239, is consistent with this approach. Although one could make a good argument that commercial reuse is no longer the reasonably anticipated land use. The RAC's recommended RSAL of 35 pCi/g Pu-239 would be consistent with this approach, if one could successfully argue that the resident rancher is a likely future scenario.

On October 30, 2000, DOE, EPA and CDPHE staff discussed these general approaches and fashioned four specific options. The four options are as follows:

Option 1	RSAL based on 25 mRem/yr dose to the anticipated future user (e.g. Open Space User, Commercial Office Worker, or Wildlife Refuge Worker). Residual Radioactivity reduced such that if institutional controls failed, a suburban resident would receive dose no greater than 100 mRem/yr.
Option 2	RSAL based on a slope factor analysis **using a specific value within the acceptable risk range** or 25 mRem/yr dose to the anticipated future user. (Whichever results in a lower RSAL)

Option 3	25 mRem/yr dose to the unanticipated future user (suburban resident).
Option 4	15 mRem/yr dose to the anticipated future user (e.g. Open Space User, Commercial Office Worker, or Wildlife Refuge Worker)

Option 1 is generally in accordance with the Decommissioning Rule, which is an Applicable or Relevant and Appropriate Requirement (ARAR) and therefore has to be met. The option, as expressed, deviates from the Rule slightly in that a suburban residential scenario is contemplated in the event of institutional control failure rather than a rural residential scenario. DOE, EPA and CDPHE believe that given that rapid growth occurring along the Front Range, a rural residential scenario is too far fetched. The RSAL developed under this approach would have to be evaluated using slope factor methodology to assure the risk falls within the acceptable range.

Option 2 is consistent with the EPA guidance and largely consistent with the Decommissioning Rule. Using a specific target value within the 10^{-4} to 10^{-6} range would be a way to avoid endless arguments over where in the acceptable risk range the RSAL should fall. There is precedent at other sites for using a single number within the range as a basis for an action level.

Option 3 recognizes the preference in the Decommissioning Rule for unrestricted release. However, DOE, EPA and CDPHE do not believe unrestricted release of Rocky Flats is likely in the foreseeable future.

Option 4 is consistent with the EPA guidance.

DOE, EPA and CDPHE staff believe that, all things considered, options 1 and 2 are the most workable. We propose that calculations be performed based upon the scenarios in options 1 and 2, and that the result of these calculations be used to develop a site-wide, surface RSAL that, at a minimum, will protect the anticipated future site user. DOE, EPA and CDPHE will use probablistic methodology developing these values. It should be noted that the RSAL being discussed would only govern the cleanup of surface contamination. Calculations as to what an appropriate RSAL for buried contamination in the Industrial Area will be performed at a later time when more is known about the nature and extent of such contamination, and the possible routes of exposure.

In addition to meeting the RSAL everywhere on the surface of the site, DOE will be

required to perform an ALARA analysis, on a project-by-project basis, to determine where cleanup should occur to levels below the RSAL. The first ALARA analysis will occur in conjunction with planning for the 903 pad remedial action and will give careful consideration to the issue of surface water protection. The analyses in other areas of the site will occur later in the project when characterization efforts are complete.

Finally, the RSAL is not a value that is protective of the surface water standard. Meeting the RSAL will in no way guarantee that the surface water standard won't be violated. DOE is obligated under the RFCA to meet the surface water standard, and will have to take the necessary steps to do so. This could include excavation of contamination to levels below the RSAL or the construction of engineered controls.

Draft EPA Rule

- Sites to be cleaned up so that dose to public <= 15 mRem/yr
- If institutional controls play a part in the remedy, then residual contamination must be reduced so that dose to public is <= 85 mRem/yr in the event of control failure.

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Rationale Behind Current RSAL

- 15 mRem Dose to Anticipated Future User
  - Office Worker (562 pCi/g)
  - Open Space User (4,145 pCi/g)
- 85 mRem to the Unanticipated Future User
  - Suburban Resident (651 pCi/g)

Change in Regulatory Landscape

- EPA Rule died a painful death.
- NRC Promulgated a rule.
  - Clean sites so dose to public is <= 25 mRem/yr (plus ALARA)
  - Residual contamination reduced so dose to public <= 100/500 mRem/yr in the event of Institutional Control failure. Residual Contamination is ALARA

Regulatory Landscape Cont.

- EPA Guidance
  - Dose limits in the NRC Rule may not be protective.
  - CERCLA Risk Range of 10-4 to 10-6 should be used for developing action levels.
  - If a dose limit is used to develop action level, it should generally be 15 mRem/yr.
  - Cleanups must protect HH&E and Comply with ARARs

Land Use and Institutional Controls

- RFCA envisioned Institutional Controls to assure the anticipated land uses.
- EPA Policy: cleanup levels consistent with reasonably anticipated future land use.
- NRC Rule prefers unrestricted use, but allows for restricted release in conjunction with institutional controls.

ALARA

- Historically the concept has been applied to worker safety.
- NRC has draft guidance for how ALARA should be used in cleanup applications.
- Some precedent at other sites.
- RFCA Vision states "where possible the site will be cleaned to maximum extent feasible".

Options

- 1) - 25 mRem to anticipated future user/100 mRem to unanticipated future user
- 2) - Single value in risk range for anticipated future user compared to 25 mRem to anticipated future user
- 3) - 25 mRem to unanticipated future user
- 4) - 15 mRem to anticipated future user

RFCA Stakeholder Focus Group
Attachment J

Title:	Radionuclide Soil Action Level Outline
Date:	November 1, 2000
Author:	Paul Hartmann U. S. Department of Energy
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RFCA RSAL Report
Draft Outline
Revision 0 – November 1, 2000

Executive Summary

Introduction

Background

Purpose

The above will contain the preamble, and will explain or address:

- What is an RSAL (and what it is not: i.e. protection of SWQ, not ALARA)
- The 1996 RSAL Report – what it did, why
- What is ALARA (broad view)
- The RAC Report (broad view)
- Land Use - general information
- RFCA – general information of the regulatory structure
- RFCA Annual Review- what reviewed and why
- Surface and Sub-surface RSALs
- The CERCLA process – What it tells us

Analysis

<u>Regulatory Review –Task 1</u>

- From EPA
- See most current draft

<u>Model Evaluation – Task 2</u>

- Discussion of current computer models
- Comparison (deltas) with RAC modified RESRAD
- Model Selected and Why

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1/2

[redacted]

RFCA RSAL Report
Draft Outline

Parameter Evaluation – Task 3

- Discussion of Parameters
- Identification of appropriate Parameters
- Deltas with RAC
- Sensitivity Analysis

New Scientific Information –Task 4

- What was considered
- What was used or not
- Basis for consideration

Other Site Clean up Levels –Task 5

- Other Site Cleanup levels (including Johnson Atoll)
- Discussion of local water impacts, as related to the cleanup standard
- Analysis

Calculation of RSAL- Task 6

References

Appendices

RFCA Stakeholder Focus Group
Attachment K

Title:	**REVISED** - Determining Cleanup Goals at Radiologically-Contaminated Sites
Date:	**November 8, 2000**
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ADMIN RECORD

RFCA Stakeholder Focus Group
Determining Cleanup Goals at Radiologically-Contaminated Sites

INTRODUCTION

The purpose of this report is to explain the context in which cleanup levels have been developed at radiologically-contaminated sites. This report documents cleanup levels and presents case studies from selected sites to demonstrate variations in the decision-making framework and basis.

Differences in cleanup levels from site to site are due to variations in one or more of the elements in the cleanup level development process. This process begins with determining which regulatory authority applies. Many sites involving the research, development, processing, assembly, waste disposal, or even deployment of nuclear weapons are CERCLA sites. According to the CERCLA and the NCP, selected remedies, and therefore cleanup guidelines, must be protective of human health and the environment and must comply with ARARs. Depending on which requirements are determined to be ARARs, Preliminary Remediation Goals (PRGs) are usually established by assessing radiological health effects using a risk-based or dose-based approach. Either approach requires selecting appropriate scenarios, models/equations, and site-specific input parameters. Modifying factors may be applied to PRGs to create Remedial Action Objectives (RAOs), which direct remediation projects, and final Remedial Goals (RGs), which are incorporated into RODs. Variations in the elements of this process have led each site to establish different cleanup levels.

Cleanup levels have been identified for several other sites besides those included in this report. Without the background and context for these values, however, they will not be reported here. Most cleanups of nuclear weapons accident sites will also not be discussed in this report. At least 11 nuclear bombs from the Cold War era, including five in the United States, have still not been recovered. Accident sites where contamination was spread and cleanup occurred include Palomares, Spain (1966) and Thule, Greenland (1968). For the most part, activity levels reported at these sites are post-remediation measurements rather than cleanup levels determined prior to remediation. As such, these levels are not appropriate for comparison in this report.

A document explaining the context for cleanup level decisions at radiologically-contaminated sites is also being conducted by the Radionuclides Work Team of the Interstate Technology & Regulatory Cooperation (ITRC), a cooperative effort among

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state regulators, federal agencies, industry, and academia. This document is currently being complied with the help of regulators from various states and is scheduled to be published early in 2001. The case studies presented in this report will become part of that document.

ORGANIZATION OF THE REPORT

Case studies from 12 radiologically-contaminated sites present a background of each site including the site history and nature of contamination. These case studies then discuss the unique manner in which each site developed cleanup levels – the regulatory basis, models and inputs used, and what factors may have been applied to derive a final cleanup number. Contact information is listed for most sites, including persons who are knowledgeable about the site and websites, if available. The sites reported are:

1. Enewetak Atoll, Marshall Islands
2. Fernald Environmental Management Project, OH
3. Ft. Dix, NJ
4. Hanford Site, WA
5. Johnston Atoll, Marshall Islands
6. Linde Site, NY
7. Maralinga, Australia
8. Nellis Air Force Base Ranges, NV
9. Oak Ridge, TN
10. Savannah River Site, SC
11. Tonapah Test Range, NV
12. Weldon Springs, MO

Cleanup levels for plutonium at various sites are listed in Table 1; Table 2 contains cleanup levels for uranium. Comparison of values in these tables can be meaningfully done only in context of the explanation of the site-specific cleanup level development process in the case studies. Table 3 presents key RESRAD input parameters used by several sites which used that computer model to determine cleanup levels.

RFCA Stakeholder Focus Group
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CASE STUDY: FORT DIX, NEW JERSEY

Background

In June 1960, a large fire in an antiaircraft bunker melted the warhead of a Boeing Michigan Aeronautical Research Center (BOMARC) missile releasing plutonium to the environment. Water used to fight the fire spread the plutonium over the land surface and into the subsurface. Some equipment was eventually removed and the area of contamination covered with layers of concrete. Many of the details regarding this accident and subsequent response remain classified.

Cleanup Level Development

On August 7, 2000, the New Jersey Commission on Radiation Standards promulgated Soil Remediation Standards for Radioactive Materials (N.J.A.C. 7:28-12). These standards are intended to apply as an ARAR at radiologically-contaminated CERCLA sites. Minimum remediation standards are based on a 15 mrem total annual effective dose equivalent (TEDE) limit. This annual dose limit includes the groundwater pathway and equates to 1 standard deviation of the background levels in the state. This dose limit was translated to soil concentration limits using an all pathways approach. These soil remediation standards are increments above background. Average background concentrations of the radionuclides at a site are determined using MARSSIM methodologies or other approved methods. The sum of fractions rule applies to sites with multiple radionuclides.

Derived Concentration Guideline Levels (DCGLs) have been calculated using a spreadsheet for several individual radionuclides (U-234, U-235, U-238, Ra-226, Ac-227, and Th-232). These dose-based DCGLs have been derived for unrestricted use (residential), limited restricted use (institutional controls required), and restricted use (institutional controls and engineering controls required) using parameters from EPA's Exposure Factors Handbook and NRC's NUREG 5512. The tables further provide different values for varying contaminant thicknesses and for varying amounts of clean cover. Table values (in pCi/g) for one foot of contaminated soil are:

Radionuclide	Unrestricted Use	Limited Restricted Use	Restricted Use* (1-foot cover)
Ac-227	3	5	17
Ra-226	3	5	7

Th-232	2	3	15
U-234	62	69	81
U-235	29	37	62
U-238	54	64	82

*for commercial use; cover must be maintained

Sites may petition for alternative remediation standards in lieu of the DCGL tables using RESRAD or the spreadsheet RaSoRS. These alternate soil cleanup standards must:

1. Not exceed 15 mrem/year TEDE;
2. Not exceed 3 pCi/L of radon in indoor air;
3. Not exceed New Jersey Groundwater Quality Standards;
4. Be derived using standard input values for certain parameters:

Parameter	**Unrestricted**	**Limited or Restricted**
Indoor onsite breathing rate (m3/hr)	0.63	1.4
Outdoor onsite breathing rate	1.40	1.4
(m3/hr)	70	12.5
Soil ingestion rate (g/yr)	17,136	0
Homegrown crop ingestion rate	700	700
(g/yr)	0.20	0.20
Drinking water consumption rate	0.80	0.80
(l/yr)	1	1
Shielding factor through building or	0.70	0.18
slab	0.05	0.05
Shielding factor through wall		
Shielding factor outside		
Fraction of time spent indoors onsite	1E-3	1E-3
Fraction of time spent outdoors	4E-2	4E-2
onsite	1E-2	1E-2
Soil to Vegetation Transfer Factors	1E-3	1E-3
(pC/g wet plant to pCi/g dry soil):	2.5E-3	2.5E-3
Th	2.5E-3	2.5E-3
Ra	1E-2	1E-2
Pb	1E-1	1E-1

Po U Ac Pa Bi		

The U.S. Air Force, which is responsible for the cleanup, derived a cleanup level of 8 pCi/g of plutonium for a ROD which was signed in 1992. This activity level was originally designed to represent a 4 mrem annual dose. Even though this value has not been reduced to account for other radionculides such as americium ingrowth, it is acceptable to the New Jersey Department of Environmental Protection since it is considerably lower than an unrestricted cleanup level based on the State's current dose criterion of 15mrem/year (approximately 25 pCi/g of Pu). The ROD requires the removal and offsite disposition of concrete and soils that exceed the 8 pCi/g cleanup level.

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CASE STUDY: JOHNSTON ATOLL

Background

Johnston Atoll is located between Hawaii and the Marshall Islands. Oahu, 720 nm northwest of the atoll is the closest inhabited island. The atoll originated as a volcanic island, but is now composed exclusively of coral. There were no indigenous people and until World War II the island was only occasionally inhabited. Since 1941 the atoll has been used as a military reservation. The Atoll is composed of two islands, Johnston Island and Sand Island. Johnston Island was originally about 46 acres, but after several periods of dredging, the area at the time of the nuclear tests was 185 acres. Since the tests the island has been further enlarged to 625 acres. The atoll has been determined to have no further defense mission. After cleanup the island will be declared a wildlife refuge under the administration of the Fish and Wildlife Service.

The contamination on Johnston Atoll was caused by three separate accidents involving THOR rockets during high altitude tests of nuclear devices during the summer and fall of 1962. None of the accidents resulted in an accidental detonation of a nuclear device. One rocket exploded on the pad on Johnston Island distributing coarse plutonium particles over the immediate around the launch pad. Two rockets were destroyed by the range safety officer at altitudes of 30,000 ft. and 109,000 ft over Johnston Atoll. The explosion at 30,000 ft definitely contaminated large areas of the atoll. The higher altitude explosion may also have contaminated the atoll. The most serious contamination was in the immediate area of the launch pad. During cleanup, some of the material was placed in the lagoon, along with some debris from the high altitude rocket explosions, which rained down on the lagoon. Later dredging efforts to expand the island resulted in some of this contamination being spread over other areas on the island.

The island has undergone several previous cleanup attempts. In 1962, the debris from the destroyed rockets and some surface coral was loaded into landing craft and disposed of at sea. The less contaminated soil was dumped into the lagoon. No formal cleanup standard was used to determine the extent of the cleanup. Two years later the lagoon was dredged and most of the contaminated soil was incorporated into the island. In the eighties a cleanup standard was adopted based on EPA draft guidance for soil screening levels of 13.5 pCi/g. That standard has now been superceded by the current EPA guidance using lifetime cancer risk.

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Cleanup Level Development

The RESRAD Version 5.82 program was used to determine cleanup levels. Instead of entering a dose limit, the program was run in the cancer risk mode. This mode is not documented, but the program is fully capable of utilizing cancer slope factors to set a soil action level. Key model input parameters are listed in Table 3 where they are compared to parameters used by other sites.

Four separate scenarios were investigated. Two of these are similar in that they involve a cleanup worker and a Fish and Wildlife worker. The difference between the two is that although both work outdoors in a dusty environment and ingest a large amount of soil, the cleanup worker also grows a modest amount of vegetables and because of the soil disturbance breaths twice the dust (.0002g/m^{-3}). The third scenario is an ecotourist who visits the island to observe seabirds. He only stays two weeks a year; therefore his exposure is less. The last scenario is a homesteader that surreptitiously lives on the island. The study used a soil ingestion rate of 73g/yr for the two worker scenarios and 36g/y for the homesteader. The EPA Exposure Factors Handbook recommends 18g/y for adults while the RESRAD default value is 36g/y. Based on this the values are conservative. Total excess cancer risk was calculated by the RESRAD code using cancer risk factors from the 1997 HEAST (EPA, 1997). The risk is greatest in the first year for all exposure scenarios. The estimated total excess lifetime risk per pCi/g of TRU alpha exposure results are given in the table below:

Allowable Residual Soil Concentration (pCi/g of TRU alpha)

Cancer Risk	**Fish & Wildlife Worker**	**JA Resident**	**EcoTourist**	**Homesteader**
1E-06	2.1	1.9	38	0.32
1E-05	21	19	380	3.2
1E-06	210	190	3800	32

If the pathways that produced the risks are examined, the ingestion pathway, especially soil ingestion, dominates.

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Pathway	Fish & Wildlife Worker	JA Resident	EcoTourist	Homesteader
Inhalation		9.3%	1.8%	3.7%
Soil Ingestion	4.9%	82.2%	16.1%	34.9%
Plant Ingestion	86.9%	0.7%	0%	56.6%
External Exposure	0% 8.2%	7.7%	82.1%	4.6%

The report does not recommend which scenario to use, but DTRA is reportedly leaning toward the Fish and Wildlife Service worker with the addition of ALARA. (personal communication with K. Higley)

{Sept '00 correspondence from EPA Reg. IX regarding cleanup levels}

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CASE STUDY: LINDE SITE

Background

The Linde Site is located in the Town of Tonawanda, New York near Buffalo. From 1942 to 1946 (or 1948 according to some records), this site was used for separation of uranium ores from Colorado and the Congo under the Manhattan Engineering District (MED). Ores were processed in three phases: 1) uranium separation from the ore; 2) conversion of U3O8 to uranium dioxide; 3) conversion of UO2 to UF4. The principal contaminants of concern resulted form the first processing phase; residues form the other phases were recycled. Disposal of processing wastes from the Linde property also contaminated three other sites in Tonawanda. Radioactive contamination occurs in processing buildings, surface and subsurface soils, and in sediments in sumps and storm and sanitary sewers. Also, approximately 55 million gallons of waste effluent containing dissolved uranium dioxide were injected into the subsurface through seven wells during a three year period. The Remedial Investigation (BNI, 1993) concluded that subsurface radioactive contamination probably occurs as minor amounts of immobile uranyl sulfates and carbonates precipitated in the underlying shale.

Cleanup Level Development

The Army Corps of Engineers became the lead regulatory agency for the Linde site in 1998 when Congress handed the Formerly Utilized Sites Remedial Action Program (FUSRAP) to the Corps. DOE had previously handled the cleanup effort and had issued a Proposed Plan in 1993 which called for cleanup levels of 60 pCi/g for uranium. In accordance with the NCP requirement that selected remedies must comply with ARARs, the Corps reviewed the Uranium Mill Tailings Radiation Control Act (UMTRCA) for applicability. Standards in UMTRCA (40 CFR Part 192) are not considered applicable since the regulation only applies to specific sites designated in the Act. The Corps, however, determined that UMTRCA is relevant and appropriate to the Linde Site cleanup since the processing activities and radionuclides in the resulting wastes are similar to those at uranium mill sites. In a new Proposed Plan issued in March 1999 and in a ROD signed in June 2000, the Corps calculated new cleanup levels based on UMTRCA.

Subpart A of 40 CFR 192 establishes groundwater standards including maximum radionuclide concentrations:

- combined Ra-226 and Ra-228 -- 5 pCi/L
- combined U-234 and U-238 -- 30 pCi/L

- gross alpha particle activity (excluding Rn and U) -- 15 pCi/L

A review by the Corps of previous groundwater sampling results shows that these standards are not exceeded. Based on these results and information that showed that groundwater at the site is not potable, the Corps concluded that groundwater at the Linde Site does not need to be remedied.

Subpart B of 40 CFR 192 addresses cleanup of soil and buildings and sets standards for residual concentrations of Ra-226 in soil. Radium concentrations cannot exceed background by more than 5 pCi/g in the upper 15 cm of soil or 15 pCi/g in any 15 cm layer below the upper layer, averaged over an area of 100 m^2.
Subpart D of 40 CFR 192 requires that releases of Rn-222 and Rn-220 into the atmosphere cannot exceed an average of rate of 20 pCi/m2-sec. The proposed plan concludes that implementation of the proposed remedy will result in releases that are below this limit.

In addition to UMTRCA requirements, the Corps also developed a uranium cleanup level that would meet the CERCLA risk range. This cleanup guideline for total uranium applies to areas of the Linde site where soils are predominantly contaminated with uranium and very little radium and thorium. A risk assessment conducted by the Corps considered the radiological risk as well as the chemical toxicity of uranium. This assessment considered the most likely future land use to be its current industrial/commercial use. A cleanup level of 600 pCi/g for uranium was calculated based on limiting potential radiological risks to 10^{-5}. This 600 pCi/g cleanup level for uranium together with the UMTRCA criteria form the cleanup requirements for the Linde Site.

The ROD for the Linde site was signed in March 2000.

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CASE STUDY: MARALINGA, AUSTRALIA

Background

Between 1955 and 1963, the United Kingdom conducted a series of nuclear weapons tests at Maralinga, including seven nuclear explosions called "major trials". The sites of these major trials no longer present any significant health risk, because all the radioactivity released in these explosions was either dispersed throughout the world or has sufficiently decayed since (ARPNSA, 2000). Plutonium contamination was spread locally as a fine dust, as small submillimeter-size particles, and as surface contamination on larger fragments by several hundred "minor trials". These consisted of radioactive materials exploded with conventional explosives, similar to the "safety shots" conducted at the Tonapah Test Range in Nevada.

Cleanup Level Development

The selected remedy involves removing 10 millimeters of soil from the areas of worst contamination and restricting access to 120 km^2 of land. The contaminated soil and debris is buried in trenches on-site under at least 5 meters of fill. Unknown amounts of contaminated debris in 21 pits will be vitrified in-situ. Cleanup criteria were set by using "conservative principals" and by estimating doses for "realistic scenarios" (ARPNSA, 2000). These include Aborigines living just outside the controlled areas and hunting inside them. The highest activity allowed outside of controlled areas is 20 - 35 kBq/m^2 (about 540 – 950 pCi/m^2) of Pu-239 depending on the particular site, which is calculated to produce a 5 mSv (500 mrem) annual dose.

Because it is relatively easy to detect in the field, Am-241 is used to indicate concentrations of Pu-239. Ratios of Pu-239/Am-241 vary from site to site and even from test to test at a single site. Therefore, Pu-239/Am-241 ratios have been determined for every cleanup area. Actual soil removals are delineated by activity levels for Am-241 that are specific for that particular area based on these ratios.

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Major U.S. Radiation Standards

Standard	Agency[a]	Numerical limits[b]
General public (10 CFR 20)	NRC	100 millirem/year
Uranium mill tailings (40 CFR 192; 10 CFR 40, App. A)	EPA; NRC	Ra-226/228: 5 pCi/g (surface) 15 pCi/g (subsurface) Rn-222: 20 pCi/m^2-sec
High-level waste operations (10 CFR 60)	NRC	100 millirem/year
Spent fuel, high-level waste, transuranic waste disposal (10 CFR 191)	EPA	All pathway: 15 millirem/year Groundwater: 4 millirem/year[c]
Low-level waste (10 CFR 61)	NRC	25 millirem/year
Drinking water (40 CFR 141.15 and 141.16)	EPA	Radium: 5 pCi / L Gross alpha: 15 pCi / L Beta/photon: 4 millirem/year[c]
Uranium fuel cycle (40 CFR 190)	EPA	25 millirem/year
Superfund (CERCLA) cleanup (40 CFR 300)	EPA	1 in 10,000 to 1 in 1,000,000 excess lifetime risk of getting cancer
Decommissioning (10 CFR 20)	NRC	25 millirem/year 5,000 millirem/year
	OSHA; NRC; DOE	

Occupational standards (29 CFR 1910; 10 CFR 20; 10 CFR 835)		

[a] NRC = Nuclear Regulatory Commission
EPA = Environmental Protection Agency
OSHA = Occupational Safety and Health Administration
DOE = Department of Energy
[b] A picocurie (pCi) is a trillionth of a curie, a unit of radioactivity.
A millirem is a thousandth of a rem, a unit of dose.
[c] Radioactivity from human-made radionuclides in community drinking water systems.

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Table 1 - Soil Cleanup Levels for Plutonium

Site	Scenario	Cleanup Level (pCi/g)	Date	Comments
Enewetak Atoll	Residential	40	*1973*	DOD-DNA/DOE
	Agricultural	80		
	Food-gathering	160		
	Subsurface	400		
Fernald EMP	Park user (on-site)	77	*1995*	DOE/EPA/OEPA; 10^{-6} risk
	Resident farmer (off-site)	9		
Ft. Dix, NJ		8	*1992*	USAF; BOMARC missile accident; 10^{-4} risk
Hanford Reservation		34	*1995*	
	Rural resident	245		WDOH; 15 mrem/year; used RESRAD ver. 5.7
	Commercial/Industrial	13.5	*1988*	
Johnston Atoll				EPA Reg. IX
		2.1 – 210	*2000*	
		1.9 – 190		DOD-DTRA; 10^{-6} – 10^{-4} risk range; used RESRAD ver. 5.82
	Fish & wildlife researcher	38 – 3800		
	Resident EcoTourist	.32 – 32		
Mound Facility	Homesteader	100		Pu-238 in canal sediments; 25 pCi/g if reasonably achievable (ALARA level)
			1999	
Nellis Air Force Range		54,000		USAF (Proposed) 25 mrem/year; used RESRAD ver. 5.61; offsite resident based on NESHAP dose criteria of 10 mrem/year; assumes a Pu-239 : Am-241 activity ratio of 12.7 : 1
		125,000		
	Industrial worker	27,000		
	Bomb detonation (USAF)	700,000		
		825,000		
	Bomb detonation (civilian)	2,000		
		150,000		
	Munitions removal	27,000		

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	Aircraft crew	68,000		
	Ground troops	10,000		
	Ordinance EOD (USAF)		*1996*	
Rocky Flats: Cleanup Agreement	Ordinance EOD (civilian)	1088		DOE/EPA Reg. VIII/CDPHE; 15 mrem/year; used RESRAD ver. 5.61
		1429		
	Construction worker	252		
	Offsite resident		*2000*	
		80		RAC; 15 mrem/year; used RESRAD ver. 5.82;
Oversight Panel	Office worker		*2000*	
	Open space	10		DOE/EPA/CDPHE; 10^{-6} risk
	Resident	17.5		
Preliminary Remediation Goals			*2000*	
	Resident rancher	200		DOE; Cleanup level used at Double Tracks and Clean Slate Sites
	Office worker			
Tonapah Test Range	Office worker			
	Open space			
	Resident rancher			

CDPHE – Colorado Dept. of Public Health & Environment
EPA – U.S. Environmental Protection Agency
DNA – Defense Nuclear Agency
DOD – U.S. Department of Defense
DOE – U.S. Department of Energy
DTRA – Defense Threat Reduction Agency
OEPA – Ohio Environmental Protection Agency
RAC – Risk Assessment Corporation
USAF – U.S. Air Force
WDOH – Washington Department of Health

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Table 2 - Soil Cleanup Levels for Uranium

Site	Scenario	Cleanup Level (pCi/g)	Date	Comments
Denver Radium Sites				
Fairfield, OH		35		
Fernald EMP	Park user (on-site):		*1995*	EPA/DOE/OEPA; 10^{-6} risk; dependent on leachability (K_1)
	total U (K_1=325 L/kg)	82 ppm		
	total U (K_1=15 L/kg)	20 ppm		
	Resident farmer (off-site)			
	total U (K_1=325 L/kg)	50 ppm		
New Jersey	Unrestricted use:		*2000*	New Jersey Commission of Radiation Protection; represents 15 mrem/year TEDE in a 1-ft. thickness of soil at the surface with no cover
	U-234	62		
	U-235	29		
	U-238	54		
	Limited restricted use:			
	U-234	69		
	U-235	37		
	U-238	64		
	Restricted use:			
	U-234	81		
	U-235	62		
	U-238	82		
Hanford Reservation	Rural resident:		*1997*	WDOH; 15 mrem/year; used RESRAD ver. 5.61
	U-234	160		
	U-235	26		
	U-238	85		
	Commercial/Industrial			
	U-234	1200	*2000*	
	U-235	100		
	U-238	420		
Hazelwood, MO		60		
Johnston Atoll	Fish & wildlife researcher Resident EcoTourist		*2000*	DOD-DTRA; 10^{-6} – 10^{-4} risk range; used RESRAD ver. 5.82

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	Homesteader			
Linde Site	Industrial / commercial	600	*1999*	USACE; 10^{-5} risk; FUSRAP site
Maywood, NJ		100		
Mound Facility				For canal sediments
Naturita, CO		30		
Nevada Test Site & associated ranges	Industrial worker Bomb detonation (USAF) Bomb detonation (civilian) Munitions removal Aircraft crew Ground troops Ordinance EOD (USAF) Ordinance EOD (civilian) Construction worker Offsite resident			USAF (proposed); 25 mrem/year; used RESRAD ver. 5.61; offsite resident based on NESHAP dose criteria of 10 mrem/year; assumes a Pu-239 : Am-241 activity ratio of 12.7 : 1)
Oxford, OH		35		
Rocky Flats:				
Cleanup Agreement		1627	*1996*	DOE/EPA Reg. VIII/CDPHE; 15 mrem/year; used RESRAD ver. 5.61;
	Industrial Use (U-234)	113		
	Industrial Use (U-235)	506		
	Industrial Use (U-238)	1738		
	Open space (U-234)	135		
	Open space (U-235)	586		
	Open space (U-238)	307		
	Resident (U-234)	24		
	Resident (U-235)	103		
	Resident (U-238)			
Oversight Panel			*2000*	RAC; 15 mrem/year; used RESRAD ver. 5.82
	Resident rancher			
	Office worker			
Preliminary Remediation Goals		68	*2000*	DOE/EPA Reg. VIII/CDPHE; 10^{-6} risk; uses Federal Regulatory Guide 13 slope factors
	Office worker (U-233)	69		
	Office worker (U-234)	0.8		
	Office worker (U-235+D)	3.8		
	Office worker (U-238+D)	122		

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	Open space (U-233)	123		
	Open space (U-234)	4.2		
	Open space (U-235+D)	17.8		
	Open space (U-238+D)	4.43		
	Resident (U-233)	4.86		
	Resident (U-234)	0.76		USACE (FUSRAP program);
	Resident (U-235+D)	0.33		surface/subsurface soil
	Resident (U-238+D)			
Springdale, PA		100		
Linde Site, NY		600		
	Commercial / industrial	3,021		
	Subsurface			

CDPHE – Colorado Dept. of Public Health & Environment
EPA – U.S. Environmental Protection Agency
DNA – Defense Nuclear Agency
DOD – U.S. Department of Defense
DOE – U.S. Department of Energy
DTRA – Defense Threat Reduction Agency
OEPA – Ohio Environmental Protection Agency
RAC – Risk Assessment Corporation
USASCE – U.S. Army Corps of Engineers
USAF – U.S. Air Force
WDOH – Washington Department of Health

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Table 3 – Comparison of Key Residential RESRAD Input Parameters

Parameter	Units	Hanford Site	Johnston Atoll	Clean Slate Sites, Nevada	Rocky Flats Cleanup Agreement	Rocky Flats Oversight Panel
Dose Limit [or risk range]	mrem/year	15	[10^{-4} – 10^{-6}]	100	15	15
RESRAD version		5.7	5.82	5.61	5.61	5.82
Exposure Pathways:						
1-External Gamma		Active	Active	Active	Active	Active
2-Inhalation		Active	Active	Active	Active	Active
3-Plant Ingestion		Active	Active	Active	Active	Active
4-Meat Ingestion		Active	Suppressed	Active	Suppressed	Active
5-Milk Ingestion		Active	Suppressed	Active	Suppressed	Active
6-Aquatic Foods		Active	Suppressed	Suppressed	Suppressed	Active
7-Drinking Water		Active	Suppressed	Active	Suppressed	Active
8-Soil Ingestion		Active	Active	Active	Active	Active
9-Radon		Suppressed	Active	Active	Suppressed	Suppressed
Distribution Coefficients (K_d):						
Americium	cm^3/g	200	10,000	1900	76	76*
Plutonium	cm^3/g	200	230,000	550	218	218*
Uranium	cm^3/g	25	50	35	50	218*
Area of Contaminated Zone	m^2	10,000	98,000	248,000	40,000	*
Thickness of Contam'd Zone	m	4.6	0.61	0.05	0.15	0.2
Inhalation Rate	m^3/yr	7300	8400	6820	7000	10800
Mass Loading (Inhalation)	g/m^3	0.0001	0.0002	.000015	.000026	.007*
Exposure Duration	yr	30	10	30	30	70
Inhalation Shielding Factor		0.4	1	1	1	1
External [illegible] Shielding Factor		0.8	0.5	0.7	0.8	0.7
Indoor Time Factor		0.6	0.25	0.58	1	0.6
Outdoor Time Factor		0.2	0.75	0.0155	0	0.4
Wind Speed	m/s	--	9	--	--	4
Fruits, Vegetables, Grain	kg/yr	110	1	120.5	--	190
Leafy Vegetables	kg/yr	2.7	1	10	--	64
Soil Ingestion	g/yr	36.5	73	37.4	70	75
Drinking Water Intake	L/yr	730		444.6	--	730
Drinking/Household Water Fraction from Groundwater		1	--	1	--	1
Depth of Soil Mixing Layer	m	0.15	--	0.15	0.15	0.03
GI Absorption Factor (f_1):						
Am-241			1E-3			5E-4
Pu-239			1E-3			5E-4
U-238+D			5E-2			2E-2
Ingestion Slope Factor:	Risk / pCi					
Am-241			3.28E-10			
Pu-239			3.16E-10			
U-238+D			6.20E-11			
Inhalation Slope Factor:	Risk / pCi					

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Parameter	Units	Hanford Site	Johnston Atoll	Clean Slate Sites, Nevada	Rocky Flats Cleanup Agreement	Rocky Flats Oversight Panel
Am-241			3.85E-8			
Pu-239			2.78E-8			
U-238+D			1.24E-8			
External Exposure:	Risk/yr per					
Am-241	pCi/g		4.59E-9			
Pu-239			1.26E-11			
U-238+D			5.25E-8			
Dose Conversion Factors:	mrem /					
(inhalation / ingestion)	pCi					
Am-241				4.40E-1 / 3.64E-3	4.44E-1 / 3.64E-3	1.55E-1 / 7.4E-4
Pu-239				4.29E-1 / 3.54E-3	3.08E-1 / 5.18E-5	5.9E-2 / 9.3E-4
U-234				1.32E-1 / 2.83E-4	1.32E-1 / 2.83E-4	3.5E-2 / 1.8E-4
U-235+D				1.23E-1 / 2.67E-4	1.23E-1 / 2.67E-1	3.1E-2 / 1.7E-4
U-238+D				1.18E-1 / 2.69E-4	1.18E-1 / 2.69E-4	3.0E-2 / 1.7E-4

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Determining Cleanup Goals at Radiologically-Contaminated Sites

* Derived probabilistically using distributions of data

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RFCA Stakeholder Focus Group
Determining Cleanup Goals at Radiologically-Contaminated Sites

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Questions and Issues for Consideration as Part of the RSAL Regulatory Analysis Discussion

November 8, 2000

The following questions and issues were prepared by David Abelson and Ken Korkia with input from members from the Rocky Flats Citizens Advisory Board and the Rocky Flats Coalition of Local Governments for consideration during the RSAL regulatory analysis discussion. These questions or issues are not meant to imply any official endorsement of issues or positions by members of either organization. They are meant solely to bring forward topics for conversation by the RFCA Stakeholder Focus Group.

1) ARARs:

- What is the distinction between applicable, relevant and appropriate?
- Is there a hierarchy among these three concepts, i.e., is applicable something you **must** consider, whereas relevant and appropriate are things you have **discretion** to consider?

0ÿ **Scenario Development:** ***The NRC rule clearly states a preference to cleaning up sites to a level that allows for unrestricted use. The rule provides that the agency must clean up to 25 mrem with institutional controls if cleanup to unrestricted use is not feasible.***

- Do the RFCA parties agree with this interpretation of the NRC rule?
- Why do the agencies appear to reject this precept by not endorsing the third option outlined in EPA's regulatory analysis?
- How do the agencies justify selectively not considering this as part of the NRC rules?
- Is there an interpretation of ARARs that justifies this decision?

3) Risk vs Dose:

- What methodology will be used to determine which approach is best?

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- If a risk approach is used, how will decisions be made to select a value within the 10^{-4} to 10^{-6} risk range?
- Why is EPA Region VIII considering the 25 mrem number, when EPA as a whole appears to disagree with the number?

4) ALARA:

- How will ALARA analysis be used?
- What is NRC's interpretation of ALARA?
- What does CERCLA have to say about ALARA?
- What is DOE and the regulators' interpretation of ALARA?
- Is ALARA analysis something discretionary, and if so, how do the agencies justify such an interpretation through the ARARs?
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RFCA Focus Group
November 8, 2000 Meeting
D R A F T

Actions for November 8, 2000 meeting

1. Draft conceptual site use model (Diane Niedzwiecki, CDPHE)
2. Information on NRC review of RESRAD 6.0 (Dave Shelton, Kaiser-Hill)
3. Draft plan for peer review of RSALS Review (Mary Harlow, City of Westminster)
4. Copy of a newspaper article regarding dust problems after the fire at the Idaho National Engineering and Environmental Laboratory (Dave Abelson, RF CLOG)
5. Regulatory framework for RSALs (Tim Rehder, EPA)
6. Information needs and schedule for continuing the water quality discussions (Joe Legare, DOE)
7. ER Decision Matrix of RSALs revision (John Corsi, Kaiser-Hill)

October 23, 2000

Dear Stakeholder:

The Rocky Flats Cleanup Agreement (RFCA) Stakeholder Focus Group will meet at the Broomfield Municipal Center at One DesCombes Drive, on November 8, 2000 from 4:30 to 6:30 p.m. A technical discussion meeting will be held in the Bal Swan room at the Broomfield Municipal Center from 3:00 to 4:15 p.m. The Focus Group meeting will be held in the Bal Swan and Zang's Spur rooms. The agenda for the November 8 meeting is enclosed (Attachment A).

The meeting minutes from the October 11, 2000 RFCA Stakeholder Focus Group are enclosed (Attachment B). Also enclosed are the following background materials requested by the Focus Group at the October 11, 2000 meeting or identified by the RFCA Parties:

- Draft conceptual site use model (CDPHE, Attachment C)
- Information on NRC review of RESRAD 6.0 (Kaiser-Hill, Attachment D)
- Copy of a newspaper article regarding dust problems after the fire at the Idaho National Engineering and Environmental Laboratory (RF CLOG, Attachment E)
- Revised ER Decision Matrix (Kaiser-Hill, Attachment F)

You are encouraged to attend the technical discussion session for these materials that will occur in the Bal Swan room at the Broomfield Municipal Center from 3:00 to 4:15 p.m. on November 8, 2000. We will have subject matter experts available to answer any questions on the packet information.

If you need additional information to prepare you for the Focus Group discussion on November 8, please contact the subject matter experts listed in the packet, or call Christine Bennett of AlphaTRAC, Inc. at 303 428-5670 (cbennett@alphatrac.com). Christine will help to find the appropriate resource for you.

Also enclosed is a schedule for the meetings through February 2001 (Attachment G).

Please visit the RFETS RFCA Stakeholder Focus Group website at www.rfets.gov and click on **Stakeholder Focus Group** to access background information, meeting minutes, etc. electronically. You may call either Christine or me if you have any questions, comments, or suggestions concerning the RFCA Stakeholder Focus Group or the upcoming meeting.

Sincerely,

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C. Reed Hodgin, CCM
Facilitator / Process Manager

November 2, 2000 + **November 8, 2000**

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Additional background materials requested by the Focus Group are attached:

- Draft Peer Review Process (Mary Harlow, Attachment H),
- Draft Radionuclide Soil Action Level Regulatory Analysis (EPA, Attachment I),
- Draft RSAL Outline (DOE, Attachment J), plus
- **Determining Cleanup Goals at Radiologically-contaminated Sites.**

Sincerely,

C. Reed Hodgin, CCM
Facilitator / Process Manager

ADMIN RECORD

October 20, 2000

Dear RFCA Stakeholder Focus Group member:

The October 25, 2000 Rocky Flats Clean-up Agreement (RFCA) Stakeholder Focus Group meeting was cancelled because of a complex-wide stewardship meeting hosted by the RFCAB during the week of October 23. Many of the Focus Group members will be involved in that workshop.

The next RFCA Stakeholder Focus Group meeting will be held Wednesday, November 8, 2000 at the Broomfield Municipal Center. Because of the extra time between meetings, the November 8 meeting packet will be issued on October 25, 2000 - two weeks before the November 8 meeting. This will give authors an extra week to prepare materials and give Focus Group members an extra week to review the packets.

The report on the regulatory framework for the RSALs being developed by EPA will be available on November 1 in draft form. Because it will be available after the packets are issued, we will make a special distribution of this short document (probably 4 or 5 pages). I would like to email or fax the document to you in order to give you as much time as possible to review this important document. If you would prefer to have the document faxed to you, please contact me by return email and include your fax number in the message. If I don't hear back from you, I will email the document to you on November 1.

cbennett@alphatrac.com
303 428-5930 (fax)

Sincerely,

Christine Bennett
Coordinator

ADMIN RECORD

To: RFCA Focus Group members
From: LeRoy Moore
Re: "NRC rule" (25 mrem/y permissible dose) as an ARAR

After a recent conversation with a person at EPA headquarters I asked about documentation for this person's comment that EPA does not accept NRC's 25 mrem/y standard as an ARAR under CERCLA. I also asked the basis for EPA's contention that 3x10-4 lifetime risk falls within the CERCLA risk range of 10-4 to 10-6. Here are the answers I received. As background, it's well to remember that in some of itw own documents EPA says a dose of 15 mrem/y = a risk of 3x10-4. You'll note that the second issue, as stated here, is closely related to the first:

"1. The EPA position on use of NRC's standard is covered in a CERCLA directive: OSWER No. 9200.4-18, August 22, 1997, "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination," Stephen D. Luftig, Director, Office of Emergency and Remedial Response, and Larry Weinstock, Acting Director, Office of Radiation and Indoor Air. The relevant sections are a) the fourth paragraph under BACKGROUND and b) Attachment B. The Background paragraph states, in part: "...EPA has determined that the dose limits established in this [the NRC] rule as promulgated generally will not provide a protective basis for establishing preliminary remediation goals (PRGs) under CERCLA...Accordingly...cleanups...will typically have to be more stringent than required by the NRC dose limits in order to meet the CERCLA and NCP (Natl Contingency Plan) requirement to be protective." Attachment B reviews the regulatory and legal basis for the above statements, and analyses the deficiencies of the NRC standard.

"2. The above-noted Attachment B also cites the regulatory basis for use of a 3x10-4 lifetime risk to satisfy the CERCLA range of 10-4 to 10-6 lifetime risk [actually, this numerical range was established in the National Contingency Plan regulations, at para. 300.430(e)(2)(i)(A)(2) as the implementation of CERCLA's more general requirement that cleanups assure protection of human health and the environment, at para. 121(d)(2)(A)]. The first key point in Attachment B is cited from an OSWER Directive (9355.0-30, April 22, 1991, "Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions," Don R. Clay, Assistant Administrator) which says: "The upper boundary of the risk range is not a discrete line at 1x10-4, although EPA generally uses

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1x10-4 in making risk management decisions. A specific risk estimate around 10-4 may be considered acceptable if justified based on site-specific conditions." The second key point is contained in the last paragraph of section 1.1 of Attachment B, which notes that EPA concluded, in its rulemaking for radionuclides under the Clean Air Act, that 3x10-4 was essentially equivalent to 1x10-4, but that 5.7x10-4 was not. The Attachment also reviews a number of other examples and concludes that they are consistent with the view that 15 mrem/y is consistent with the CERCLA risk range, and that the NRC 25 mrem/y is not. The bottom line here is that when dealing with orders of magnitude EPA found, correctly, that the boundary between two adjacent orders of magnitude (e.g., between 10-3 and 10-4) lies halfway between them on a logarithmic scale (e.g., the boundary between 1x10-3 and 1x10-4 is halfway on a logarithmic scale, which is 3x10-4)."

My comments: First, perhaps someone from EPA can provide us with the pertinent texts mentioned in the foregoing.

Second, given the above, I raise again a question I posed to Dan Miller on Nov 8 when he very gave his very clear presentation on ARARs to the Focus Group. May it be, I asked then and repeat now, that the NRC rule (which permits a dose of 25 mrem/y) as adopted by the State of Colo meets some but not all conditions of being an ARAR? That is, it appears to be "applicable" and "relevant" but not "appropriate" -- not appropriate because it fails to meet the CERCLA risk requirement.

When I posed this question on Nov. 8 Dan Miller replied: "Under CERCLA . . . we have to go through NRC, figure out what number we come up with." I take this to mean that the agencies are required to determine whether or not an existing state regulation (such as the adoped NRC rule) is in fact an ARAR -- that is, whether it fits all three ARAR conditions.

What is happening now seems to be exactly what Dan described. The agencies propose to look at various future use scenarios according to several dose and risk options, including 25 mrem/y (the NRC rule) and risk at 10-4, 10-5, 10-6 (risk levels within the CERCLA range).

If the words from EPA quoted above are correct, their correctness should be confirmed by the projected calculations.

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- Do the RFCA parties agree with this interpretation of the NRC rule?
- Why do the agencies appear to reject this precept by not endorsing the third option outlined in EPA's regulatory analysis? Clarify Option 3.
- How do the agencies justify selectively not considering this as part of the NRC rules?
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3) Risk vs Dose:

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