RFCA Stakeholder Focus Group
Meeting Agenda

When: **November 29, 2000, 4:30 - 6:30 p.m.**

Where: **Arvada Center for Arts and Humanities, 6901 Wadsworth Blvd.**

4:30 Introductions, Agenda Review, 11/8 Meeting Minutes Review

4:40 RFCA Peer Review Meeting Update - Mary Harlow

4:45 Answer Regulatory Analysis Questions - All Agencies

6:20 Topics for Upcoming Meetings

6:30 Adjourn

RFCA Stakeholder Focus Group
Attachment A

Title:	Agenda for November 29, 2000 Focus Group Meeting
Date:	November 20, 2000
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Background

The RFCA Parties are evaluating the Colorado Radiation Control Regulations "decommissioning rule" for radioactive materials licensees found at 6 CCR 1007-1 Part 4, section 4.61, to determine those portions of the rule that would be Applicable or Relevant and Appropriate Requirements (ARARs) pursuant to CERCLA. Colorado, as an NRC Agreement State adopted a decommissioning rule that contains essentially the same provisions as the NRC decommissioning rule found at 10 CFR 20, Subpart E. According to the decommissioning rule, annual dose rates from residual contamination must not exceed 25 millirem and be "As Low as Reasonably Achievable" (ALARA) for unrestricted use or restricted use. *See*, Part 4, section 4.61.2 and .3, and 10 CFR 20.1402 and 1403.

According to CERCLA's implementing regulations, termed "the National Contingency Plan", compliance with ARARs is one of the two threshold criteria for remedy selection at CERCLA sites. *See*, 40 CFR 300.430 (e)(9)(iii) A and B, and (f)(1)(i)(A). The other threshold criterion is that the remedy must provide overall protection of human health and the environment, for which the goal is identified at 40 CFR 300.430 (e)(2)(i)(A)(2) as an upper bound lifetime cancer risk to an "individual" of between 10E-6 to 10E-4.

Among other issues of interest to the RFCA Parties and the public for this evaluation are the regulatory provisions that define or identify the human receptor to which the annual radiation dose (ARAR) or lifetime cancer risk (CERCLA) standards apply. This receptor is generally referred to as a "member of the public", but the regulatory requirements are much more specific.

This paper provides general information regarding these regulatory requirements. Since the Colorado Radiation Control Regulations and the NRC Regulations do not differ on the terms discussed herein, the NRC citations are given in this discussion. Also, because the Colorado decommissioning rule is based on the NRC rule, the information developed by the NRC in proposing and finalizing its rule is helpful in interpreting the Colorado rule.

Discussion

The decommissioning rule dose rate standard applies to the "average member of the critical group". The "critical group" is defined at 10 CFR 20.1003, and "means the group of individuals reasonably expected to receive the greatest exposure to residual activity for any applicable set of circumstances." The preamble to the rule explains

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further that the "critical group would be the group of individuals reasonably expected to be the most highly exposed considering all reasonable potential future uses of the site." *See,* 62 FR 39067 (A.4.2). The "average member" is "an individual who is assumed to represent the most likely exposure scenario based on prudently conservative exposure assumptions." *Id.*at 39068. As one example, the preamble discusses the residential use scenario, and states "the critical group could be persons whose occupations involve resident farming at the site, not an average of all residents at the site."

According to the preamble the NRC considered whether the standard should apply to the "most exposed person" rather than an "average person." The NRC found that, consistent with other NRC guidance, ICRP practice, National Academy of Sciences recommendations and EPA's proposed Federal radiation Protection Guidance for Exposure to the General Public, use of the average person approach is appropriate. See, 62 FR 39067 (A.2.2.1) and 39067-68.

According to the NRC's Draft Regulatory Guide DG-4006, "Demonstrating Compliance with Radiological Criteria for License Termination.", section C.1, dose modeling for the average member of the critical group should be derived based on the methods in Draft NUREG-1549, "Guidance on Using Decision methods for Dose Assessment to Comply with Radiological Criteria for License Termination." Use of these methods results in a "derived concentration guideline" (DCGL). The DCGL is the concentration of residual radioactivity above background that, if distributed uniformly throughout a survey unit, would result in a 25 millirem per year dose to the average member of the critical group. This guidance provides for the use of generic screening scenarios and parameters associated with the DandD computer code. If conditions are reasonably expected to differ from the DandD code default parameters that would result in a significant increase in dose, then the DandD code use might not be justified. Thus, NRC requirements focus on parameters related to the "average person" in the critical group.

CERCLA regulations do not explicitly identify the "individual" to which the risk standard applies. The preamble to the NCP indicates EPA's preference for use of policy and risk assessment guidance for risk assessment related to the "reasonable maximum exposure scenario" (RME) rather than establishing regulatory definitions. See, 55 FR 8701 (and also 40 CFR 300.430 (d)(3), which provides that ARARs and pertinent guidance be identified in a timely manner).

The "Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A through D" (RAGS) is the EPA's guidance for determining cancer risks. EPA stated that, "The reasonable maximum exposure scenario is 'reasonable' because it is a

product of factors, such as concentration and exposure frequency and duration, that are an appropriate mix of values that reflect averages and 95th percentile distributions", and thus does not include unrealistic assumptions and scenarios. *See,* 55 FR 8701. The NCP does require evaluation of factors, such as sensitive populations, to support potential remedial action alternatives. *See,* 40 CFR 300.430 (d)(2).

The EPA is currently conducting a RAGS review as part of its regulatory reform initiatives, which includes a review of the current concepts in the RME. The RAGs approach to determine the carcinogenic hazard multiplies the carcinogenic slope factor (SF) posed by a hazardous substance by the average daily intake of that substance over an assumed lifetime of 70 years. The SF is an upper bound estimate of cancer risk per mass of hazardous substance contacted per unit body weight per day, and are extrapolated to give the highest possible linear slope (within the 95% confidence limit) at low exposure doses. This results in a determination of a "reasonably maximally exposed individual" for a given RME scenario.

RAGS Part D now requires the use of probabilistic risk assessment methodology. Thus, the range of values to be used to determine exposure factors used for average daily intake for any RME scenario is important in estimating an individual maximum exposure.

NAME		ORGANIZATION / COMPANY
David	Abelson	RFCLOG
Michael A.	Anderson	SUMMIT Technical Resources, Inc.
Christine	Bennett	AlphaTRAC, Inc.
Ray	Betts	
Laura	Brooks	Kaiser-Hill Company, LLC
Lane	Butler	Kaiser-Hill Company, LLC
Kimberly	Chleboun	RFCLOG
John	Ciolek	AlphaTRAC, Inc.
John	Corsi	Kaiser-Hill Company, LLC
Gerald	DePoorter	RFCAB
Rick	DiSalvo	US DOE - RFFO
Honorable Samantha	Dixion	City of Westminster
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
Roman	Kohler	Homesteaders
Ken	Korkia	RFCAB
Carol	Lyons	City of Arvada
John	Marler	RFCLOG
Tom	Marshall	Rocky Mountain Peace and Justice Center
Dan	Miller	Office of Attorney General Ken Salazar
LeRoy	Moore	RMPJC
Diane	Niedzwiecki	CDPHE
Karen	Reed	EPA
Tim	Rehder	US EPA
Kathy	Schnoor	City of Broomfield
Joel	Selbin	
Dave	Shelton	Kaiser-Hill Company, LLC
Carl	Spreng	CDPHE

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Ken	Starr	TCAT / RFSALOP
Noelle	Stenger	RFCAB
Honorable Hank	Stovall	City of Broomfield
George	Vancil	City of Arvada

RFCA Stakeholder Focus Group
November 29, 2000
UPDATED Meeting Minutes

INTRODUCTION AND ADMINISTRATIVE NOTES

Reed Hodgin began the meeting explaining the layout of the meeting room - the open square table setup is for those who wished to join the conversation; 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 29, 2000 Rocky Flats Clean-up Agreement (RFCA) Stakeholder Focus Group meeting is included in this report as Appendix A.

Reed reviewed the Focus Group purpose.

Reed went over the meeting rules and agenda.

The November 8, 2000 RFCA Stakeholder Focus Group meeting minutes were reviewed. It was noted that there was a discussion of ARARs at the end of the meeting which was not included in the minutes. The minutes will be revised and reissued to the RFCA Focus Group website at http://www.rfets.gov/.

David Abelson suggested that the technical sessions and main Focus Group sessions be combined. It appears that policy-related discussions are occurring naturally in the technical sessions. David suggested that if this is to continue, the umbrella of the main session should be extended to cover the entire discussion. This issue was discussed among the stakeholders and it was decided that the Group would have a combined meeting running from 3:00 - 6:30 p.m. on each meeting day.

Tim Rehder suggested that there are certain issues that are very technical by nature that only a few people will be interested in. We could put those issues at the end of the meetings.

It was noted that there needs to be a forum for answering technical questions at the level of detail that has been served by the technical sessions. The Focus Group agreed to ensure that time will be provided for technical questions / answer sessions.

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It was suggested that the first portion of the meeting be set aside for open discussion that may be technical or policy in nature.

RFCA PROJECT PEER REVIEW PROCESS UDPATE

Mary Harlow, City of Westminster, presented an update to the Group on the progress in designing the peer review process for the RFCA agencies' review of the interim Radioactive Soil Action Levels (RSALs) for Rocky Flats.

The ad hoc working group is making great progress toward getting our peer review team in place. They met this week and prepared a list of candidate peer reviewers. The U.S. Department of Energy (DOE) is putting together their list of possible peer reviewers which should be provided to the working group on November 30, 2000. There will then be a conference call scheduled for Friday (December 1, 2000) to select the pool of peer reviewers. The group will then interview the candidate peer reviewers and make final selections based on their interest and availability.

A question arose concerning peer review for Task 2, "Model Evaluation." The working group would like input from the full Focus Group on the need for a peer review of Task 2, the scope of such a review, the number of peer reviewers needed, and recommended candidates. Mary asked for time on the next Focus Group agenda to discuss peer review of Task 2.

Ken Korkia, Rocky Flats Citizens Advisory Board, gave a presentation on a proposed revision of the RSAL review schedule to accommodate peer review (Appendix B). We moved back some dates that we moved back to accommodate the peer review process.

The peer reviews for Task 1 and Task 2 follow a similar path because they both have an original deadline of February 15, 2001. The working group is proposing to move both those deadlines to March 15, 2001 to help accommodate the peer review process. Written comments will be obtained from the peer reviewers and transmitted to Focus Group for initial discussion at the January 31, 2001 Focus Group meeting. At the same time, the RFCA agencies will be addressing the comments and providing written responses. The agencies' responses will also be discussed at the February 28, 2001

Focus Group meeting, following which a final peer review report will be prepared and submitted to the agencies by March 15, 2001.

The peer review for Task 3, "Parameter Evaluation," will be a more involved process. The 1st draft of the Parameter Evaluation report is due to the Focus Group on January 26, 2001. The Focus Group should decide whether to immediately send the report to peer review, or discuss the report and provide scope and priority direction to the peer reviewers. Written comments will be due back from the peer reviewers by March 12, 2001, with a Focus Group discussion on the comments at its March 14, 2001 meeting. April 6, 2001 is the due date for the written response from DOE and the regulators concerning the peer review comments, as well as their delivery of the 2nd draft of the task. Those will arrive concurrently and the written comments plus the next draft of the Task 3 report will then go out to the peer reviewers again. The second round of peer review comments will be due on April 23, 2001, with Focus Group discussion on April 25, 2001. The agencies' responses to the second round of peer review comments will be due on may 3, 2001, with Focus Group discussion at its May 9, 20001 meeting. The final peer review report will be issued the following week.

The final activity that the working group feels is important for peer review is the draft RSAL document. The working group is proposing that the overall RSAL Review schedule be extended somewhat to accommodate the peer review process. The RFCA agencies have agreed to issue an initial draft of the report to the Focus Group around May 23, 2001, before it actually goes out for formal public comment period. The Focus Group could discuss the draft report, determine the peer review scope and priorities, and transmit the initial draft to the peer reviewers. The peer reviewers could respond with written comments during July, 2001, while the formal public comment period is underway. The comments could be discussed and a peer review report issued by the end of the public comment period.

The Focus Group then discussed the peer review process.

Steve Gunderson, State of Colorado expressed concern about the amount of work to be accomplished within the aggressive schedule, especially for development of the parameter evaluation report. The group agreed to continue looking at the schedule as the peer review process proceeds.

The working group invited input from all Focus Group members on the scope of the peer review. The peer reviewers for Task 1 will be chosen shortly.

Mary asked the group to consider answers to 3 questions for Task 2:

1. Do we need peer reviewers for Task 2?
2. How many peer reviewers do we need for Task 2, if we need peer reviewers?
3. What are the questions we need to have answered?

For Task 3, the working group asked for a discussion among the full group to identify which areas are most important to have peer reviewed and what type of expertise should be included in the peer review panel. Names of candidate peer reviewers were solicited from the Focus Group.

RSALS REGULATORY FRAMEWORK DISCUSSION

Reed Hodgin introduced the discussion by reviewing the discussion to date. A draft report on the Regulatory Framework for the RSALs was issued to the Focus Group on September 20. A Focus Group discussion was begun at the November 8, 2000 meeting. At that time, the RFCA agencies identified their goals for the discussion:

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?

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- 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.

Reed summarized the Focus Group objective: to calibrate the agencies so that Draft 2 of the Regulatory Framework report is much more on target than it would be without community input.

The Focus Group posed a series of questions to the RFCA agencies at the November 8, 2000 meeting. Dan Miller, State of Colorado, responded to those questions in a written report which was distributed at the November 29, 2000 meeting (Appendix C). The discussion at the November 29, 2000 meeting focused on the answers to those questions. Because the Focus Group had not seen the document before the meeting, Dan summarized his answer to each question. This was followed by an open group forum on the issue.

Following is a summary of the discussion:

Question 1: What is the Distinction Between Applicable, Relevant, and Appropriate?

Q: Can you take portions of an ARAR and apply it to a particular cleanup?
A: Yes. We're doing it now.

Q: What is the relationship between the RSAL Regulatory Framework report and the report issued by Dan Miller?
A: Dan Miller's document answers the specific questions that the Focus Group had at the November 8, 2000 meeting. These answers and our discussions will help in the second draft of the Regulatory Framework report.

Q: I'm still confused about how ARARs overlay and underlie CERCLA law. Is it fair to say that the most restrictive requirement would be applied?

A: As a hypothetical example, let's say there was one set of maximum concentration limit of 5 parts per billion for TCE and another is 10 ppb for TCE from different regulatory programs. If you determined that they were both either applicable or relevant and appropriate, you would have to meet the more stringent of the requirements. It should be noted that determining whether a requirement is relevant and appropriate involves a certain amount of discretion.

Q: So, adding additional ARARs to the regulatory framework can only result in a more restrictive cleanup, you can't use ARARs to move toward a less restrictive cleanup.

A: That's true.

C: That's a very important point. A lot of people are using the NRC, we don't want to use the NRC because it's less restrictive. We're only going to use the parts of the NRC that are more restrictive.

A: You have to look at it on a case-by-case basis. We'll get into it.

C: We have several environmental statutes and regulatory schemes that already supply ARARs that are incorporated into decision documents for cleanup at Rocky Flats. This is not new. We already have the ARARs under the Hazardous Substance Act, under the Clean Air Act, etc.

A: Under CERCLA, the remedies must both be protective and meet ARARs. If meeting an ARAR does not result in a protective remedy under CERCLA, more must be done.

C: A good example of this situation is the water standard. The NRC rule is less restrictive than the existing State water standard.

A: That's an example of two different ARARs; you choose the more stringent.

Q: Don't we need to know what all the ARARs are before we can evaluate the interrelations and which are to be applied?

A: We do have a master list of ARARs that EPA has compiled for all the remedies at the site. That's currently a document entitled the "Implementation Guidance Document." The Agencies will provide copies..

Q: Which regulation is the ARAR for Rocky Flats – the NRC rule or the equivalent State rule?
A: It's the State's rule.

Q: Does the State then have parameters / guidance, something that differs from what the NRC rule is, that would affect the applicability or the implementation of the ARAR at RFETS?
A: There are some differences between the NRC regulation and the State regulation. We need to go see why we didn't adopt exactly the same rule, if there was any discussion of why they were different. There is no State implementing guidance.

Q: What is it about the State rule that makes it more appropriate or relevant?
A: I don't know how it works under EPA, but under the Federal Hazardous Waste Law, when we adopt a State rule, the Federal rule goes away, so there's only one rule. If that's the case for the State radiation regulations in this State, then there really isn't any Federal regulation that applies here, so you would use the State rule.

Question 2: Is there hierarchy among applicable, relevant, and appropriate?

C: The answer is no, once you've determined a regulation to either be applicable or relevant and appropriate, the cleanup has to meet the requirement. The applicable requirements don't get any greater or lesser weight than relevant and appropriate requirements.

Question 3: How do the agencies interpret the NRC / State decommissioning rule?

C: The text of the state rule has been provided as part of the written response.

Q: Does ALARA contemplate actions other than source removal? For instance, capping an area--does that comply with ALARA? You could have unrestricted use, but it's unrestricted with a cap over an area of contamination.

A: EPA doesn't believe that you could release an area as unrestricted if an engineered control is in place.

Q: What's the difference between maximum exposed individual and average member of the critical group?

A: There's an answer in the NRC rule. The definition states,"Critical group means group or individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances."

Q: Does that mean a wildlife refuge worker?

A: Yes.

Q: Please explain, "Please note that at Rocky Flats, use restrictions may nonetheless be required for purposes other than limiting dose."

A: For instance, if the entire site was cleaned up sufficiently to limit doses below thresholds, but plutonium was still present at low levels in the soil, you might want to restrict disturbance of the soil to avoid release of the contamination.

A: Another example is surface water protection. We might need to place restrictions to ensure compliance with the water standard, even though doses / risks are low enough for unrestricted use.

C: There is no example of institution controls that have lasted for any length of time.

C: This process needs to include the consideration of the impermanence of institution-engineered controls and deal with that in some way.

C: We definitely have to seriously evaluate the limited technical and institutional abilities that are available to deal with the contamination problems that we face in deciding what is an appropriate **control**?

C: The DOE has started to look at long-term stewardship in this very serious context, that's where a lot of like institutional controls and things like that will

probably be addressed. Long-term stewardship needs to be included in your remedy selection.

C: The ALARA concept in the context of cleaning up a site helps to choose among alternatives. It's very similar to the CERCLA alternatives analysis.

Q: It seems that the question of unrestricted use could come up in two places: 1) how does it factor into the setting RSAL? And 2) could it come up in the ALARA analysis?

A: The RSAL is the floor – the starting point for cleanup. ALARA may be used to investigate the practicability of cleaning up to an unrestricted use for each individual cleanup site.

Q: If you're looking at unrestricted use, where do you determine what the potential reasonable future uses are?

A: The NRC guidance suggests the rural residential scenario. We could consider that. We could also consider the residential and land use development patterns in the Denver metropolitan area and, if it were to be developed, what would it most likely be developed as. It's more likely to be a suburban development than rural residential, but we can evaluate different scenarios.

Q: What about action levels for surface soils and subsurface soils? Can subsurface contamination or groundwater contamination drive cleanup?

A: Take the 903 Pad. We have an RSAL based on a wildlife refuge worker as a floor. Then we have two issues we have to deal with. One of them is protection of the surface water standard, the other one is ALARA. ALARA, under this ARAR, is a driver to try to see if we can clean up to an unrestricted use. In that issue, I don't see anything about the subsurface driving that.

Q: The viability of institutional controls over a 1,000 year time frame should be considered.

A: The decommissioning rule says that if it's not reasonable to clean it up to 25 mrem assuming unrestricted use, that you can include use restrictions as part of your cleanup, but your overall cleanup still has to meet 25 mrem and you have to analyze what happens if your use restrictions fail, you can't go beyond 100 mrems. It requires consideration of the potential of the institutional control.

Similarly, in the CERCLA process, you have to consider the long-term effectiveness of the remedy in evaluating what the remedial action will be. We may find it difficult to maintain institutional controls for 1,000 years and we have to weigh that difficulty against the additional remediation that would be required to allow an unrestricted use.

Q: Will there be a definition of ALARA and what constitutes an ALARA?
A: I think that's an important thing that this Focus Group has to develop; some kind of process as to how we're going to look at ALARA. We need to have it built before the IM / IRA for the 903 Pad is put together; within the next year.

Q: Will the state ARARs apply to waste landfills?
A: Yes. But they'll be under our hazardous waste laws, not our solid waste laws.

The Focus Group interrupted it's discussion because of time constraints and agreed that more time was needed to continue and conclude its comments.

TOPICS FOR UPCOMING MEETINGS

The Focus Group agreed to follow the revised topics schedule presented by the Peer Review working group.

At the next meeting (December 13, 2000) the Focus Group will conclude the Regulatory Framework discussion and begin its discussion on the Task 2 report – "Model Evaluation." The "New Science" discussion will be moved to the January 3, 2001 meeting.

The members of the Focus Group agreed to propose additional regulatory scenarios (in addition to the ones presented in the Regulatory Framework report). The group agreed to submit any proposed scenarios to AlphaTRAC, Inc. by noon on December 6, 2000 for inclusion in the next packet.

ADJOURNMENT

The meeting was adjourned at 6:30 p.m.

RFCA Stakeholder Focus Group
November 29, 2000
Meeting Minutes

Appendix A
Participants List

RFCA Stakeholder Focus Group
November 29, 2000
Meeting Minutes

Appendix B
Ken Korkia: RSAL Review Schedule

RFCA Stakeholder Focus Group
November 29, 2000
Meeting Minutes

Appendix C
Dan Miller: Response to Questions Presented at 11/8/00 Meeting

RFCA Stakeholder Focus Group
Attachment B

Title:	Meeting Minutes for November 29, 2000 Focus Group Meeting
Date:	December 6, 2000
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RFCA Stakeholder Focus Group
Attachment C
Remedial Action Alternative Selection

Title: Remedial Action Alternative Selection

Date: September 20, 2000

Author: Lane Butler
Kaiser-Hill Inc., LLC

Phone Number: (303) 966-5245

Email Address: lane.butler@rfets.gov

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RFCA Stakeholder Focus Group
Attachment C

Title:	Determining Cleanup Goals at Radiologically-Contaminated Sites
Date:	November 8, 2000
Author:	Carl Spreng CDPHE
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ADMIN RECORD

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.

The cleanup level development process begins with determining which regulatory authority applies, which determines the applicable radiological standard. Table 1 lists major radiological standards in effect in the United States. The Conference of Radiation Control Program Directors (CRCPD, 1998) has complained that radioactively-contaminated sites "are not being cleaned up in a timely manner because there is no uniform cleanup standard applicable to the radioactive materials. ... [T]he U.S. has a mixed bag of inconstant annual dose limit fractions (4 mrem/year for water, 10 mrem/year for air, 15 mrem/year for high level waste, 25 mrem/year for fuel cycle). Uniformity is not apparent in this melange."

In a position statement, the CRCPD recommends using the total effective dose equivalent (TEDE) as the basis for uniform criteria for regulating the risk from exposure to radiation. This statement agrees with the NCRP and the ICRP that the dose limit for members of the public should be 100 mrem/year TEDE. "This value - 100mrem/year - should be the basis of the standard. The only technical reason for discussion of constraints to lower levels is for the members of the public who may be exposed to more than one such source of radiation at the same time. The CRCPD agrees with the NCRP's opinion that the potential for exposure to multiple exposures is remote. Using currently available instrumentation, it is feasible to measure radiation levels that correspond to a dose level of 25 to 30 mrem/year. A value in this range is sufficient to allow an adequate margin of safety to account for the possibility of exposure to multiple sources of radiation. The meaningful issue is how far below 100 mrem/year do regulators need to push limits for individual sites to account for the possibility of a person's exposure to multiple sources. ...Based on widely accepted technical and scientific information, a standard higher than 25 mrem/year would not likely result in a member of the public receiving a dose exceeding 100 mrem/year and would be acceptable." The CRCPD believes that an all pathways cleanup standard of 25 mrem/year (the NRC promulgated standard) "provides a more than adequate margin of safety below the public dose limit."

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 applicable or relevant and appropriate requirements (ARARs). Cleanup guidelines and remedies based on ARARs must ultimately be found to fall within the CERCLA risk range.

Various terms are used, sometimes interchangeably, to describe numbers that guide remedial actions at radiologically-contaminated sites. Cleanup levels from site to site, or even at a single

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site, cannot be compared without knowing their purpose, how they were derived, and how they will be applied. Soil screening levels, Preliminary Remediation Goals (PRGs), action levels, and Remedial Action Objectives (RAOs) are usually used to describe relatively conservative numerical values developed early in the remediation process. Final cleanup levels, Final Remediation Levels, or Remediation Goals (RGs), are established by Records of Decision (RODs) and guide final remedial or management actions at a site or portion of a site.

An Action Level in the Superfund program refers to the existence of a contaminant concentration in the environment high enough to warrant action or trigger a response under the Superfund Amendments and Reauthorization Act (SARA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The term can be used similarly in other regulatory programs (EPA OSWER Glossary). Responses triggered may include actions such as removal, treatment, containment, stabilization, or institutionally controlling exposure.

Preliminary Remediation Goals (PRGs) are the initial or proposed cleanup goals usually developed early in the Remedial Investigation phase to provide risk reduction targets. PRGs based on ARARs are generally considered protective for single pathways or contaminants. Depending on which requirements are determined to be ARARs, 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. Risk-based PRGs are developed when multiple pathways or contaminants are present. Numerical PRGs for radionuclides are typically based on the upper bound carcinogenic risk of one in a million (10^{-6}). Only cancer risks are considered for most radionuclides; non-cancer hazards are sometimes also included for uranium. Until the final remedy is selected and documented in the Record of Decision (ROD), PRGs constitute initial guidelines, not final cleanup goals [40 CFR 300.430 (e)(2)(i)].

Remedial Action Objectives (RAOs) or final Remediation Goals (RGs) are media-specific cleanup goals for a selected remedial action. CERCLA requires the development of "...methods and criteria for determining the appropriate extent of removal, remedy, and other measures..." for responding to releases of hazardous pollutants and contaminants [CERCLA Section 105(a)(3)]. In order to meet this requirement, a process defined in the revised NCP evaluates potential remedial alternatives, once it has been determined that remediation is warranted. The development of remedial action objectives is directly tied to this alternatives evaluation. These numerical remediation goals can be based on existing standards that are ARARs or on risk calculations [40 CFR 300.430(e)]. These two requirements are the "threshold criteria" for evaluating both remedial alternatives and remedial action objectives. Because risk-based PRGs do not necessarily represent realistic exposure and risk, those numbers may not be appropriate cleanup levels. PRGs can be proportionally adjusted upward to become RGs using a level higher in the acceptable carcinogenic risk range to account for the conservatism inherent in the PRGs. Other factors related to technical limitations (e.g., detection or quantification limits) can also be applied. In addition, the "balancing criteria" and the "modifying criteria" for analyzing remedial alternatives, such as cost, state and community acceptance, should also be considered [40 CFR 300.430(e)(2)(i)(A)]. In some cases, RGs may be adjusted downward to account for multiple radionuclides or co-occurring non-radionuclide chemicals. Final RGs are documented in the

Decision Summary section of the ROD as radionuclide-specific "remediation levels" [40 CFR 300.430(f)(5)] or qualitative definition of the risk-reduction cleanup objective to be achieved for the non-numerical RGs (EPA,).

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 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.

Cleanup levels for plutonium at various sites are listed in Table 2; Table 3 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 4 presents key RESRAD input parameters used by several sites which used that computer model to determine cleanup levels.

CONCLUSIONS

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. These elements may include regulatory authority, land uses, site conceptual models, computer models or risk equations, input parameters, and modifying factors, such as the ALARA concept. Variations in the elements of this process have led each site to establish different cleanup levels. The differences in cleanup levels can only be understood by understanding the context in which the decisions in each cleanup level development process were made.

A document explaining the context for cleanup level decisions at radiologically-contaminated sites is also being produced by the Radionuclides Work Team of the Interstate Technology & Regulatory Cooperation (ITRC), a cooperative effort among state regulators, federal agencies, industry, and academia. This document is currently being compiled 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.

CASE STUDY: BROOKHAVEN NATIONAL LABORATORY

Background

Brookhaven National Laboratory (BNL), formerly Camp Upton, was administered by the U.S. Army during World Wars I and II and has been operated by DOE and its predecessors since 1947. This facility processed, treated, and stored radioactive and hazardous waste. The BNL site was placed on New York State's Department of Environmental Conservation (NYDEC) list of Inactive Hazardous Waste Sites in 1980 and on the NPL in 1989. Remediation at this site is being done under CERCLA, 40 CFR Part 300. Soils in several areas were contaminated with radionuclides from past waste handling operations, spills, or inadvertent use of contaminated soils for landscaping. Most of the radioactively contaminated soils are at the former Hazardous Waste Management Facility.

Cleanup Level Development

The radionuclide soil cleanup level is based on a total dose limit of 15 mrem/year above background considering 50 years of institutional controls for the selected land use. Residual radiological contamination following remediation will also be within the CERCLA risk range. Specific cleanup levels for individual radionuclides were determined using the RESRAD computer code. Cesium cleanup levels within the Former Hazardous Waste Management Facility assumes industrial land use with 50 years of institutional controls and residential land use with 100 years of institutional controls. Outside the Facility, cleanup levels for cesium are based on residential land use with 50 years of institutional controls. The cleanup level for strontium-90 is based on impacts to groundwater and is protective of residential and industrial use as well. DOE Order 5400.5 is the basis for the cleanup level chosen for radium-226. The New York Department of Environmental Conservation's guidance of 10 mrem/year above background will be an ALARA goal to be considered during remedial design.

Soil Cleanup Levels for Radiological Contaminants (pCi/g)

Radionuclide	Residential Land Use	Industrial Land Use
Cesium-137	23	67
Strontium-90	15	15
Radium-226	5	5

Remedial Actions

Operable Unit I includes soils at the site contaminated with radionuclides. Over 2,500 cubic yards of landscaping soils with low levels of radionuclides have been excavated and shipped to a disposal facility in Utah. Other areas of radiologically contaminated soils include the Hazardous Waste Management Facility, the Waste Concentration Facility, the Reclamation Facility sump, and tanks at Building 811. All soil cleanups at Operable Unit I are expected to be completed by 2005. Post-remedial sampling will ensure that the dose from all residual radionuclides will not exceed 15 mrem/year (considering 50 years of institutional control for the specified land use).

Contacts

Website: http://www.bnl.gov/erd

CASE STUDY: FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Background

The Fernald Environmental Management Project (Fernald) is a 1500-acre DOE facility about 17 miles northwest of Cincinnati near the village of Fernald, Ohio. Fernald operated from 1952 to 1989 as the Feed Materials Production Center, a large-scale production facility extracting uranium from ores and ore concentrates to yield high-purity metal products in support of U.S. defense programs. During this period, over 500 million pounds of slightly enriched and depleted uranium metal products were shipped to other DOE sites across the country. Smaller amounts of thorium were also produced. Production stopped in 1989 and the site was added to the EPA's National Priorities List. In 1991 the site was officially closed and renamed to reflect its new cleanup mission.

Topography in the area consists of gently rolling uplands with steep hillsides along major stream. Surface drainage at Fernald is from east to west and south into Paddy's Run, with the exception of the northeast corner, which drains east toward the Great Miami River. Groundwater is contained in two geologic units: glacial overburden ranging in thickness between 0 and 50 feet, and sand and gravel of the Great Miami Aquifer. Groundwater in the glacial overburden is considered perched since it is contained within silty sand lenses within a low-permeability, clay-rich soil. The underlying Great Miami Aquifer is the principal drinking water supply for the region and is regulated as a sole-source aquifer under the Safe Drinking Water Act.

Six waste pits used during past operations contain approximately 475,000 tons of waste, including uranium, thorium and other radioactive and chemical contaminants. The pits range in size from a football field to a baseball diamond, and vary in depth from 13 to 30 feet. Two of the pits have a water cover, one has a synthetic cap and the others have a soil cover. The waste pits are either in close proximity to, or in contact with, the Great Miami Aquifer and are contributing to contamination of the ground water.

There are four concrete silos at the FEMP that were constructed to store radioactive materials. Two of them, referred to as the K-65 silos, contain high radium-bearing residues, one contains lower-level dried uranium residues, and one has never been used. To reinforce the K-65 silos, a soil berm was added in the 1960s and enlarged in the early 1980s. In 1991, bentonite clay was injected into the tops of the two K-65 silos to cap the high radium residues and reduce radon emissions from the silos.

Large volumes of contaminated soil exist on site as a result of dumping, spilling and fugitive emissions during site operations. Disposal areas include the Southern Waste Units, Solid Waste Landfill, and Lime Sludge Ponds. Soil underlying the current production area is contaminated as a result of leaks and spills.

USEPA and DOE have a Federal Facility Agreement covering CERCLA remediation and NESHAP activities. The State of Ohio and DOE have a Consent Order covering hazardous waste, surface water, and natural resource restoration.

Cleanup Level Development

Cleanup levels for the entire site have been established through CERCLA Records of Decision for the five operable units that encompass the site. Soil cleanup levels are risk based using EPA risk assessment guidance and land uses consisting of an on-site undeveloped park and an off-site resident farmer. Groundwater cleanup levels are based upon EPA drinking water MCLs, proposed MCLs, or risk-based numbers. The following tables list cleanup values presented in the Operable Unit 5 ROD, which addresses the large majority of the site. Cleanup values differ in other portions of the site based upon proximity to groundwater and contaminant type, but are generally similar.

FINAL REMEDIATION LEVELS (FRLs) FOR SOIL

Contaminant	On-Property FRL(pCi/g)	Off-Property FRL (pCi/g)
Cesium-137 + 1D	1.4×10^{0}	8.2×10^{-1}
Neptunium + 1D	3.2×10^{0}	4.9×10^{-1}
Lead-210	3.8×10^{1}	2.2×10^{0}
Plutonium-238	7.8×10^{1}	9.3×10^{0}
Plutonium-239/240	7.7×10^{1}	9.0×10^{0}
Radium-226 + 8D	1.7×10^{0}	1.5×10^{0}
Radium-228 + 1D	1.8×10^{0}	1.4×10^{0}
Strontium-90	1.4×10^{1}	6.1×10^{-1}
Technetium-99	3.0×10^{1}	1.0×10^{0}
Thorium-228 + 7D	1.7×10^{0}	1.5×10^{0}
Thorium-230	2.8×10^{2}	8.0×10^{1}
Thorium-232 + 10D	1.5×10^{0}	1.4×10^{0}
Uranium, total (K_l=325 L/kg) (ppm)	8.2×10^{1}	5.0×10^{1}
Uranium, total (K_l=15 L/kg) (ppm)	2.0×10^{1}	NA

FRLs FOR SEDIMENT

Contaminant	FRL (pCi/g)
Cesium-137 (+1D)	7.0×10^{0}
Neptunium-237 (+1D)	3.2×10^{1}
Lead-210 (+2D)	3.9×10^{2}
Plutonium-238	1.2×10^{3}

Plutonium-239/240	1.1×10^{3}
Radium-226 (+8D)	2.9×10^{0}
Radium-228 (+1D)	4.8×10^{0}
Strontium-90 (+1D)	7.1×10^{3}
Technetium-99	2.0×10^{5}
Thorium-228 (+7D)	3.2×10^{0}

FRLs FOR GMA GROUNDWATER

Contaminant	FRL (pCi/L)
Neptunium-237 (+1D)	1.0×10^{0}
Radium-226 (+8D)	2.0×10^{1}
Radium-228 (+1D)	2.0×10^{1}
Strontium-90 (+1D)	8.0×10^{0}
Technetium-99	9.4×10^{1}
Thorium-228 (+7D)	4.0×10^{0}
Thorium-230	1.5×10^{1}
Thorium-232 (+10D)	1.2×10^{0}
Uranium, total (mg/L)	2.0×10^{-2}

Remediation

Waste Pits Remedial Action Project (Waste storage area, including six waste pits, clear well and bum pit) - The waste pit contents will be excavated, thermally dried and shipped by rail to a permitted commercial disposal facility. Significant effort has been put into upgrading on- and off- site rail systems.

On-Site Disposal Facility - Contaminated soil and debris is being excavated and disposed in the on-site engineered disposal cell. Any waste that exceeds the waste acceptance criteria will be disposed off-site. No off-site waste will be allowed in the disposal cell. The first waste placement occurred in December, 1997. The OSDF is designed to hold 2.5 million yards of waste.

Facilities Closure and Demolition Project (Former production area, including all buildings, equipment, inventoried hazardous material and scrap metal piles) – All on-site buildings will be decontaminated and dismantled. Debris within the waste acceptance criteria will go in the on-site disposal facility, with higher level materials going off-site. Significant progress has been made in the safe shutdown of nuclear materials and the decontamination and dismantlement of

production facilities. A number of innovative technologies have been deployed during the D&D activities including gas-oxy torch, insulation removal, decon equipment, scanning equipment, etc.

Silos Project (Silos 1-4, including the K-65 silos, their contents and associated piping and soils) Due to the 1996 failure in the Vitrification Pilot Plant, an Explanation of Significant Difference was completed for Silo 3 and a Record of Decision Amendment will be completed for Silos 1 and 2.

Soils Characterization and Excavation Project (formerly OU2 and OU5) Contaminated soils will be excavated and those meeting the waste acceptance criteria will be disposed in the on-site disposal facility. Excavation of the first contaminated soils area was completed in 1997. Technologies being used include a number of field deployed analytical devices for quick assessment of radionuclide concentrations.

Aquifer Restoration and Waste Water Project (formerly OU5) The Great Miami Aquifer will be remediated by a combination of treatment, extraction and injection of the ground water. The Advanced Waste Water Treatment Facility was completed in 1994 with additional capacity added in 1998. The South Plume extraction system removal action began pumping in August 1993. The South Field extraction and injection system became operational in the summer of 1998.

The future land use will include natural resource restoration on the majority of the site. Natural resource restoration is part of on-going negotiations to settle the State of Ohio's Natural Resource Damages claim against DOE. Restoration will include development of wetlands, forests and prairie areas. Low impact public access will be allowed. The On-Site Disposal Facility will remain and be managed/monitored.

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

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.

The New Jersey Soil Remediation Standards include a section pertaining to changes in land use. These requirements state that a "subsequent proposed use of a property that is different from the intended use (other than unrestricted use remedial actions) described in the original remediation proposal shall require a prior review and prior approval by the Department [of Environmental Protection]." The Department and affected cities must be informed of the following:

- the new land use compared to the original use;
- additional remedial actions, or engineering or institutional controls to be implemented;
- a dose assessment analysis;
- new characterization data, such as soil concentrations.

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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.

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 ($.0002 g/m^{-3}$). 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.

Pathway	Fish & Wildlife Worker	JA Resident	EcoTourist	Homesteader
Inhalation	4.9%	9.3%	1.8%	3.7%
Soil Ingestion	86.9%	82.2%	16.1%	34.9%
Plant Ingestion	0%	0.7%	0%	56.6%
External Exposure	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, 2000)

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

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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CASE STUDY: WELDON SPRINGS

This site processed uranium and thorium ore from 1957 to 1966. A cleanup target of 25-mrem/year was selected. Alternative uranium soil cleanuop levels were calculated using an on-site farmer scenario. An ALARA analysis yielded a goal equivalent to about 7 mrem/year. The resulting remedy includes an onsite disposal cell.

Table 1 - 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
Occupational standards (29 CFR 1910; 10 CFR 20; 10 CFR 835)	OSHA; NRC; DOE	5,000 millirem/year

[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.

Table 2 - Soil Cleanup Levels for Plutonium

Site	Scenario	Cleanup Level (pCi/g)	Date	Comments
Enewetak Atoll	Residential Agricultural Food-gathering Subsurface	40 80 160 400	*1973*	DOD-DNA/DOE
Fernald EMP	Park user (on-site) Resident farmer (off-site)	77 9	*1995*	DOE/EPA/OEPA; 10^{-6} risk
Ft. Dix, NJ		8	*1992*	USAF; BOMARC missile accident; 4 mrem/year
Hanford Reservation	Rural resident Commercial/Industrial	34 245	*1995*	WDOH; 15 mrem/year; used RESRAD ver. 5.7
Johnston Atoll		13.5	*1988*	EPA Reg. IX
	Fish & wildlife researcher Resident EcoTourist Homesteader	2.1 – 210 1.9 – 190 38 – 3800 .32 – 32	*2000*	DOD-DTRA; 10^{-6} – 10^{-4} risk range; used RESRAD ver. 5.82
Mound Facility		100		Pu-238 in canal sediments; 25 pCi/g if reasonably achievable (ALARA level)
Nellis Air Force Range	Industrial worker Bomb detonation (USAF) Bomb detonation (civilian) Munitions removal Aircraft crew Ground troops Ordinance EOD (USAF) Ordinance EOD (civilian) Construction worker Offsite resident	54,000 125,000 27,000 700,000 825,000 2,000 150,000 27,000 68,000 10,000	*1999*	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
Rocky Flats:				
Cleanup Agreement	Office worker Open space Resident	1088 1429 252	*1996*	
Oversight Panel	Resident rancher Office worker	80	*2000*	DOE/EPA Reg. VIII/CDPHE; 15 mrem/year; used RESRAD ver. 5.61
Preliminary Remediation Goals	Office worker Open space	10 17.5	*2000*	RAC; 15 mrem/year; used RESRAD ver. 5.82;
Tonapah Test Range	Resident rancher	200	*2000*	DOE/EPA/CDPHE; 10^{-6} risk
				DOE; Cleanup level used at Double Tracks and Clean Slate Sites

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

Table 3 - 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): total U (K_1=325 L/kg) total U (K_1=15 L/kg) Resident farmer (off-site) total U (K_1=325 L/kg)	 82 ppm 20 ppm 50 ppm	*1995*	EPA/DOE/OEPA; 10^{-6} risk; dependent on leachability (K_1)
New Jersey	Unrestricted use: U-234 U-235 U-238 Limited restricted use: U-234 U-235 U-238 Restricted use: U-234 U-235 U-238	 62 29 54 69 37 64 81 62 82	*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
Hanford Reservation	Rural resident: U-234 U-235 U-238 Commercial/Industrial U-234 U-235 U-238	 160 26 85 1200 100 420	*1997* *2000*	WDOH; 15 mrem/year; used RESRAD ver. 5.61
Hazelwood, MO		60		
Johnston Atoll	Fish & wildlife researcher Resident EcoTourist Homesteader		*2000*	DOD-DTRA; 10^{-6} – 10^{-4} risk range; used RESRAD ver. 5.82
Linde Site	Industrial / commercial Subsurface	600 3,021	*1999*	USACE; 10^{-5} risk; FUSRAP site
Maywood, NJ		100		
Mound Facility				For canal sediments
Naturita, CO		30		
Nellis AFB ranges	Industrial worker Bomb detonation (USAF) Bomb detonation (civilian) Munitions removal Aircraft crew Ground troops			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 :

	Ordinance EOD (USAF) Ordinance EOD (civilian) Construction worker Offsite resident			Am-241 activity ratio of 12.7 : 1)
Oxford, OH		35		
Rocky Flats:				
Cleanup Agreement	Industrial Use (U-234) Industrial Use (U-235) Industrial Use (U-238) Open space (U-234) Open space (U-235) Open space (U-238) Resident (U-234) Resident (U-235) Resident (U-238)	1627 113 506 1738 135 586 307 24 103	*1996*	DOE/EPA Reg. VIII/CDPHE; 15 mrem/year; used RESRAD ver. 5.61;
Oversight Panel	Resident rancher Office worker		*2000*	
Preliminary Remediation Goals	Office worker (U-233) Office worker (U-234) Office worker (U-235+D) Office worker (U-238+D) Open space (U-233) Open space (U-234) Open space (U-235+D) Open space (U-238+D) Resident (U-233) Resident (U-234) Resident (U-235+D) Resident (U-238+D)	68 69 0.8 3.8 122 123 4.2 17.8 4.43 4.86 0.76 0.33	*2000*	RAC; 15 mrem/year; used RESRAD ver. 5.82 DOE/EPA Reg. VIII/CDPHE; 10^{-6} risk; uses Federal Regulatory Guide 13 slope factors
Springdale, PA		100		

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

Table 4 – 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:		Active	Active	Active	Active	Active
1-External Gamma		Active	Active	Active	Active	Active
2-Inhalation		Active	Active	Active	Active	Active
3-Plant Ingestion		Active	Suppressed	Active	Suppressed	Active
4-Meat Ingestion		Active	Suppressed	Active	Suppressed	Active
5-Milk Ingestion		Active	Suppressed	Suppressed	Suppressed	Active
6-Aquatic Foods		Active	Suppressed	Active	Suppressed	Active
7-Drinking Water		Active	Active	Active	Active	Active
8-Soil Ingestion		Suppressed	Active	Active	Suppressed	Suppressed
9-Radon						
Distribution		200	10,000	1900	76	76*
Coefficients (K_d):	cm^3/g	200	230,000	550	218	218*
Americium	cm^3/g	25	50	35	50	218*
Plutonium	cm^3/g					
Uranium		10,000	98,000	248,000	40,000	*
	m^2	4.6	0.61	0.05	0.15	0.2
Area of Contaminated	m					
Zone		7300	8400	6820	7000	10800
Thickness of Contam'd	m^3/yr	0.0001	0.0002	.000015	.000026	.007*
Zone	g/m^3	30	10	30	30	70
	yr	0.4	1	1	1	1
Inhalation Rate		0.8	0.5	0.7	0.8	0.7
Mass Loading		0.6	0.25	0.58	1	0.6
(Inhalation)		0.2	0.75	0.0155	0	0.4
Exposure Duration		--	9	--	--	4
Inhalation Shielding	m/s					
Factor		110	1	120.5	--	190
External 🕮 Shielding	kg/yr	2.7	1	10	--	64
Factor	kg/yr	36.5	73	37.4	70	75
Indoor Time Factor	g/yr	730		444.6	--	730
Outdoor Time Factor	L/yr					
Wind Speed		1	--	1	--	1
		0.15	--	0.15	0.15	0.03
Fruits, Vegetables,	m					
Grain						
Leafy Vegetables			1E-3			5E-4
Soil Ingestion			1E-3			5E-4
Drinking Water Intake			5E-2			2E-2
Drinking/Household						
Water	Risk /		3.28E-10			
Fraction from	pCi		3.16E-10			
Groundwater			6.20E-11			
Depth of Soil Mixing						
Layer			3.85E-8			
	Risk /		2.78E-8			
GI Absorption Factor	pCi		1.24E-8			
(f_1):						
Am-241			4.59E-9			
Pu-239			1.26E-11			
U-238+D	Risk/yr		5.25E-8			
Ingestion Slope Factor:	per					
Am-241	pCi/g					
Pu-239				4.40E-1 /	4.44E-1 / 3.64E-	1.55E-1 / 7.4E-4
U-238+D				3.64E-3	3	5.9E-2 / 9.3E-4
Inhalation Slope	mrem /			4.29E-1 /	3.08E-1 / 5.18E-	3.5E-2 / 1.8E-4
Factor:	pCi			3.54E-3	5	3.1E-2 / 1.7E-4

Parameter	Units	Hanford Site	Johnston Atoll	Clean Slate Sites, Nevada	Rocky Flats Cleanup Agreement	Rocky Flats Oversight Panel
Am-241 Pu-239 U-238+D External Exposure: Am-241 Pu-239 U-238+D Dose Conversion Factors: (inhalation / ingestion) Am-241 Pu-239 U-234 U-235+D U-238+D				1.32E-1 / 2.83E-4 1.23E-1 / 2.67E-4 1.18E-1 / 2.69E-4	1.32E-1 / 2.83E-4 1.23E-1 / 2.67E-1 1.18E-1 / 2.69E-4	3.0E-2 / 1.7E-4

* Derived probabilistically using distributions of data

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RFCA Stakeholder Focus Group
Attachment D

Title:	Schedule
Date:	November 8, 2000
Author:	Jeremy Karpatkin DOE
Phone Number:	(303) 966-8392
Email Address:	jeremy.karpatkin@rf.doe.gov

MIN RECORD

DRAFT RSAL Public Process Proposed Schedule

Tasks	First Draft Distributed	Focus Group Meeting	Second Draft	Focus Group Meeting	Draft to Principals
Review process		CAB Meeting: 10/5/00 Focus Group: 10/25/00			
Task One (Regulatory Analysis)	10/27/00	11/8/00 and 11/29/00	1/3/01	1/17/01	2/15/01
Task Two (Model Evaluation)	11/20/00	12/13/00	1/3/01	1/31/01	2/15/01
Task Three (Parameter Evaluation)	1/26/01	2/14/01 and 2/28/01	4/6/01	4/25/01	5/2/01
Task Four (New Science)	11/3/00	12/13/00	1/3/01	1/31/01	2/15/01
Task Five (Cleanup levels at other Sites)	10/25/00	11/8/00	12/1/00	1/3/01	1/17/01

Focus Group Meetings:

10/25/00:	**11/8/00:**	**11/29/00:**	**12/13/00:**	**1/3/01:**
➢ Review and discuss RSAL process	➢ Regulatory Analysis 1 ➢ Cleanup Levels 1	➢ Regulatory Analysis 2	➢ Model Evaluation 1 ➢ New Science 1	➢ Cleanup Levels 2
1/17/01:	**1/31/01:**	**2/14/01:**	**2/28/01:**	**4/11/01**
➢ Regulatory Analysis 3	➢ Model Eval. 2 ➢ New Science 2	➢ Parameter Evaluation 1	➢ Parameter Evaluation 2	➢ Outline of Report to Focus Group
4/25/01	**5/9/01**			
➢ Parameter Evaluation 3	➢ Draft Report to Focus Group			

Formal Public Comment Period for RSAL Report:

5/16/01	**7/16/01**	**8/15/01**
➢ Public Comment begins	➢ Public Comment Ends	➢ Final Report Released

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DRAFT DRAFT

October 5, 2000

TO: RFCA Project Coordinators, RFCA staff, RFCA Stakeholder Focus Group participants, other interested stakeholders and members of the public

FROM: Jeremy Karpatkin, DOE Rocky Flats

RE: Public Process for RSALs

Below is a draft public process and agency project schedule for the RSAL review. The General Principles below explain the assumptions and strategy behind the schedule. The schedule is also available in a chart form (below).

Public Process General Principles

1) This schedule is an attempt to lay out a useful and substantive public process for discussing RFCA agency deliberations on the RSAL review prior to the initiation of formal public comment. There is nothing magical about these dates. They are a first attempt to lay out a schedule that shows the amount of time it takes to do this right but no more time than is necessary. For site cleanup purposes, we do not need to have closure on RSALs by the end date of this schedule; we only need it before we begin developing the IM/IMRA on the 903 pad.

2) We will maximize use of the RFCA Focus Group. This will mean devoting a great deal of time of the Focus Group for this topic. In general, we should use the Focus Group for technical and policy discussions focused on preliminary drafts of discreet parts of the review. We have made a commitment to share with the Focus Group these drafts before they go to the agency principals. Some of the topics will require one full meeting of the Focus Group; some will require more than one. In all cases, our goal will be to have these documents in the Focus Group packet and on the Rocky Flats Home Page at least a week prior to the Focus Group meeting.

3) We will use the technical sessions to provide regular technical briefings and updates on the progress of the review. These sessions should be focused on a specific technical topic that should preferably be advertised – through the RFCA FG packet mailing – in advance. Some written document should be distributed in the packet as well to support these discussions. Technical sessions will also be used to continue discussions from Focus Group meetings (although these are not reflected in the calendar below.)

4) The conference calls will continue as a means to keep stakeholders informed of progress. The schedule of conference calls is not included in the schedule below.

5) For each discreet topic, we will be flexible to allow other meetings as needed. These can either be specific follow on technical or policy discussions or even a public meeting more

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widely advertised on a topic considered important for a full public review. These discreet meetings will be scheduled as needed. We will not establish a new set of meetings nor will the schedule below reflect these meetings. The schedule does not reflect formal briefings of CAB, RFCLOG, local governments or other stakeholder groups. The agencies will conduct and support such meetings on request, but they are not specifically reflected in this schedule.

6) We will continue to encourage individual stakeholders to interact directly with technical and project leads, via telephone, e-mail and personal visits. This is not intended as a substitute for public process. Rather, it is intended to satisfy the appetite for technical information shown by some of our stakeholders without diverting the general public process into technical discussions inaccessible or not of interest to a broader (although still focused) stakeholder audience.

7) The schedule below assumes that the first draft of each Task will be a product of the RFCA PCs, and not just of the individual staff authors. This means that the lead for each document will have to work and collaborate with staff of other agencies in developing their first draft. Also, the schedule reflects some time between the due dates of the documents and when they are first presented to the RFCA FG. These Rev. 1's will describe the issue, outline the options and the pros and cons of each option. To the extent it is know, the first draft will describe different agency positions. To the extent there are unanswered policy questions, the first draft will list and discuss them. These first drafts will be written as first drafts of the RFCA report on RSALs, not as issue papers. These Task reports will then be discussed with the RFCA Focus Group. Tasks 1 and 3 each have two FG meetings devoted to the first draft. The other Tasks have one Focus Group meeting. After this initial round of Focus Group meetings the agency staffs will consider the comments and discussion and develop a Rev. 2 of each Task. These will reflect the community comments and how the PCs propose to resolve them. Where resolution on issues has not been reached, the Rev. 2s will record the different agency positions. These are drafts of documents that will go to the Principals for review and decision. (Only Tasks 1 and 3 are described here as requiring substantive public process for Rev. 2. It is assumed that the Rev. 2's of Tasks 2, 4 and 5 will only require a report back to the RFCA FG.)

8) The schedule below presumes that the Principals of each agency will review, approve and as needed make decisions on outstanding issues contained in each discreet Task report. These approvals must come no later than the dates indicated in the "To the Principals" column of the chart. It is also presumed that these discreet pieces will be wrapped together and presented, still as pre-draft, and presented as a pre-draft final report to the RFCA FG on 5-9-01. The Principals can still make a 5-16-01 deadline to get this report out for public comment. The public will see the draft conclusion or conclusions no later than 5-9-01, but they will see each discreet piece, including draft recommendations, prior to 5-9-01. This schedule does not address the specific schedule or timing of Principal's meetings. The Principals can meet as needed or get briefed by their own staffs as needed. It is likely that the Principals will have to meet at least once prior to 5-9-01 to address and resolve any outstanding issues.

9) This schedule allows room for formal public meetings during the formal 60-day comment period. It does not spell out any specific proposals for how the agencies will conduct these meetings, where they will take place or how many of them will take place. There may be a range of activities that we engage in; this document does not seek to describe these.

10) This schedule and proposal represents a draft. It is open to improvement and to community input. We also will find as we proceed that these dates may need to be amended. Nevertheless, it represents a first cut at a working schedule. If the public and the agencies can live with it as a working document, we ought to use it as such.

11) Some of the Task reports will include interim deliverables – specific pieces or sub-components of the Task completed in draft form prior to the deadline for the full task report indicated in the schedule. These interim reports will be shared with the community as they are available. This is not reflected in the schedule.

12) This document does not address the issue of peer review. Some in the community have raised this as a desirable course of action. This schedule allows us to see where such a peer review makes sense and what it impact it may have on the schedule.

DRAFT General Plan and Schedule:

Review RSAL process:

CAB Meeting:	Oct. 5th
RFCA FG meeting:	Oct. 25th

Action 1: Regulatory Analysis:

Rev. 1 Deliverable date:	October 27th
POC:	Tim Rehder
First RFCA FG meeting:	Nov. 8th (technical session and RFCA FG)
Second RFCA FG meeting:	Nov. 29th (technical session and RFCA FG)
Rev. 2 Deliverable:	January 3
Third RFCA FG:	January 17
Draft to Principals:	February 15

(NOTE: The Nov. 29th date reflects a change in schedule to avoid a FG meeting the Wednesday prior to Thanksgiving.)

Action 2: Model Evaluation:

Deliverable date:	November 20
POC:	Russell McCallister
First meeting:	December 13th
Rev. 2 Deliverable date:	January 3rd
Second Meeting:	January 31st
Draft to Principals:	February 15th

Action 3: Parameter Evaluation:

Deliverable date:	January 26th
POC:	Russell McCallister
First meeting:	February 14th
Second Meeting	February 28th
Rev. 2 due:	April 6th
Third Meeting:	April 25th
Draft due to Principals:	May 2nd

Action 4: New Scientific Information:

Deliverable date:	November 3rd
POC:	Russell McCallister
First meeting:	December 13th
Rev. 2 due:	January 3rd
Second Meeting:	January 31st
Draft to Principals:	February 15th

Action 5: Cleanup levels at other Sites:

Deliverable date:	October 25th
POC:	Carl Spreng
First meeting:	November 8th
Rev. 2 Due:	December 1st
Second meeting:	January 3rd
Draft to Principals:	January 17th

DRAFT RSAL Document:

Outline and Table of Contents Rev. 1 Due:	March 15
POC:	RFCA PCs
First Meeting:	April 11
Draft RFCA Report Rev. 1 Due:	April 25
First Meeting:	May 9
Public Comment Begins:	May 16th
Public Meeting(s):	???
Public Comment Ends:	July 16th
Changes to RFCA (if any) and Response to Comment Released:	August 15th

RFCA Stakeholder Focus Group
Attachment E

Title: Post NRC guidance (1549, 4006) links

Date: November 20, 2000

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DOE

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Email Address: russell.mccallister@rf.doe.gov

NUREG 1549
http://techconf.llnl.gov/cgi-bin/library?source=*&library=rad_cri_public&file=*

Radiological Criteria for License Termination Rule Text
http://techconf.llnl.gov/cgi-bin/library?source=*&library=rad_cri_state&file=*

ADMIN RECORD

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November 20, 2000

MEMORANDUM

TO: Rocky Flats Focus Group

FROM: Daniel S. Miller
First Assistant Attorney General
Natural Resources & Environment Section
Hazardous and Solid Waste Unit

RE: Response to questions presented at 11/8/00 meeting

Below is my attempt to answer the questions posed at the November 8, 2000 meeting of the Rocky Flats Focus Group. These responses do not necessarily reflect the views of the RFCA Parties.

Q: What is the distinction between applicable, relevant and appropriate?

A: First, a bit of background. In enacting CERCLA, Congress did not create an entirely new set of regulatory requirements to govern cleanup standards. Instead, Congress took a two-pronged approach to setting cleanup standards. It (1) established a general statutory standard that all CERCLA cleanups must meet, and (2) directed EPA to look to other existing environmental laws for specific cleanup standards.

Under the general statutory standard, all remedies must:

- protect human health and the environment;
- be cost-effective; and
- utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

CERCLA § 121(1), 42 U.S.C. § 9621(1). EPA has promulgated regulations defining what risk it considers to be protective of human health and the environment. Under EPA's regulations,

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CERCLA cleanups are to result in a residual cancer risk of between one in a million and one in ten thousand (the 10^{-6} to 10^{-4} risk range), and a hazard index of less than 1. EPA uses risk assessment methods to determine whether a remedy will result in a residual risk within this range.

CERCLA's second directive regarding cleanup standards -- that remedies must meet specific standards from other environmental laws -- is the origin of the "ARARs" concept. CERCLA § 121(d)(2) says that remedies which result in contamination remaining onsite must achieve a level or standard of control for such contamination that complies with any "standard, requirement, criteria, or limitation" of any federal or state environmental law that is "legally applicable or relevant and appropriate."[1] EPA may waive the requirement to meet an ARAR, but must justify its decision to do so under one or more criteria set forth in CERCLA. EPA seldom waives ARARs.

So, requirements under environmental laws such as the Clean Air Act, Clean Water Act, RCRA, Endangered Species Act, Toxic Substances Control Act, or Atomic Energy Act may become ARARs at a given CERCLA site. Whether any given requirement under one of these laws becomes an ARAR at a given CERCLA site depends on a number of factors. If the requirement "specifically addresses a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site," it is "applicable." If it does not, it may still be relevant and appropriate if it addresses problems or situations similar to the circumstances of the release or remedial action, and is well-suited to the site. EPA's CERCLA regulations list a number of factors to consider in deciding whether a requirement is relevant and appropriate. These factors require a comparison of:

> (i) The purpose of the requirement and the purpose of the CERCLA action;
> (ii) The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site;
> (iii) The substances regulated by the requirement and the substances found at the CERCLA site;
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[1] Somehow, EPA came up with the "ARAR" acronym out of that phrase. Perhaps they wanted to avoid confusion between a LARA and ALARA. (A little legal humor.)

affected resource at the CERCLA site.

Let's use the state's Radiation Control Division regulations as an example. These regulations do not legally apply to DOE facilities because the Atomic Energy Act excludes such facilities from state and NRC regulation. Thus, they are not "applicable" under CERCLA. But they can still be relevant and appropriate. To determine whether they are, we compare the RCD regulations with the CERCLA cleanup at Rocky Flats.

(i) The purpose of the requirement and the purpose of the CERCLA action

The purpose of the RCD regulations is to protect public health and the environment by minimizing or preventing exposure to unsafe levels of radiation. The purpose of cleaning up radioactive contamination at Rocky Flats is to protect public health and the environment by minimizing or preventing exposure to unsafe levels of radiation. This factor weighs in favor of categorizing the RCD regulations as ARARs.

(ii) The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site.

Portions of the RCD regulations apply to radioactively-contaminated soil, groundwater, surface water, and buildings. The cleanup actions at Rocky Flats will address soil, groundwater, surface water, and buildings that have radioactive contamination. This factor weighs in favor of categorizing the RCD regulations as ARARs.

(iii) The substances regulated by the requirement and the substances found at the CERCLA site.

The RCD regulations regulate radioactive materials, including plutonium, americium and uranium. The radioactive contaminants at Rocky Flats include plutonium, americium and uranium. This factor weighs in favor of categorizing the RCD regulations as ARARs.

(iv) The actions or activities regulated by the requirement and the remedial action contemplated at the CERCLA site.

Various provisions of the RCD regulations address decommissioning of facilities with radioactive contamination. Other provisions address disposal of low-level radioactive waste. The cleanup of Rocky Flats involves decommissioning of facilities with radioactive contamination, and may involve on-site disposal of radioactive waste. This factor weighs in favor of categorizing the RCD regulations as ARARs.

(v) Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site.

Although the RCD regulations exempt DOE facilities, this exemption should not count against their being considered as relevant and appropriate requirements. In the preamble to the National Contingency Plan" ("NCP"), EPA explained that this criteria refers to variances,

waivers and exemptions that are based on technical or environmental considerations. The exemption for DOE facilities is due to the legislative decision decades ago to allow DOE to be self-regulating with respect to Atomic Energy Act requirements. That decision was grounded in concerns for national security, not environmental or technical issues.

(vi) The type of place regulated and the type of place affected by the release or CERCLA action.

The RCD regulations govern any place where radioactive materials are used, and Rocky Flats is a place where such materials were used.

(vii) The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action.

The applicability of RCD regulations is not dependent on the size of the structure or facility in which the radioactive materials are used. As far as the type of structure, the analysis of the preceding criterion applies.

(viii) Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resource at the CERCLA site.

The RCD regulations for decommissioning create a preference for cleanup to a level that is safe for unrestricted use. The regulations do allow for cleanup to restricted use levels if further reductions to comply with unrestricted use criteria would result in net harm to the public or the environment, so long as appropriate institutional controls are imposed, and so long as the cleanup meets ALARA requirements. It is likely that the future uses at the Rocky Flats site will be limited to open space, although limited industrial use of the industrialized portion of the site is possible.

Based on applying these criteria to the cleanup and decommissioning of Rocky Flats, it is clear that the RCD regulations, as a group, are relevant and appropriate requirements under CERCLA. Of course, specific regulations may or may not be relevant to cleanup and decommissioning, so we need to review each regulation individually to determine whether it is an ARAR. And under EPA's regulations, only substantive requirements can be ARARs. Procedural requirements, such as permitting and reporting requirements, are never ARARs.

Q: Is there a hierarchy among applicable, relevant and appropriate?

A: No, once a requirement is determined to be either relevant and appropriate or applicable, the remedy must meet that requirement (unless EPA waives the ARAR). However, as the above example shows, there is more discretion in determining whether a requirement is relevant and appropriate than there is in determining whether it is applicable.

Q: How do the agencies interpret the NRC (and state) decommissioning rule?

To be completed

Q: How will the agencies decide whether to set a cleanup number based on dose or risk?

To be completed

Q. The CERCLA risk range covers two orders of magnitude. How does EPA select which part of the risk range the remedy must meet?

A. The more conservative end of the range, 10^{-6}, is the "point of departure." EPA considers the CERCLA balancing criteria (short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; implementability; cost; community acceptance; and state acceptance) in selecting among remedies that are protective and meet (or waive) ARARs. Obviously, cost and implementability are two factors that generally tend to push remedies toward the less stringent end of the risk range. The effect of the other factors may change from one case to another.

Q: Why is EPA Region VIII considering the 25 millirem number, when EPA headquarters appears to disagree with it?

A: The 25 millirem number is the number in the decommissioning rule, which we have agreed is an ARAR. Because it is an ARAR, EPA has to consider it. The EPA policy to which this question refers simply notes that in some instances, for some radionuclides, achieving a residual dose of 25 millirems per year will not yield a residual risk within the CERCLA risk range. In those instances, additional remedial actions to reach the risk range would be necessary.

Questions on ALARA

To be completed

The NRC guidance document on ALARA is titled "Demonstrating Compliance with the Radiological Criteria for License Termination" (Draft Regulatory Guide DG-4006). This document is available on the NRC's website. The URL is http://www.nrc.gov/NRC/RG/04/index.html.

Here is the text of the Colorado decommissioning rule:

> RH 4.61.2 Radiological Criteria For Unrestricted Use.
>
> A site will be considered acceptable for license termination under conditions of unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 0.25 mSv per year (25 mrem/y), including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are ALARA.
>
> RH 4.61.3 Radiological Criteria For Restricted Use.
>
> A site will be considered acceptable for license termination under restricted conditions if: 4.61.3.1 The licensee can demonstrate that further reductions in residual radioactivity necessary to comply with the provisions of RH 4.61.2 would result in net public or environmental harm or were not being made because the residual levels of contamination associated with restricted conditions are ALARA;
>
> 4.61.3.2 The licensee has made provisions for durable, legally enforceable institutional controls which provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 0.25 mSv per year (25 mrem/y); and
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RFCA Stakeholder Focus Group
Attachment F

Title: RSAL Review Processes Answers

Date: September 20, 2000

Author: Dan Miller
STATE OF COLORADO. DEPARTMENT OF LAW

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4.61.3.2 The licensee has made provisions for durable, legally enforceable institutional controls which provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 0.25 mSv per year (25 mrem/y); and

4.61.3.3 Residual radioactivity at the site has been reduced so that if the institutional controls were no longer in effect, there is reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group is ALARA and would not exceed either: 1 mSv per year (100 mrem/y); or 5 mSvper year (500 mrem/y), provided the licensee demonstrates that further reductions in residual radioactivity necessary to comply with the 1 mSv per year (100 mrem/y) value of this paragraph are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm.

RFCA Stakeholder Focus Group
Attachment G

Title:	Computer Model Selection To Support Development Of Radionuclide Soil Action Levels
Date:	November 20, 2000
Author:	Russell McCallister DOE
Phone Number:	(303) 966-9692
Email Address:	russell.mccallister@rf.doe.gov

ADMIN RECORD

PRELIMINARY DRAFT

COMPUTER MODEL SELECTION TO SUPPORT DEVELOPMENT OF RADIONUCLIDE SOIL ACTION LEVELS

OCTOBER 26, 2000

ADMIN RECORD

[redacted]

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1. Introduction

This Computer Model Selection supports the calculation of the Radionuclide Soil Action Levels (RSAL) at the Rocky Flats Environmental Technology Site (RFETS). RSALs are radionuclide concentrations in soils that are protective of human health. RSALs are calculated based on the future land uses at RFETS per the Rocky Flats Cleanup Agreement (RFCA). RSALs are being developed for Pu-239, Am-241, U-234, U-235 and U-238 for inclusion in RFCA.

Computer models are needed to calculate RSALs due to the complexity in calculating radiation dose to individuals associated with future land uses. Radiation dose must be calculated for multiple radionuclides, multiple exposure pathways and multiple exposure scenarios over a 1,000 year period. Several computer models may be used to calculate the RSALs. These computer models include: 1) RESRAD 6.0, 2) DandD 2.0, 3) RESRAD 5.82 modified by RAC and 4) MEPAS/GENII/FRAMES/SUM3 package of computer codes. These computer codes are considered since they can assess radiation dose from radionuclides in soils in a probabilistic manner. They can also trace the movement of radionuclides in the environment over the 1,000 year assessment period.

Section 2.0 of this report outlines the capabilities of each of the computer models chosen for assessment. Section 3.0 outlines the model selection criteria to be used to evaluate the chosen models. Section 4.0 evaluates each of the computer models with respect to the selection criteria. Section 5.0 provides conclusions based on the comparison with selection criteria. Section 6.0 provides references for the report.

2. Model Descriptions

2.1. RESRAD 6.0

RESRAD is a computer code developed by Argonne National Laboratory for the U.S. Department of Energy to calculate site-specific residual radioactive material guidelines using radiation dose and radiation risk. These residual radioactive material guidelines can be developed on a deterministic or probabilistic basis. Residual radioactive material guidelines are equivalent to an RSAL at RFETS.

RESRAD uses a pathway analysis method in which the relation between radionuclide concentrations in soil and the dose to a member of a critical population group is expressed as a pathway sum, which is the sum of products of "pathway factors." Pathway factors correspond to pathway segments connecting compartments in the environment between which radionuclides can be transported or radiation emitted. The nine environmental pathway segments assessed by RESRAD are direct exposure, inhalation of particulates and radon, and ingestion of plant foods, meat, milk, aquatic foods, water and soil.

2.2. DandD 2.0

DandD (Decontamination and Decommissioning) is a computer code developed by the Nuclear Regulatory Commission to support decommissioning under their License Termination Rule. Screening level cleanup concentrations are calculated by DandD for surface soils and building surfaces using probabilistic analysis. The DandD computer code software was developed using the environmental pathways and exposure scenarios documented in Volumes 1 and 3 of NUREG/CR-5512, "Residual Radioactive Material From Decommissioning."

DandD assesses a residential exposure scenario for soils and a building occupancy scenario for building surfaces. The building occupancy scenario relates volume and surface contamination levels in existing buildings (presumably released following decommissioning for unrestricted commercial or light industrial use) to estimates of the total effective dose equivalent (TEDE) received during a year of exposure with the conditions defined in the scenario. The more complex and generalized residential scenario is meant to address sites with contamination in soils and groundwater. Input parameter distributions for each scenario and exposure pathway were developed consistent with conducting screening dose assessments, increasing the likelihood of overestimating rather than underestimating potential dose.

2.3. RESRAD 5.82 modified by RAC (RAC-RESRAD)

RESRAD 5.82 has all of the capabilities listed above for RESRAD 6.0 except that it does not have the capability to assess parameters in a probabilistic manner. The Risk Assessment Corporation (RAC) wanted to assess exposure scenarios and exposure pathways in a probabilistic manner though. RAC also wanted to calculate the amount of radioactive material in the air differently than RESRAD 5.82. Therefore RAC developed probabilistic computer codes and air modeling computer codes to supplement the capabilities of RESRAD 5.82. The RAC developed computer codes were run concurrently with RESRAD 5.82 to get the desired results.

RAC-RESRAD can assess multiple exposure scenarios and exposure pathways in a probabilistic manner.

2.4. MEPAS/GENII/FRAMES/SUM3

The MEPAS/GENII/FRAMES/SUM3 set of computer codes works as a unit to calculate radiation dose to individuals associated with multiple exposure scenarios. FRAMES is the shell in which all of the other computer codes run. MEPAS and GENII contain the source term definition component, the fate & transport component and the radiation dosimetry component of the set of computer models. SUM3 is the package that allows the use of probabilistic analysis within the set of computer codes. These four computer codes are further discussed in the sections below.

2.4.1. MEPAS

The MEPAS (Multimedia Environmental Pollutant Assessment System) computer code assesses the impact to individuals from radionuclides and chemicals in the environment. MEPAS integrates environmental transport and exposure pathways to determine their potential impact on the surrounding environment, individuals, and populations. MEPAS is a deterministic computer code that can assess multiple exposure pathways and exposure scenarios.

MEPAS provides a user-friendly interface for setting up cases and analyzing results. This interface provides on-line help, units conversions, pictorial depiction of the Conceptual Site Model, ability to reference all data, ability to edit most default parameters and graphical views of input and output data. MEPAS is applicable to a wide range of multimedia transport and consequence analysis.

2.4.2. GENII

The GENII computer code was developed at Pacific Northwest National Laboratory (PNNL) to integrate radionuclide dosimetry models with environmental pathway analysis models. The resulting second generation of environmental dosimetry computer codes is compiled in the Hanford Environmental Dosimetry System (Generation II or GENII). Although the codes were developed for use at Hanford, they were designed with the flexibility to accommodate input parameters for a wide variety of generic sites.

The GENII system includes the capabilities for calculating radiation doses following chronic and acute releases, with options for annual dose, committed dose, and accumulated dose. Radionuclide transport via air, water, or biological activity may be considered. GENII is a deterministic computer code that can assess multiple exposure pathways and exposure scenarios.

2.4.3. FRAMES

FRAMES (Framework for Risk Analysis in Multimedia Environmental Systems) is a software platform used to link different computer codes required to perform an appropriate assessment. FRAMES is an open-architecture, object-oriented system that provides an environmental database. This software platform aids the user in constructing exposure scenarios and exposure pathways applicable to site-specific situations. Furthermore, the software allows the user to choose the most appropriate codes to solve simulation requirements and presents graphical packages for analyzing results.

FRAMES currently contains sockets for a collection of computer codes that simulate elements of a source, fate & transport, exposure, and risk-assessment system. FRAMES provides data file specifications that describe how all site information is stored within the framework and passed between modules. These

data file specifications are not associated with the model-specific information, only with the transfer of information between modules or other frameworks. The environmental transport and radiation dose computer codes currently available within the FRAMES software platform are MEPAS and GENII. SUM3 is an additional computer code available in the FRAMES software platform that supports probabilistic analysis.

2.4.4. SUM3

The FRAMES software is currently designed for deterministic environmental and human health impact models. The Sensitivity/Uncertainty Multimedia Modeling Module (SUM3) software product was designed to allow statistical analysis using the existing deterministic models available in FRAMES within the FRAMES platform. SUM3 randomly samples input variables and preserves the associated output values in an external file available to the user for evaluation. This enables the user to calculate deterministic values with variable inputs, producing a statistical distribution of results.

3. Model Selection Criteria

The following criteria will be used to assess the capabilities of 1) RESRAD 6.0, 2) DandD 2.0, 3) RESRAD 5.82 modified by RAC and 4) MEPAS/GENII/FRAMES/SUM3 package of computer codes. These criteria will be applied to each of the computer codes independently. The computer code(s) that meets all or most of the criteria will be chosen for use over those computer models that meet few or none of the criteria.

These criteria were developed after reviewing the current literature on computer modeling and choosing criteria based on the literature. In general, the literature supported the use of computer models that comply with project-specific needs and that have been extensively tested. A major assumption in developing these criteria is that the RSALs will be developed based on radiation dose in a probabilistic manner in accordance with the NRC's License Termination Rule.

3.1. Criteria #1 - Does the model incorporate key processes from the Conceptual Site Model?

The Conceptual Site Model (CSM) is developed to illustrate how an individual can be exposed to radionuclides in the soil. This exposure is then translated into a radiation dose to the individual due to inhalation, ingestion and external irradiation from the radionuclides in the soils. The radiation dose caused by a certain soil concentration can then be translated into an RSAL.

The CSM must first show the configuration of radionuclides in soil so that the source term can be adequately modeled. At RFETS, the source of radionuclides in soils can be in either surface soils or subsurface soils. Therefore, the computer model must be able to assess these two soil horizons.

The CSM must then be able to trace the contaminant from the source to the exposed individual. At RFETS, the environmental transport mechanisms that must be assessed are surface water runoff, surface water stream transport, air resuspension, leaching in the vadose zone and ground water transport. Therefore, the computer model must be able to assess all of these environmental transport mechanisms.

The CSM must show all the exposure pathways through which an individual could be exposed. At RFETS, the exposure pathways of ingestion of soil, inhalation of resuspended soils, external irradiation of soils, ingestion of homegrown fruits/vegetables/grains and ingestion of meat and milk are the exposure pathways of interest at RFETS. Therefore, the computer model must be able to assess all of these exposure pathways.

The CSM has to include all the exposure scenarios associated with an individual. The exposure scenarios of interest at RFETS are the industrial office worker, recreational open space user, wildlife refuge worker, hypothetical future resident and hypothetical future resident rancher. The individuals associated with these exposure scenarios may be an adult, child or infant. Therefore, the computer model chosen to calculate the RSAL must be able to assess these exposure scenarios.

3.2. Criteria #2 - Does the model satisfy study objectives?

The study objective is to estimate the soil concentration that equates to an acceptable radiation dose for all applicable radionuclides over a study period of 1,000 years. Therefore, the chosen computer model must be able to trace a radionuclide through the environment to each applicable exposure scenario for a 1,000 year period. The maximum radiation dose in this period must be calculated, and the RSAL associated with this maximum concentration must be delineated. It would be ideal if the computer code chosen would perform this calculation automatically.

3.3. Criteria #3 – Has the model been verified using published analytical equations in scientific and technical journals?

Verification is the process of comparing model outputs with the solutions to analytical equations under the same conditions as the model was run. These results need to be equivalent to assure that the analytical equations have been coded into the model correctly. The model chosen to calculate the RSAL shall be verified.

3.4. Criteria #4 – Has the model been validated against known site conditions?

Validation is the process of determining how well the fate and transport model describes actual system behavior. Validation of the model can be achieved by matching model output to measurements. It involves the process of using a set of input parameter values and boundary conditions for a calibrated model to approximate, within an acceptable range, an independent set of measurements made

under conditions similar to the model conditions. The model chosen to calculate the RSAL shall be validated.

Benchmarking may be considered supporting information when assessing the validation of a model. Benchmarking is an exercise that consists of solving the same set of problems with several different computer models and comparing results.

3.5. Criteria #5 – Does the model have the capability to satisfy study objectives using probabilistic analysis?

There are two ways to assess radiation dose per the CSM requirements. The first method is to choose a single conservative value for each input parameter from the model. This is a deterministic analysis. Parameters chosen in a deterministic manner will produce a single conservative RSAL for each radionuclide in each exposure scenario. The second method is to choose a distribution of values for the most sensitive parameters from the model. This is a probabilistic analysis. Parameters chosen in a probabilistic manner will produce an output set of radiation dose distributions over time for each radionuclide in each exposure scenario. The RSAL will be chosen based on the "Peak of the Mean Dose versus Time" as required by the NRC. The model chosen to calculate the RSAL shall have the capability to perform a probabilistic analysis.

3.6. Criteria #6 – Is the model well documented?

Documentation for each model should include: 1) A user's manual that discusses how to navigate through the model interface and 2) A technical basis document that outlines the technical aspects (including mathematical formulations) of the radiological source term, the environmental transport algorithms, the exposure pathways factors and the radiation dosimetry algorithms.

3.7. Criteria #7 – Is the model available in the public domain?

The model will need to be available in the public domain. This means that the model and its' documentation can be accessed either through a government agency or through a private company. There may also be a charge associated with the software. The model may not be experimental in nature and only available to select individuals.

4. Model Criteria Evaluation

The Model Selection criteria will now be applied to 1) RESRAD 6.0, 2) DandD 2.0, 3) RESRAD 5.82 modified by RAC (RAC-RESRAD) and 4) MEPAS/GENII/FRAMES/SUM3 package of computer codes independently. The results of applying these criteria to each computer model will be used to select the appropriate computer code to calculate the RSAL. The results of applying these model selection criteria are outlined in Table 1, "Model Selection Criteria Assessment," of Section 5.0.

4.1. RESRAD 6.0

4.1.1. Criteria #1 - Does the model incorporate key processes from the Conceptual Site Model?

RESRAD 6.0 can assess all aspects of the CSM applicable at RFETS. RESRAD 6.0 can trace a contaminant from its origin in soils to an exposed individual through all applicable exposure pathways. RESRAD 6.0 can assess radionuclides in surface soils and subsurface soils. RESRAD 6.0 can assess the exposure pathways of ingestion of soil, inhalation of resuspended soils, external irradiation of soils, ingestion of homegrown fruits/vegetables/grains and ingestion of meat and milk. RESRAD 6.0 can assess the industrial office worker, recreational open space user, wildlife refuge worker, hypothetical future resident and hypothetical future resident rancher exposure scenarios. RESRAD 6.0 can assess an adult, child and infant within the appropriate exposure scenarios.

4.1.2. Criteria #2 - Does the model satisfy study objectives?

RESRAD 6.0 can estimate the soil concentration that equates to an acceptable radiation dose for all applicable radionuclides over a study period of 1,000 years. RESRAD 6.0 can trace a radionuclide through the environment to each applicable exposure scenario for a 1,000 year period. The maximum radiation dose in this period can be calculated by RESRAD 6.0, and the RSAL associated with this maximum concentration can be delineated by RESRAD 6.0. RESRAD 6.0 can perform this calculation automatically.

4.1.3. Criteria #3 – Has the model been verified using published analytical equations in scientific and technical journals?

The RESRAD computer code has been extensively verified. Verification of RESRAD has included the following:

1. Argonne National Laboratory performed an internal verification of the RESRAD computer code using hand calculations before its initial release in 1989.
2. An independent verification of RESRAD was performed in 1994 and is documented in "Verification of RESRAD, A Code for Implementing Residual Radioactive Material Guidelines, Version 5.03," HNUS-ARPD-94-174, Halliburton NUS Corporation, June 1994

4.1.4. Criteria #4 – Has the model been validated against known site conditions?

The RESRAD computer code has been extensively validated. Validation of RESRAD is documented in the following reports:

1. Analysis of BIOMOVS II Uranium Mill Tailings Scenario 1.07 with the RESRAD Computer Code, ANL/EAD/TM-66, Argonne National Laboratory, August 1997
2. Application of the RESRAD Computer Code to VAMP Scenario S, ANL/EAD/TM-70, Argonne National Laboratory, March 1997

BIOMOVS (BIOspheric MOdel Validation Study) II is an international cooperative study to test models designed to quantify the environmental transfer and bioaccumulation of radionuclides and other trace substances. Scenario 1.07 of the BIOMOVS study is the culmination of numerous iterations among the members of this working group in developing a hypothetical scenario, comparing predictions of the intermediate scenarios, and refining and clarifying the scenario to arrive at a reasonably well-defined scenario to serve as the basis for comparison of deterministic predictions of the models participating in the study.

VAMP (Validation of Environmental Model Predictions) is an international program established by the International Atomic Energy Agency (IAEA) in 1988 to use data from the Chernobyl fallout to test and improve biospheric models. Scenario S involved the prediction of the radiological consequences of cesium-137 from Chernobyl-driven fallout in southern Finland.

RESRAD has been extensively benchmarked.

4.1.5. Criteria #5 – Does the model have the capability to satisfy study objectives using probabilistic analysis?

RESRAD 6.0 can assess radiation dose per the CSM requirements using deterministic and/or probabilistic analysis. RESRAD 6.0 has the capability to choose a single conservative value for each input parameter for the model to support a deterministic analysis. RESRAD 6.0 also has the capability to choose a distribution of values for the most sensitive parameters for the model to support a probabilistic analysis. RESRAD 6.0 can perform sensitivity analyses so that the most sensitive parameters can be delineated. RESRAD 6.0 has the capability to produce an output set of radiation dose distributions over time for each radionuclide in each exposure scenario. Therefore, RESRAD 6.0 can produce the "Peak of the Mean Dose versus Time."

4.1.6. Criteria #6 – Is the model well documented?

RESRAD 6.0 is very well documented. The following reports have been published to support the use of RESRAD 6.0:

1. Probabilistic Modules for RESRAD and RESRAD-BUILD Computer Code, ANL/EAD/TM-91, Argonne National Laboratory, June 2000

2. Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0, Working Draft For Comment, ANL/EAD/LD-2, Argonne National Laboratory, September 1993
3. Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil, ANL/EAIS-8, Argonne National Laboratory, April 1993
4. Evaluation of the Area Factor Used in the RESRAD Code for the Estimation of Airborne Contaminant Concentrations of Finite Area Sources, ANL/EAD/TM-82, Argonne National Laboratory, July 1998
5. External Exposure Model Used in the RESRAD Code for Various Geometries of Contaminated Soil, ANL/EAD/TM-84, Argonne National Laboratory, September 1998

4.1.7. Criteria #7 – Is the model available in the public domain?

RESRAD 6.0 is available in the public domain. RESRAD 6.0 and its' documentation can be accessed through the Nuclear Regulatory Commission website at http://www.nrc.gov/RES/rescodes.htm. There is no charge associated with this software.

4.2. DandD 2.0

4.2.1. Criteria #1 - Does the model incorporate key processes from the Conceptual Site Model?

DandD 2.0 is a screening level computer code and therefore cannot assess all aspects of the CSM applicable at RFETS. DandD 2.0 can trace a contaminant from its origin in soils to an exposed individual through all applicable exposure pathways. DandD 2.0 can assess radionuclides in surface soils only and not subsurface soils. DandD 2.0 can assess the exposure pathways of ingestion of soil, inhalation of resuspended soils, external irradiation of soils, ingestion of homegrown fruits/vegetables/grains and ingestion of meat and milk. DandD 2.0 cannot assess the industrial office worker, recreational open space user, wildlife refuge worker, hypothetical future resident and hypothetical future resident rancher exposure scenarios. DandD 2.0 cannot assess an adult, child and infant within the appropriate exposure scenarios. DandD only assesses an adult in a residential setting.

4.2.2. Criteria #2 - Does the model satisfy study objectives?

DandD 2.0 can estimate the soil concentration that equates to an acceptable radiation dose for all applicable radionuclides over a study period of 1,000 years. DandD 2.0 can trace a radionuclide through the environment to each applicable exposure scenario for a 1,000 year period. The maximum radiation dose in this period can be calculated by DandD 2.0, and the RSAL associated with this maximum concentration can be delineated by DandD 2.0. DandD 2.0 can perform this calculation automatically.

4.2.3. Criteria #3 – Has the model been verified using published analytical equations in scientific and technical journals?

DandD 2.0 has not been verified in a manner that can be referenced.

4.2.4. Criteria #4 – Has the model been validated against known site conditions?

DandD 2.0 has not been validated or benchmarked.

4.2.5. Criteria #5 – Does the model have the capability to satisfy study objectives using probabilistic analysis?

DandD 2.0 cannot assess radiation dose per the CSM requirements per Criteria #1, but DandD 2.0 has the capability to incorporate deterministic and/or probabilistic analyses. DandD 2.0 though is meant to be a screening level computer model that has no inputs changed and gives a conservative cleanup level as output. DandD 2.0 has the capability to choose a single conservative value for each input parameter for the model to support a deterministic analysis. DandD 2.0 also has the capability to choose a distribution of values for the most sensitive parameters for the model to support a probabilistic analysis. The sensitivity analysis has already been performed for DandD 2.0, and distributions of values have been incorporated into the model for the most sensitive parameters. DandD 2.0 has the capability to produce an output set of radiation dose distributions over time for each radionuclide in each exposure scenario. Therefore, DandD 2.0 can produce the "Peak of the Mean Dose versus Time."

4.2.6. Criteria #6 – Is the model well documented?

DandD 2.0 is very well documented. The following reports have been published to support the use of DandD 2.0:

1. Residual Radioactive Contamination From Decommissioning: Technical Basis for Translating Contamination Levels to Annual Effective Dose Equivalent, Final, Volume 1, NUREG/CR-5512, US Nuclear Regulatory Commission, October 1992
2. Residual Radioactive Contamination From Decommissioning: User's Manual, Draft, Volume 2, NUREG/CR-5512, US Nuclear Regulatory Commission, May 1999
3. Residual Radioactive Contamination From Decommissioning: Parameter Analysis, Draft, Volume 3, NUREG/CR-5512, US Nuclear Regulatory Commission, April 1996

4.2.7. Criteria #7 – Is the model available in the public domain?

DandD 2.0 is available in the public domain. DandD 2.0 and its' documentation can be accessed through the Nuclear Regulatory Commission website at http://www.nrc.gov/RES/rescodes.htm. There is no charge associated with this software.

4.3. RESRAD 5.82 Modified by RAC (RAC-RESRAD)

4.3.1. Criteria #1 - Does the model incorporate key processes from the Conceptual Site Model?

RAC-RESRAD can assess all aspects of the CSM applicable at RFETS. RAC-RESRAD can trace a contaminant from its origin in soils to an exposed individual through all applicable exposure pathways. RAC-RESRAD can assess radionuclides in surface soils and subsurface soils. RAC-RESRAD can assess the exposure pathways of ingestion of soil, inhalation of resuspended soils, external irradiation of soils, ingestion of homegrown fruits/vegetables/grains and ingestion of meat and milk. RAC-RESRAD can assess the industrial office worker, recreational open space user, wildlife refuge worker, hypothetical future resident and hypothetical future resident rancher exposure scenarios. RAC-RESRAD can assess an adult, child and infant within the appropriate exposure scenarios.

4.3.2. Criteria #2 - Does the model satisfy study objectives?

RAC-RESRAD can estimate the soil concentration that equates to an acceptable radiation dose for all applicable radionuclides over a study period of 1,000 years. RAC-RESRAD can trace a radionuclide through the environment to each applicable exposure scenario for a 1,000 year period. The maximum radiation dose in this period can be calculated by RAC-RESRAD, but the RSAL associated with this maximum concentration cannot be delineated by RAC-RESRAD (See Criteria #5).

4.3.3. Criteria #3 – Has the model been verified using published analytical equations in scientific and technical journals?

RAC-RESRAD has not been verified as a set of computer codes. The RESRAD portion of RAC-RESRAD that has not been modified has been verified, but the RAC generated computer code has not been verified. The documentation listed in Criteria #3 for RESRAD 6.0 are applicable to this version of RESRAD. The RAC generated portion of RAC-RESRAD has not been verified in a manner that can be referenced.

4.3.4. Criteria #4 – Has the model been validated against known site conditions?

RAC-RESRAD has not been validated as a set of computer codes. The RESRAD portion of RAC-RESRAD that has not been modified has been validated, but the RAC generated computer code has not been validated. The documentation listed in Criteria #4 for RESRAD 6.0 are applicable to this version of RESRAD. The RAC generated portion of RAC-RESRAD has not been validated.

RAC-RESRAD has not been benchmarked as a set of computer codes. The RESRAD portion of RAC-RESRAD that has not been modified has been benchmarked though (See RESRAD 6.0, Criteria #4).

4.3.5. Criteria #5 – Does the model have the capability to satisfy study objectives using probabilistic analysis?

RAC-RESRAD can assess radiation dose per the CSM requirements using deterministic and/or probabilistic analysis. RAC-RESRAD has the capability to choose a single conservative value for each input parameter for the model to support a deterministic analysis. RAC-RESRAD also has the capability to choose a distribution of values for the most sensitive parameters for the model to support a probabilistic analysis. RAC-RESRAD can perform sensitivity analyses so that the most sensitive parameters can be delineated by using RESRAD 5.82 only. RAC-RESRAD does not have the capability to produce an output set of radiation dose distributions over time for each radionuclide in each exposure scenario. Therefore, RAC-RESRAD cannot produce the "Peak of the Mean Dose versus Time."

4.3.6. Criteria #6 – Is the model well documented?

RAC-RESRAD is not a well documented set of computer codes. The RESRAD portion of RAC-RESRAD that has not been modified is very well documented, but the RAC generated computer code is not well documented. The documentation listed in parts 2 through 5 of Criteria #6 for RESRAD 6.0 are applicable to this version of RESRAD. RAC-RESRAD is only documented through a 1.5 page README file that comes with the code. RAC-RESRAD is also documented through comments within the raw computer coding. This README file with the raw computer code comments is insufficient to run the RAC-RESRAD computer model.

4.3.7. Criteria #7 – Is the model available in the public domain?

RAC-RESRAD is available in the public domain. RAC-RESRAD and its' documentation can be obtained through the Rocky Flats Citizens Advisory Board. There is no charge associated with this software.

4.4. MEPAS/GENII/FRAMES/SUM3

4.4.1. Criteria #1 - Does the model incorporate key processes from the Conceptual Site Model?

MEPAS/GENII/FRAMES/SUM3 can assess all aspects of the CSM applicable at RFETS. MEPAS/GENII/FRAMES/SUM3 can trace a contaminant from its origin in soils to an exposed individual through all applicable exposure pathways. MEPAS/GENII/FRAMES/SUM3 can assess radionuclides in surface soils and subsurface soils. RAC-RESRAD can assess the exposure pathways of ingestion of soil, inhalation of resuspended soils, external irradiation of soils, ingestion of homegrown fruits/vegetables/grains and ingestion of meat and milk. MEPAS/GENII/FRAMES/SUM3 can assess the industrial office worker, recreational open space user, wildlife refuge worker, hypothetical future resident and hypothetical future resident rancher exposure scenarios. MEPAS/GENII/FRAMES/SUM3 can assess an adult, child and infant within the appropriate exposure scenarios.

4.4.2. Criteria #2 - Does the model satisfy study objectives?

MEPAS/GENII/FRAMES/SUM3 can estimate the soil concentration that equates to an acceptable radiation dose for all applicable radionuclides over a study period of 1,000 years. MEPAS/GENII/FRAMES/SUM3 can trace a radionuclide through the environment to each applicable exposure scenario for a 1,000 year period. The maximum radiation dose in this period can be calculated by MEPAS/GENII/FRAMES/SUM3, and the RSAL associated with this maximum concentration can be delineated by MEPAS/GENII/FRAMES/SUM3.

4.4.3. Criteria #3 – Has the model been verified using published analytical equations in scientific and technical journals?

The MEPAS/GENII/FRAMES/SUM3 computer code has been extensively verified. Verification of MEPAS/GENII/FRAMES/SUM3 has included the following:

1. Test Plan and Baseline Testing Results for the MEPAS 4.1 - Computed Source Term Release Module, Pacific Northwest National Laboratory, R. Taira, December 1999
2. Test Plan and Baseline Testing Results for the MEPAS 4.1 - Vadose Zone Transport Module, Pacific Northwest National Laboratory, J. McDonald, December 1999
3. Test Plan and Baseline Testing Results for the MEPAS 4.1 - Saturated Zone (Aquifer) Transport Module, Pacific Northwest National Laboratory, J. McDonald, December 1999

4. Test Plan and Baseline Testing Results for the MEPAS 4.1 - Surface Water (Non-Tidal River) Transport Module, Pacific Northwest National Laboratory, J. McDonald, December 1999
5. Test Plan and Baseline Testing Results for the MEPAS 4.1 - Atmospheric Transport Module, Pacific Northwest National Laboratory, J. McDonald & C. Fosmire, December 1999
6. Test Plan and Baseline Testing Results for the MEPAS 4.1 - Chronic Exposure Module, Pacific Northwest National Laboratory, R. Taira & S. Snyder, December 1999
7. Test Plan and Baseline Testing Results for the MEPAS 4.1 - Intake Module, Pacific Northwest National Laboratory, R. Taira, December 1999
8. Test Plan and Baseline Testing Results for the MEPAS 4.1 - Human Health Impact Module, Pacific Northwest National Laboratory, R. Taira, December 1999.
9. GENII "Conversion Testing, Verification, and Validation of Software" plan listing 42 tests performed as of 2/7/1989, Napier, 1990
10. Hand calculations performed to support acute models in GENII, Sawyer, L.H., T.A. Ikenberry, 1991
11. Hand Calculations performed on GENII to support NPR-EIS program, Nelson, I.C., L.H. Sawyer, T.A. Ikenberry. 1990.
12. GENII Hand Calculation Worksheets, version of February 2, 1994 , Peloquin, R.A., 1994.
13. Test Plan and Baseline Testing Results for the FRAMES User Interface, Pacific Northwest National Laboratory, R Tiara, December 1999
14. Test Plan and Baseline Testing Results for the FRAMES Viewers, Pacific Northwest National Laboratory, R Lundgren, December 1999
15. Test Plan and Baseline Testing Results for the FRAMES User Defined Source Module, Pacific Northwest National Laboratory, M. Eslinger, August 1999
16. Test Plan and Baseline Testing Results for the FRAMES User Defined Water Transport Module, Pacific Northwest National Laboratory, M. Eslinger, August 2000
17. Test Plan and Baseline Testing Results for the FRAMES User Defined Air Transport Module, Pacific Northwest National Laboratory, M. Eslinger, August 2000
18. Test Plan and Baseline Testing Results for the FRAMES User Defined Exposure Pathway Module, Pacific Northwest National Laboratory, M. Eslinger, August 2000
19. Test Plan and Baseline Testing Results for the Sensitivity/ Uncertainty Multimedia Modeling Module (SUM3). Pacific Northwest National Laboratory, R Taira, September 2000
20. An Approach to Ensuring Quality In Environmental Software, PNNL-11880, Pacific Northwest National Laboratory, G.M. Gelston, R. E. Lundgren, J.P. McDonald, B.L. Hoopes, May 1998

4.4.4. Criteria #4 – Has the model been validated against known site conditions?

The MEPAS & GENII computer codes have been extensively validated. Validation of MEPAS & GENII is documented in the following reports:

1. A Demonstration of the Applicability of Implementing the Enhanced Remedial Action Priority System (RAPS) for Environmental Releases, PNL-7102, Pacific Northwest National Laboratory, G. Whelan, J.G. Droppo, D.L. Strenge, M.B. Walter, J.W. Buck, December 1989
2. Summary Technical Review of the Multimedia Environmental Pollutant Assessment System (MEPAS), Prepared for the Office of Federal Facilities Enforcement US EPA, ICF Incorporated, November 1991
3. Validation of Models using Chernobyl Fallout Data from the Central Bohemia Region of the Czech Republic: Scenario CB (GENII Validation), IAEA-TECDOC-795, First Report of the VAMP Multiple Pathways Assessment Working Group, International Atomic Energy Agency, 1995
4. A Comparison of Environmental Radionuclide Concentrations Calculated by a Mathematical Model with Measured Concentrations (GENII Validation), PNL-SA-14720, In Proceedings of ANS Topical Conference on Population Exposure from the Nuclear Fuel Cycle. Oak Ridge, Tennessee. Jaquish, R. E., and B. A. Napier. 1987

MEPAS & GENII have been extensively benchmarked.

4.4.5. Criteria #5 – Does the model have the capability to satisfy study objectives using probabilistic analysis?

MEPAS/GENII/FRAMES/SUM3 can assess radiation dose per the CSM requirements using deterministic and/or probabilistic analysis. MEPAS/GENII/FRAMES/SUM3 has the capability to choose a single conservative value for each input parameter for the model to support a deterministic analysis. MEPAS/GENII/FRAMES/SUM3 also has the capability to choose a distribution of values for the most sensitive parameters for the model to support a probabilistic analysis. MEPAS/GENII/FRAMES/SUM3 can perform sensitivity analyses so that the most sensitive parameters can be delineated. MEPAS/GENII/FRAMES/SUM3 does have the capability to produce an output set of radiation dose distributions over time for each radionuclide in each exposure scenario. Therefore, MEPAS/GENII/FRAMES/SUM3 can produce the "Peak of the Mean Dose versus Time."

4.4.6. Criteria #6 – Is the model well documented?

MEPAS/GENII/FRAMES/SUM3 is very well documented. The following reports have been published to support the use of MEPAS/GENII/FRAMES/SUM3:

1. Multimedia Environmental Pollutant Assessment System (MEPAS) Guidance, Guidelines for Evaluating MEPAS Input Parameters for Version 3.1, Pacific Northwest Laboratory, June 1997
2. Multimedia Environmental Pollutant Assessment System (MEPAS) Formulations, Compilation of Mathematical Formulations for MEPAS Version 3.2, Pacific Northwest National Laboratory, February 1997
3. GENII Version 2 User's Guide, Pacific Northwest National Laboratory, January 1999
4. GENII Version 2 Software Design Document, Pacific Northwest National Laboratory, January 1999
5. Concepts of a Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES), Pacific Northwest National Laboratory, October 1997
6. GENII Version 2 Sensitivity/Uncertainty Multimedia Modeling Module User's Guidance, Draft, Pacific Northwest National Laboratory, December 1998
7. Sensitivity/Uncertainty Multimedia Modeling Module (SUM3) User's Guide, Pacific Northwest National Laboratory, http://mepas.pnl.gov:2080/earth/sum3/sum3ug/sum3ug.htm.

4.4.7. Criteria #7 – Is the model available in the public domain?

MEPAS/GENII/FRAMES/SUM3 is available in the public domain. MEPAS/GENII/FRAMES/SUM3 and its' documentation can be accessed through the Pacific Northwest National Laboratory website at http://mepas.pnl.gov:2080/earth/earth.htm. There is no charge associated with this software for Department of Energy contractors. There is a charge for these computer models and documentation to the general public.

5. Conclusions

Table 1, "Model Selection Criteria Assessment," outlines each of the four computer models with the model selection criteria. RESRAD 6.0 and MEPAS/GENII/FRAMES/SUM3 are the computer codes that meet all the selection criteria. Therefore RESRAD 6.0 and MEPAS/GENII/FRAMES/SUM3 may be used to calculate RSALs at RFETS.

Since RESRAD has been used at RFETS to derive RSALs and the Public reviewing the RSALs is intimately familiar with RESRAD, RESRAD 6.0 will be used to calculate RSALs at RFETS.

TABLE 1
MODEL SELECTION CRITERIA ASSESSMENT

Computer Model vs Selection Criteria	RESRAD 6.0	DandD 2.0	RESRAD 5.82 RAC Modified	FRAMES MEPAS GENII SUM3
Criteria #1	YES	NO	YES	YES
Criteria #2	YES	YES	NO	YES
Criteria #3	YES	NO	NO	YES
Criteria #4	YES	NO	NO	YES
Criteria #5	YES	NO	NO	YES
Criteria #6	YES	YES	NO	YES
Criteria #7	YES	YES	YES	YES

6. References

ASTM, Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, E1739-95e1, November, 1995

ASTM Technical & Professional Training, RBCA Fate and Transport Models: Compendium and Selection Guidance, 1999

DOE, Rocky Flats Environmental Technology Site, Human Health Risk Assessment Model Description, Operable Unit 3, Technical Memorandum No. 3, March 6, 1995

DOE, Rocky Flats Environmental Technology Site, Draft Description of Models for the Human Health Risk Assessment, Operable Unit 4, Technical Memorandum No. 5, March 1993

DOE, Rocky Flats Environmental Technology Site, Final Human Health Risk Assessment Model Description, Operable Unit 5, Technical Memorandum No. 13, November 17, 1994

EPA Fact Sheet: Documenting Ground-Water Modeling at Sites Contaminated with Radioactive Substances, EPA 540-F-96/002, January, 1996

EPA Fact Sheet: Computer Models Used to Support Cleanup Decision making at Hazardous and Radioactive Waste Sites, EPA/540/F-94-022, January, 1996

EPA Fact Sheet: Environmental Characteristics of EPA, NRC, and DOE Sites Contaminated with Radioactive Substances, EPA 540-F-94-023, January, 1996

EPA Fact Sheet: Environmental Pathway Models – Ground-Water Modeling in Support of Remedial Decision Making at Sites Contaminated With Radioactive Material, EPA/540/F-94-024, January, 1996

EPA Fact Sheet: A Technical Guide to Ground-Water Model Selection at Sites Contaminated with Radioactive Substances, EPA/540/F-94-025, January, 1996

Risk Assessment Corporation, Task 2: Computer Models, Final Report, July, 1999

RFCA Focus Group
November 8, 2000 Meeting

Actions for November 29, 2000 meeting

1. Reprint "Determining Cleanup Goals at Radiologically-contaminated Sites," Table 4, printing off page. (CDPHE / AlphaTRAC, Inc.)

2. RFCA Focus Group schedule reissue (Jeremy Karpatkin, DOE)

3. Post NRC guidance (1549, 4006) links on RFCA site; Note links in 11/29/00 meeting packet (Russell McCallister, DOE)

4. Status of Radiological Materials License (Richard DiSalvo, DOE)

5. Where possible, answer questions and issues for consideration as part of the RSAL Regulatory Analysis discussion presented by the RF CAB and RFCLOG and supplemented by the Focus Group stakeholders for the next packet (all agencies)

November 20, 2000

Dear Stakeholder:

The Rocky Flats Cleanup Agreement (RFCA) Stakeholder Focus Group will meet at the **Arvada Center for Arts and Humanities**, 6901 Wadsworth Blvd., on November 29, 2000 from 4:30 to 6:30 p.m. A technical discussion meeting will be held at the Center from 3:00 to 4:15 p.m. The agenda for the November 29 meeting is enclosed (Attachment A).

The meeting minutes from the November 8, 2000 RFCA Stakeholder Focus Group are enclosed (Attachment B). Also enclosed are the following background materials requested by the Focus Group at the November 8, 2000 meeting or identified by the RFCA Parties:

- Reprint "Determining Cleanup Goals at Radiologically-contaminated Sites," Table 4 (AlphaTRAC, Inc., Attachment C)
- RFCA Focus Group schedule reissue (Jeremy Karpatkin, DOE, Attachment D)
- Post NRC guidance (1549, 4006) links on RFCA site (Russell McCallister, DOE, Attachment E)
- Answers to questions from the RFCA Focus Group about the RSAL review processes (All agencies, Attachment F).

Also enclosed is the preliminary draft "Computer Model Selection To Support Development Of Radionuclide Soil Action Levels." (Attachment G)

You are encouraged to attend the technical discussion session for these materials that will occur at the Center from 3:00 to 4:15 p.m. on November 29, 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 29, 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.

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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S[redacted]

C. Reed Hodgin, CCM
Facilitator / Process Manager

Introduction

At the last Stakeholder Focus Group Meeting, the discussion focused on selection of remedial alternatives that would meet the RSALs and Surface Water Quality Standards balanced against the nine CERCLA criteria. DOE and Kaiser-Hill provided four example remedial alternatives with preliminary, qualitative evaluations against the nine CERCLA criteria to illustrate the alternative identification, relevant relationships and the selection process. Using the same process, the focus group agreed to provide separate qualitative evaluation against the CERCLA criteria for the four example alternatives and for any additional alternatives of interest. The focus group requested additional definition and information about the CERCLA criteria and potential components of remedial alternatives. More specific and quantitative information was requested regarding long-term and short-term risk.

Technical Summary

Template Criteria Discussion

Definitions of the nine CERCLA criteria were provided in the last meeting and are included on the template for completeness. Additional definition is provided below to supplement those definitions.

Protection of Human Health and the Environment: The definition provided in the handout provides little explanation of the various segments of human health that must be protected. Below the human health and environment segments for the 903 Pad are broken out separately to explain how the evaluation template was used.

Protection of Local Off-site Residents: Risk to off-site residents may be considered a long-term risk based on the residual contamination left at the site. This segment is primarily focused on exposure routes via wind and surface water. For example, if a remediation scenario cannot guarantee that the surface water standard will be met, the long-term the risk to an off-site resident would be inappropriate (i.e., result in a downward arrow). This risk should not be confused with the long-term risk to the actual land-user.

Protection of Future On-site Land User: This segment is focused on exposure to the future land user. Currently under RFCA the land use is specified as open space and

industrial use, with pending legislation to make the site a wildlife refuge. The primary exposure routes of exposure for the future land user are soil and surface water.

Protection of Site Workers: This segment consists of the workers who will actually perform the remediation at the site. Protection of the workers is of prime importance to DOE and Kaiser-Hill. An integrated safety management system will be implemented with health and safety plans for remediation projects to provide proven methods to protect the workers. However, all industrial activities carry inherent risks and zero risk can only be achieved with zero activity. Risk includes potential exposure to contaminants, but the primary risk is industrial accidents, such as accidents with heavy equipment. Therefore, it is imperative that appropriate risk reduction in other segments adequately offset these imposed risks.

Protection of Transportation Workers and Public Exposed to Transportation Risks: This segment consists of the drivers and public during transportation of waste generated during remediation. Mitigation and risk reduction of this segment is very challenging. While safety programs include proper training, procedures, inspections, and preventive maintenance, DOE and the contractors have no control of the actions of others on the road.

Protection of Disposal Site Workers: This segment consists of the workers who will unload the waste from the transport vehicles and place the waste in the disposal site. An integrated safety management system will be implemented to provide proven methods to protect the workers. However, all industrial activities carry inherent risks and zero risk can only be achieved with zero activity. The primary risk in this segment is industrial accidents.

Meet Surface Water Quality Standard On-site: On-Site Water Quality is closely linked to protection of the health of the future land user and the environment. It is also considered as part of meeting the ARARs since it will be a requirement under RFCA. If a given remediation scenario, such as remediate to Tier 1 only, cannot guarantee the water standard will be met, that scenario may not be deemed effective. Definition of where and how this standard will be measured on-site has not been resolved.

Meet Surface Water Quality Standard Off-site: Similar to the on-site water quality, off-site water quality must meet a standard that is deemed to be protection of the environment and the local off-site resident. It is also considered as a part of meeting the ARARs.

Protection of the Environment: This segment includes protection of other environmental resources such as the tall prairie grasses and habitat of wildlife. Generally, protection of the Prebles Meadow Jumping Mouse would be included. However, for this exercise we have included the Threatened and Endangered Species Act as part of the ARARs as a separate criteria.

Compliance with ARARs is defined in Attachment F.

The balancing criteria are defined in Attachment F. For this exercise, the cost was divided into (1) capital or remediation cost and (2) operation and maintenance or stewardship cost. Capital cost should be considered as the initial cost for implementation of the remedial alternative. Operation and maintenance cost is the long-term stewardship cost to operate and maintain the remedial alternative. This consists of any subsequent actions required including institutional controls.

The modifying criteria are defined in Attachment F.

Stewardship is not a CERCLA criteria, but has been added to this exercise at the request of the focus group. This criteria has reference to long-term stewardship actions that may or may not be required following implementation of a remedial alternative. It is assumed that less follow-up actions required for an alternative are better than more.

Alternative Development Discussion

The four example alternatives presented at the last stakeholder meeting were developed to consider soil excavation for protection of the land user with engineered barriers for protection of surface water. Examples of potential improvements to the alternatives were presented. The following provides additional detail on the potential improvements.

Variable Cleanup Levels Based on Erosion Potential: The example alternatives were presented as "bounding" alternatives and considered removal of source at Tier 1 as a "minimum" excavation case and 10 pCi/g as a "maximum" excavation case. The maximum case assumed removal of all contaminated soil at the 903 Pad above 10 pCi/g regardless of where it was located. This potential improvement would consider cleaning up to some base level, such as Tier 1, and then excavating to a much lower level on the erodable surfaces. In this way, surface water protection is enhanced, while

waste generation and the associated handling by the workers and the transportation industry is reduced from the maximum excavation case.

Stabilization Techniques: This concept is based on stabilizing residual plutonium contamination to prevent erosion into surface water. Examples of this may be surface grouting with various agents such as phosphate-based cements, enhanced vegetation, soil fixants, and physical erosion controls such as rip rap.

Precision Excavation Techniques: Generally, industry practices for minimum excavation depth using standard equipment and methods is six inches, due to equipment limitations. In most areas around the 903 Pad, the soil contamination is only in the top inch or two. Identification of innovative excavation methods to minimize the soil removal could significantly reduce waste volumes and the associated handling by the workers and the transportation industry. As a result both long-term risk to land users and short-term risk to workers and public during excavation, transport, and disposal could be substantially reduced.

Soil Screening for Waste Volume Reduction: Surface soil at Rocky Flats consists of sands and clays mixed with significant amount of rock. Plutonium contamination at the 903 Pad has been determined to be bound in the small soil particle fraction rather than the rocks. The small particle fraction is also most susceptible to erosion. Significant waste volume reduction can be achieved by simple screening of the soil to remove the larger rocks from the waste soils. This method could significantly reduce waste volumes and the associated handling by the workers and the transportation industry. As a result both long-term risk to land users and short-term risk to workers and public during excavation, transport, and disposal could be reduced.

Capping and Covering: Capping or covering of residual contamination could be used in conjunction with soil excavation to minimize the waste. Capping is similar to stabilization in that the contaminant residual is not removed, but placed in a more stable configuration to prevent migration off-site.

DRAFT RSAL Public Process Proposed Schedule

Tasks	First Draft Distributed	Focus Group Meeting	Second Draft	Focus Group Meeting	Draft to Principals
Review process		CAB Meeting: 10/5/00 Focus Group: 10/25/00			
Task One (Regulatory Analysis)	10/27/00	11/8/00 and 11/29/00	1/3/01	1/17/01	2/15/01
Task Two (Model Evaluation)	11/20/00	12/13/00	1/3/01	1/31/01	2/15/01
Task Three (Parameter Evaluation)	1/26/01	2/14/01 and 2/28/01	4/6/01	4/25/01	5/2/01
Task Four (New Science)	11/3/00	12/13/00	1/3/01	1/31/01	2/15/01
Task Five (Cleanup levels at other Sites)	10/25/00	11/8/00	12/1/00	1/3/01	1/17/01

Focus Group Meetings:

10/25/00:	**11/8/00:**	**11/29/00:**	**12/13/00:**	**1/3/01:**
➢ Review and discuss RSAL process	➢ Regulatory Analysis 1 ➢ Cleanup Levels 1	➢ Regulatory Analysis 2	➢ Model Evaluation 1 ➢ New Science 1	➢ Cleanup Levels 2
1/17/01:	**1/31/01:**	**2/14/01:**	**2/28/01:**	**4/11/01**
➢ Regulatory Analysis 3	➢ Model Eval. 2 ➢ New Science 2	➢ Parameter Evaluation 1	➢ Parameter Evaluation 2	➢ Outline of Report to Focus Group
4/25/01	**5/9/01**			
➢ Parameter Evaluation 3	➢ Draft Report to Focus Group			

Formal Public Comment Period for RSAL Report:

5/16/01	**7/16/01**	**8/15/01**
➢ Public Comment begins	➢ Public Comment Ends	➢ Final Report Released

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RFCA Stakeholder Focus Group
Attachment F

Title: Allowable Concentrations in Environmental Media Applicable to Nuclear Regulatory Commission (NRC) or NRC Agreement State Radioactive Material Licensees

Date: November 20, 2000

Author: Richard DiSalvo
U.S. Department of Energy
Rocky Flats Field Office

Phone: 303-966-4765

Email Address: richard.disalvo@rf.doe.gov

Background - The NRC, pursuant to the Atomic Energy Act (AEA), has limited exclusive jurisdiction to regulate the possession and use of classes of radioactive materials defined as source, special nuclear or byproduct materials. Relevant to Rocky Flats, plutonium and some isotopes of uranium and enriched uranium is special nuclear material, other uranium is source material, while americium is a byproduct material.

The NRC jurisdiction is "limited" because the AEA confers authority to DOE to regulate AEA radioactive materials at DOE facilities. The AEA further provides that a state may regulate byproduct and certain quantities of source and special nuclear radioactive materials over which the NRC has jurisdiction. To do this, the state must enter into an agreement with the NRC to implement state regulations that are compatible with and at least as stringent as NRC regulations. Colorado has entered into such an agreement, and thus is referred to as an NRC Agreement State. The Colorado Radiation Control Regulations for source, special nuclear and byproduct radioactive materials are in most instances identical to the NRC's regulations, but some requirements are additional to or more stringent than NRC regulations.

Except for very small "exempt" quantities or "exempt" low concentrations of some AEA regulated radioactive materials, the possession and use of these materials is restricted to persons who are licensed by the NRC or an Agreement State. Some uses of specific types of AEA regulated materials are "generally licensed" in the NRC or Agreement State regulations, allowing persons to possess and use these materials without applying and qualifying for the issuance of a "specific license". Persons authorized to use and materials pursuant to a general or specific radioactive materials license are referred to as "licensees". The locations at which these materials may be possessed and used are referred to as "licensed facilities". The requirements for the use and control of these licensed materials and the radiation emanating from radioactive materials are contained in the regulations and in the terms and conditions of the license itself.

The regulations are not legally applicable to Rocky Flats because it is not a "licensed facility" and DOE is not a "licensee". However, the Rocky Flats Cleanup Agreement parties agree that pursuant to the Comprehensive Environmental Response, Compensation and Liability Act, certain substantive requirements of Colorado's Radiation Control Regulations are potentially relevant and appropriate requirements (ARAR's) pertaining to the degree of cleanup of radioactive materials. Most notably, the Colorado Regulations dose based standards for decommissioning licensed facilities do

address abatement and control of hazards posed by residual radioactive materials typically regulated under the AEA.

The Rocky Flats Radionuclide Soil Action Level (RSAL) in the Context of Licensee Requirements - The consideration of dose based ARAR's derived from NRC and Agreement State regulations that are legally applicable to licensees has generated interest in whether these regulations contain concentration based standards for soils. This paper is based primarily on a review of Colorado's Radiation Control Regulations (6 CCR 1007-1 Part 1 (RH-1) through Part 20 (RH 20)), since these regulations served as the basis for the ARAR's review done by the RFCA parties. Note that these regulations are compatible with and may be more stringent than NRC's regulations. Also, this analysis is preliminary and not intended to be exhaustive. Review of additional regulatory materials, including the NRC regulations that cover topics that are not part of the Agreement State jurisdiction may result in identification of other concentration based standards applicable to NRC licensees.

In responding to this question, it is necessary to provide the underlying regulatory annual dose limits for the radiation control requirements applicable to licensees. These annual limits are:

- the occupational dose limits for adults – the more limiting of 5 rem total effective dose equivalent, or the committed dose equivalent of 50 rem to any organ other than the lens of the eye, which is limited to 15 rem or the skin or any extremity, which is limited to 50 rem (RH 4.6);
- dose limits for individual members of the public – 100 mrem total effective dose equivalent from any licensed operation (above background and excluding dose received from medical treatment, as well as any dose received from disposal of licensed material via sanitary sewer) and less than 2 mrem per hour from any external source of radiation (RH 4.14);
- notwithstanding RH 4.14, to implement ALARA, dose limit to individual member of the public from air emissions to the environment – 10 mrem (RH-4.5.4).

Also of interest are regulations that exempt "persons" who may possess certain concentrations or amounts of specific radioactive materials from all regulatory requirements. For example, a person may possess and use any amount of source material (i.e., uranium or thorium) if the concentration is below 0.05 weight % without being subject to regulation at all (RH 3.2). The regulations also contain listings and

tables of products, quantities and concentrations of certain radioactive materials - including americium (0.05 microcuries, such as for smoke detectors) but not including plutonium - which are exempt from regulation (RH 3.3, Part 3 Schedules A and B).

The Colorado regulations applicable to licensee activities at licensed facilities do not contain specific radioactive material concentration limits for soils, except for plutonium. Soils containing more than 2.0 disintigrations per minute (approximately 0.9 picocuries) of plutonium per gram of soil or per square centimeter of surface area require the use of special techniques of construction upon land so contaminated (RH 4.60.1). This "plutonium construction standard" regulation provides that CDPHE will evaluate proposed control techniques upon request.

The Colorado regulations do contain radioactive material concentration limits for "effluent concentrations", i.e., releases to the environment, of licensed radioactive material to air and water. These concentration values are equivalent to radioactive material concentrations, which if inhaled or ingested continuously over the course of a year in a non-occupational scenario would produce a total effective dose equivalent of 50 mrem. These values are based upon not exceeding the annual dose limits for members of the public discussed above, including a reduction factor to account for exposures to pre-adult age groups. (Part 4, Appendix B, Table II, columns 1 and 2.)

For Am - 241 and Pu-239 and 240 the effluent concentration limits are the same:

- Water (i.e., ingestion): 2 E-8 microcuries per ml. (= 20 picocuries per liter);
- Air (i.e., inhalation): 2 E-14 microcuries per ml. (= 0.02 picocuries per cubic meter.)

These concentrations have been calculated using the inhalation and ingestion limits for occupational exposure, which are based on the "Annual Limit of Intake" (ALI) for each radionuclide. Inhalation or ingestion of the ALI would be expected to result in the <u>occupational</u> committed dose equivalent limits described above. Thus, the environmental effluent concentrations are based upon the lower dose limits for the public and longer time of exposure (i.e., continuously present versus only present during work).

Peer Review Activities and Schedule

Peer Review Activity 1: Review of Task 1 Report: Regulatory Analysis

January 3: 2nd draft of report transmitted to Peer Reviewers

January 29: Written comments due back from Peer Reviewers

January 31: Focus Group discusses peer review comments

February 22: Deadline for DOE and Regulators to complete written response to comments

February 28: Focus Group discusses DOE and Regulator response to comments

March 15: Task 1 Report transmitted to RFCA Principals

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Peer Review Activity 2: Review of Task 2 Report: Computer Models

January 3: 2nd draft of report transmitted to Peer Reviewers

January 29: Written comments due back from Peer Reviewers

January 31: Focus Group discusses peer review comments

February 22: Deadline for DOE and Regulators to complete written response to comments

February 28: Focus Group discusses DOE and Regulator response to comments

March 15: Task 2 Report transmitted to RFCA Principals

Peer Review Activity 3: Review of Task 3 Report: Parameter Evaluation

January 26: Earliest date 1st draft of report could be transmitted to Peer Reviewers (Note: the date may slip depending on time it takes Focus Group to identify issues or topics of concern.)

March 12: Written comments due from Peer Reviews

March 14: Focus Group discussion of peer review comments

April 6: Due date for written response from DOE and regulators concerning peer review comments. Due date for delivery of 2nd draft of Task 3 report and transmittal to Peer Reviewers.

April 23: Written comments due from Peer Reviewers

April 25: Focus Group discussion of peer review comments

May 3: Deadline for written response to peer review comments from DOE and the Regulators

May 9: Focus Group discussion of DOE and Regulator response

Peer Review Activity 4: Review of Draft RSAL Document

May 23: Initial Draft of Report discussed with Focus Group. Initial draft of report transmitted to Peer Reviewers along with issues or areas of focus identified by the Focus Group.

June 7: Public comment draft of report released and transmitted to Peer Reviewers.

July 7: Written comments due from Peer Reviewers

July ??: Focus Group discusses peer review comments

Revised Draft Scope of Work and Remuneration Schedule for RSAL Peer Review

Prepared by Ken Korkia, Board / Staff Coordinator, Rocky Flats Citizens Advisory Board
November 29, 2000

Review Activity 1: Task 1 Report on Regulatory Analysis

- *Number of Reviewers Proposed:* 2/3

- *Scope of Work:*

  The reviewers will be asked to review the second draft of the report scheduled for delivery on January 3. The reviewers will be asked to provide written comments no later than January 29, so that they can be discussed at the January 31 Focus Group meeting.

  Timeframe for Review:
  - Document sent out to Peer Reviewers on January 3
  - Comments due from reviewers on January 29
    - 17 business days for review, allowing 1 day for receipt of document and 1 day for transmittal of comments
  - DOE and regulators respond in writing to comments in time for inclusion in meeting packet by February 22.
  - Focus Group meeting discussion of DOE and regulator response on February 28.

- *Remuneration:* For their work under either scenario, the reviewers will receive an honorarium of $500

- *Total Estimated Expenditure:* $1,500 (assuming three reviewers at $500 each)

Review Activity 2: Task 2 Report on Computer Model Evaluation

- *Number of Reviewers Proposed:* 2/ 3

- *Scope of Work:*

  The Focus Group may determine the necessity for reviewers to provide comments on the draft document as a whole or in part, based on the need for particular expertise. The reviewers would start their review of the second draft scheduled for delivery on January 3. Written comments would be due no later than January 29, so that they can be considered during the January 31 Focus Group meeting.

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Timeframe for Review:

- Document sent out on January 3
- Comments due on January 29
  - 17 business days for review, allowing 1 day for receipt of document and 1 day for transmittal of comments
- DOE and regulators respond to comments in time for inclusion in meeting packet by February 22.
- Focus Group meeting discussion of DOE and regulator response on February 28.

- *Remuneration:* An appropriate honorarium would be $500 for work completed in this activity.

- *Total Estimated Expenditure:* $1,500 (assumes three reviewers at $500 each)

Review Activity 3: Task 3 Report on Parameter Evaluation

- *Number of Reviewers Proposed:* 3

- *Scope of Work:*

Reviewers will be selected based on their abilities to provide input on key decisions or questions contained within the parameters selected. Generally, reviewers will be asked to review the entire draft document, focusing on their particular area of expertise and considering specific questions the Focus Group may ask them to focus on in their review. As background for their review, the reviewers will be supplied current versions of the Task 4 (New Science, available on February 15) and Task 5 (Cleanup levels at Other Sites, available on January 17) reports as background reading. They will not be asked to provide specific comments on these two reports.

The reviewers should be selected by early-to-mid January so that they are in place to receive the first draft of the document on January 26. Determining which reviewers to select may necessitate the Focus Group to identify before the Task 3 report comes out particular areas of expertise they might need on the review team. (Note: The Focus Group may wish to review the report first to identify areas contained within for which they would like particular reviewers to focus. Such a strategy may delay the date for when the reviewers receive the report). The reviewers will be asked to review the document, focusing on their particular area of expertise, and provide written comments to the Focus Group by March 12. The Focus Group will discuss the comments during their meeting on March 14. The reviewers will then receive the second draft of the document on April 6 and will be asked to provide written comments, again focusing on their area of expertise. They will be asked to judge DOE's and the regulators' response to their first set of comments, and to respond to any particular questions the Focus Group might ask. The due date for comments will be April 23.

Timeframe for Review:

- Review of 1st Draft
  - Document sent out on January 26 (Note: The Focus Group may wish to review the document first to determine questions or areas of focus for the reviewers. This may delay the transmittal date of the document.)
  - Comments due from reviewers on March 12
    - 32 business days for review, allowing 1 day for delivery of document and 1 day for transmittal of comments. The number of days for review will be reduced if the transmittal date to the reviewers extends past January 26.

- Review of 2nd Draft:
  - Document sent out on April 6
  - Comments due from reviewers on April 23
    - 10 business days, again allowing in each case 1 day for delivery of document and 1 day for transmittal of comments.

- *Remuneration:* Each reviewer will receive an honorarium of $1,000 for his or her work on this activity.

- *Total Estimated Expenditure:* $3,000 (assuming three reviewers at $1,000 each)

Review Activity 4: Draft RSAL Document Review

- *Estimated Number of Reviewers:* Selected reviewers who performed the above tasks will be asked to review the final draft document; estimate is five reviewers.

- *Scope of Work:*

  Reviewers will receive the initial draft document after it is released on May 23 and will be asked to start their review. The Focus Group will meet on that date and may note areas for particular attention by the reviewers. The "official" public comment draft of the document will be released on June 7. Following the delivery of the "official" public comment draft, the reviewers will be asked to provide written comments thirty days after delivery of the document.

  - Review of Official Public Comment Draft:
    - Initial draft document sent out to Peer Reviewers on May 23 along with notations for particular emphasis by the Focus Group
    - Official public comment draft of document forwarded to the Peer Reviewers on June 7
    - Written comments due from reviewers thirty calendar days afterward on July 7

- *Remuneration:* Each reviewer will receive $1,000 for work in this task.

- *Total Estimated Expenditure:* $5,000 (assumes five reviewers at $1,000 each)

Total Estimated Expenditure for All Activities:

Activity 1: Regulatory Analysis	$1,500
Activity 2: Model Evaluation	$1,500
Activity 3: Parameter Evaluation	$3,000
Activity 4: Draft RSAL Report	$5,000
Total	**$11,000**

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