



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

April 16, 2014

MEMORANDUM TO: ACRS Members

FROM: Derek A. Widmayer, Senior Staff Scientist **/RA/**  
Technical Support Branch, ACRS

SUBJECT: CERTIFIED MINUTES FOR THE ACRS RADIATION PROTECTION AND  
NUCLEAR MATERIAL SUBCOMMITTEE MEETING, NOVEMBER 19,  
2013 – ROCKVILLE, MARYLAND

The minutes of the subject meeting have been certified on December 12, 2013, as the official record of the proceedings for that meeting. Copies of the certification letter and minutes are attached.

Attachment: As stated

cc w/o Attachment: E. Hackett  
C. Santos



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

MEMORANDUM TO: Derek A. Widmayer, Senior Staff Scientist  
Technical Support Branch, ACRS

FROM: Dr. Michael T. Ryan, Chairman  
Radiation Protection and Nuclear Materials Subcommittee

SUBJECT: CERTIFICATION OF THE MINUTES FOR THE MEETING OF  
THE RADIATION PROTECTION AND NUCLEAR MATERIALS  
SUBCOMMITTEE, NOVEMBER 19, 2013 – ROCKVILLE,  
MARYLAND

I hereby certify, to the best of my knowledge and belief, that the minutes of the  
subject meeting on November 19, 2013, are an accurate record of the proceedings of  
that meeting.

/ RA / 12/12/2013  
\_\_\_\_\_  
Michael T. Ryan, Chairman Date  
Radiation Protection and Nuclear  
Materials Subcommittee

**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
RADIATION PROTECTION AND NUCLEAR MATERIALS  
SUBCOMMITTEE MEETING MINUTES  
November 19, 2013  
Rockville, MD**

The Advisory Committee on Reactor Safeguards (ACRS) Subcommittee on Radiation Protection and Nuclear Materials (RPNM) met on November 19, 2013, at 11545 Rockville Pike, Rockville, MD, in Room T2-B1. The meeting was convened at 1:00 pm and adjourned at 5:20 pm.

The entire meeting was open to the public. Mr. Derek A. Widmayer was the cognizant ACRS staff scientist and the Designated Federal Official for this meeting. No requests for time to make an oral statement or written comments were received from the public concerning this meeting.

**ATTENDEES**

**ACRS**

M. Ryan, Chairman  
H. Ray, Member  
C. Brown, Member  
S. Schultz, Member  
J. Rempe, Member  
P. Riccardella, Member  
D. Widmayer, ACRS Staff

D. Skillman, Member  
S. Armijo, Member  
S. Banerjee, Member  
R. Ballinger, Member  
J. Stetkar, Member

**NRC Staff**

R. Tadesse, COM/WDM  
A. Carrera, FSME/DLIR  
A. Schwartzman, FSME/DWMEP  
A.C. Ridge, FSME/DWMEP  
C. Grossman, FSME/DWMEP  
D. Lowman, FSME/DWMEP  
G. Comfort, FSME/DLIR  
M. George, FSME/DWMEP  
J. Smith, NMSS/FCSS/UEB

P. Castleman, COM/KLS  
A. Mohseni, FSME/DWMEP  
C. Barr, FSME/DWMEP  
J. Kennedy, FSME/DWMEP  
D. Esh, FSME/DWMEP  
J. Shaffner, FSME/DWMEP  
G. Suber, FSME/DWMEP  
J. Maltese, OGC

**US Department of Energy Staff**

C. Gelles, DOE/EM  
R. Boehlecke, DOE/NV.  
E. Regneir, DOE/HSS  
K. Martin, DOE/OGC

A. Wallo, DOE/HSS  
S. Ross, DOE/SR  
R. Seitz, SRNL  
C. Corredor, DOE/HSS

**Others**

J. Schlueter, NEI  
K. Fletcher, Exchange Monitor  
J. Tauxe, Neptune and Associates

W. Goldston, EFCOG/EnergySolutions  
R. Thomas  
M. Lewis

## **SUMMARY**

The purpose of this Subcommittee meeting was to hear presentations from and discuss the US Department of Energy (DOE) low-level waste disposal requirements and technical bases for conducting performance assessments (PAs) as they relate to the technical basis for revisions to 10 CFR Part 61, *Licensing Requirements for Land Disposal of Radioactive Waste* published in December 2012. The RPNM Subcommittee will also hold a meeting on the technical basis for Part 61 revisions on December 3, 2013 with presenters from Agreement States, operators of low-level waste (LLW) disposal facilities, LLW generators, and other stakeholders. The Subcommittee planned to gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, from this Subcommittee meeting in conjunction with the December 3, 2013, Subcommittee meeting for deliberation by the Full Committee at its February 2014 meeting.

<b><i>SIGNIFICANT ISSUES</i></b>	<b><i>Reference Transcript Pages</i></b>
Dr. Michael Ryan, Chairman of the Subcommittee, introduced the meeting and its purpose and the first speaker from the DOE.	4 – 7
Ms. Christine Gelles, Deputy Assistant Secretary for Disposal at the US DOE Office of Environmental Management began the presentations with an introduction of the DOE speakers for the day, and introductory remarks about the topics the speakers would be covering.	7 – 13 (Slides Pgs 210 – 216)
Mr. Roger Seitz of the Savannah River National Laboratory provided an overview of the systems approach used by the DOE in assessing performance of their LLW disposal facilities and introduced some of the basic requirements in the DOE rules and guidance on performing PAs and Composite Analysis (CAs) at DOE sites.	13 – 74 (Slides Pgs 217 – 234)
<p>The members addressed the following issues during this presentation:</p> <ul style="list-style-type: none"> <li>• That hazardous waste is regulated under RCRA and radioactive waste is regulated under the AEA, but the time that some hazardous waste and radioactive waste, like U, is dangerous is basically forever. (Ryan/Armijo)</li> <li>• Whether DOE's approach to time of compliance is different than NRC's by the use of the term, "reasonable expectation." (Armijo)</li> <li>• Clarifying that DOE's "maintenance" of PAs does not mean the mathematical models are run every year, and what is included in the required Annual Report. Addressing new waste streams, for example from</li> </ul>	<p>19</p> <p>20 – 22</p> <p>23 – 27</p>



<p>decommissioning a facility, is what is often addressed when the models are needed to be run. (Rempe/Ryan)</p> <ul style="list-style-type: none"> <li>• Whether other countries also followed the recommendations of IAEA. (Schultz)</li> <li>• Using the long-term analysis for restricting inventories if a problem is perceived. (Ryan)</li> <li>• The “safety benefit” of a 10,000-year performance calculation, when DOE’s long experience with disposal is probably adequate in determining how to properly dispose of waste. (Armijo)</li> <li>• The importance of the terms “compliance” and “reasonable” when used together and what meaning should be attached to calculations out to thousands of years. (Ray/Schultz)</li> <li>• Clarifying the meaning of “institutional controls” to the DOE in assuming they are no longer effective in the performance modeling. (Armijo)</li> <li>• The volume of LLW disposed by DOE compared to other waste streams, particularly U mill tailings, and compared to the Barnwell, SC disposal facility. (Banerjee/Ryan)</li> <li>• The meaning of “defense-in-depth” and how conservative assumptions in the modeling help you identify the proper measures to employ. (Schultz)</li> </ul>	<p>31</p> <p>34</p> <p>35 – 37</p> <p>41</p> <p>48 – 50</p> <p>52 – 54</p> <p>61 – 63</p>
<p>Mr. Andy Wallo of DOE’s Office of Health, Safety and Security continued the presentation on DOE’s systems approach used by the DOE in assessing performance of their LLW disposal facilities, including the history and justification for some of the requirements in the DOE rules and guidance on performing PAs and CAs at DOE sites, including the time of compliance.</p> <p>The members addressed the following issues during this presentation:</p> <ul style="list-style-type: none"> <li>• The length of time for which DOE authorizes operations of a LLW disposal facility. (Banerjee/Ryan)</li> <li>• Clarifying the radon dose flux rates in the DOE Order 435.1 and where the receptor is for modeling. (Brown/Ryan)</li> <li>• Clarifying the configuration of the 100-meter buffer zone (Skillman)</li> </ul>	<p>74 – 119 (Slides Pgs 235 – 262)</p> <p>82 – 84</p> <p>86 – 91</p> <p>91</p>

<ul style="list-style-type: none"> <li>• The perspective DOE has that it, or a successor government agency, will care for the site in perpetuity, similar to RCRA hazardous waste disposal sites. (Ryan)</li> <li>• From DOE's perspective, what was wrong with 500 years for time of compliance, excluding long-lived waste. (Armijo)</li> <li>• That the value of the compliance metric (25mrem/yr) also has increasing uncertainty as time goes on, and therefore, there is a limit to its meaning that is commensurate with uncertainty with other parameters. (Armijo/Ryan/Schultz)</li> </ul>	<p>93 – 95</p> <p>101</p> <p>105 – 109</p>
<p>Mr. Seitz continued the presentation on the history and justification for some of the requirements in the DOE rules and guidance on performing PAs and CAs at DOE sites, including the intruder assessment and how it is used.</p> <p>The members addressed the following issues during this presentation:</p> <ul style="list-style-type: none"> <li>• When does an inadvertent intruder become an “advertent” intruder (e.g., anthropologist or graverobber) and why the speculation and uncertainty contributes to the DOE belief there should not be a dose constraint for which compliance is measured for the intruder. (Ryan/Armijo/Brown)</li> <li>• Why hazardous waste disposal uses a design standard as opposed to a performance standard, and that it is a completely different waste management strategy, and why there is a design standard for U mill tailings, rather than a performance standard. (Ryan/Banerjee)</li> </ul>	<p>119 – 135 (Slides Pgs 263 – 271)</p> <p>119 – 124</p> <p>127 – 133</p>
<p>Mr. Robert Boehlecke of DOE's Nevada Field Office presented introductory material on the DOE's Nevada National Security Site (NNSS) low-level waste disposal facility and how they perform and maintain their PA and CA, including how it establishes the Waste Acceptance Criteria (WAC).</p> <p>The members addressed the following issues during this presentation:</p> <ul style="list-style-type: none"> <li>• The types of things that were addressed in revisions to the WAC (current version is Revision 10). (Schultz)</li> <li>• What regulatory authority the State of Nevada has over the NNSS. (Ryan)</li> </ul>	<p>135 – 161 (Slides Pgs 290 – 311)</p> <p>141</p> <p>143</p>

<ul style="list-style-type: none"> <li>The applicability of the experience at NNSS and DOE responsibilities with siting and regulating a commercial LLW disposal facility under Part 61. (Ray)</li> </ul>	159 – 160
<p>Ms. Sherri Ross of DOE's Savannah River Field Office presented introductory material on the DOE's Savannah River Saltstone and LLW disposal facilities and how they perform and maintain their PA and CA.</p> <p>The members addressed the following issues during this presentation:</p> <ul style="list-style-type: none"> <li>Clarification of the meaning of graph lines on Slide No. 11 (Slide Pg 282) (Rempe)</li> </ul>	<p>161 – 186 (Slides Pgs 272 – 289)</p> <p>172 – 175</p>
<p>The Subcommittee discussed the presentations and provided the following insights from the meeting:</p> <ul style="list-style-type: none"> <li>Member Ray reiterated his concern about the applicability of the DOE experience with siting and regulating a commercial LLW disposal facility and also commented on the uncertainty associated with calculations way out in time.</li> <li>Member Skillman provided a perspective on why 1000 years is easier to understand than 10,000 years through the example of the Magna Carta.</li> <li>Member Rempe asked a question about why calculations are taken out to 10,000 years and the value of the results and their use.</li> <li>Member Armijo commented that the expense of the analysis might not be the best use of resources. Member Ray responded by saying it was not so much the cost that concerned him, but the needless introduction of controversy.</li> <li>In response to a question from Member Ballenger, Ms. Ross answered that the public around the Savannah River Site is more concerned about current risk reduction (i.e., tanks which could leak in the short term) than future risk as demonstrated by modeling.</li> </ul>	186 – 198

<p>The following members of the public who were attending the meeting via teleconference provided questions and comments:</p> <p>John Tauxe Ruth Thomas Marvin Lewis</p>	198 – 208
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<b>ACTION ITEMS</b>	<b>Reference Transcript Pages</b>
<p>The DOE representatives were asked to provide details on the public comment period for the upcoming revision to Order 435.1.</p> <p><i>Response: The current plan (although subject to change) for the public review of DOE Order 435.1 revision is 60 days, with two public meetings to be conducted by webinar. The start of this comment period is still TBD.</i></p>	116
<p>The DOE representatives were asked to provide the waste form and/or packaging details for the thorium nitrate waste for which a special analysis was conducted for disposal at the NNSS.</p> <p><i>Response: To be delivered by DOE in early 2014.</i></p>	155

## **ATTACHMENT**

Official Transcript of Proceedings, Meeting of ACRS Radiation Protection and Nuclear Materials Subcommittee, November 19, 2013, Rockville, MD.

### **Documents Provided to the Subcommittee:**

1. DOE M 435.1-1, *Radioactive Waste Management Manual*, U.S. Department of Energy, July 1999
2. DOE G 435.1-1, *Implementation Guide for use with DOE M 435.1-1, U.S. Department of Energy, Chapter IV, Low-Level Waste Requirements*, July 1999

3. *Performance Assessment For The Saltstone Disposal Facility at The Savannah River Site*, SRR-CWDA-2009-00017, Revision 0, Prepared by SRR Closure & Waste Disposal Authority, Prepared for U.S. Department of Energy Under Contract No. DE-AC09-09SR22505, July 2009
4. *Composite Analysis for the Area 5 Radioactive Waste Management Site at the Nevada Test Site, Nye County, Nevada*, DOE/NV--594-ADD1, Prepared by Bechtel Nevada, Prepared for U.S. Department of Energy, National Nuclear Security Administration Under Contract Number DE-AC08-96NV11718, November 2001
5. *Compliance Evaluation for the Savannah River Site Saltstone Disposal Facility Performance Assessment*
6. Memorandum, Frei, DOE/EM-43, to Carlson, Nevada Operations Office, *Disposal Authorization for the Nevada Test Site Area 5 Radioactive Waste Management Site Submittal of Performance Assessment and Composite Analysis Addenda*, May 23, 2002
7. *Nevada National Security Site Waste Acceptance Criteria*, DOE/NV-325, Revision 9, Prepared by U.S. Department of Energy, National Nuclear Security Administration, Nevada Site Office, Waste Management Project, February 2012
8. *Integrated Closure And Monitoring Plan for the Area 3 and Area 5 Radioactive Waste Management Sites at the Nevada Test Site*, DOE/NV/11718—449, Revision 1, Prepared for National Nuclear Security Administration, Nevada Operations Office, under Contract Number DE-AC08-96NV11718, September 2001
9. *Nevada National Security Site 2010 Waste Management Monitoring Report Area 3 and Area 5 Radioactive Waste Management Sites*, DOE/NV/25946—1226, Prepared by National Security Technologies, LLC, Prepared for U.S. Department of Energy National Nuclear Security Administration Nevada Site Office, June 2011
10. *Maintenance Plan for Performance Assessments and Composite Analyses of the Area 3 and Area 5 Radioactive Waste Management Sites at the Nevada Test Site*, DOE/NV/25946—091, Prepared by National Security Technologies, LLC, Prepared for U.S. Department of Energy National Nuclear Security Administration Nevada Site Office under Contract Number DE-AC52-06NA25946, January 2007

11. *2011 Annual Summary Report for the Area 3 and Area 5 Radioactive Waste Management Sites at the Nevada National Security Site, Nye County, Nevada, Review of the Performance Assessments and Composite Analyses*, DOE/NV/25946—1451, Prepared by National Security Technologies, LLC, Prepared for U.S. Department of Energy National Nuclear Security Administration Nevada Site Office under Contract Number DE-AC52-06NA25946, March 2102
12. *Special Analysis of the Area 3 Radioactive Waste Management Site at the Nevada National Security Site, Nye County, Nevada*, DOE/NV/25946—1617, Prepared by National Security Technologies, LLC, Prepared for U.S. Department of Energy National Nuclear Security Administration Nevada Site Office under Contract Number DE-AC52-06NA25946, September 2102
13. Result Summary for the Area 5 Radioactive Waste Management Site Performance Assessment Model Version 4.113
14. U.S. Department of Energy, Office of Environmental Management, Comments on the U.S. Nuclear Regulatory Commission's Preliminary Proposed Rule Language and Regulatory Analysis for Proposed Revisions to the Low-Level Waste Disposal Requirements, 10 CFR Part 61, November 29, 2012

# **Official Transcript of Proceedings**

## **NUCLEAR REGULATORY COMMISSION**

Title:                   Advisory Committee on Reactor Safeguards  
                              Radiation Protection and Nuclear Materials

Docket Number:   (n/a)

Location:               Rockville, Maryland

Date:                  Tuesday, November 19, 2013

Work Order No.:       NRC-428

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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

3 + + + + +

4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

6 + + + + +

7 RADIATION PROTECTION AND NUCLEAR MATERIALS

8 SUBCOMMITTEE

9 + + + + +

10 TUESDAY

11 NOVEMBER 19, 2013

12 + + + + +

13 ROCKVILLE, MARYLAND

14 + + + + +

15 The Subcommittee met at the Nuclear  
16 Regulatory Commission, Two White Flint North, Room T2B1,  
17 11545 Rockville Pike, at 1:00 p.m., Michael T. Ryan,  
18 Chairman, presiding.

19 COMMITTEE MEMBERS:

20 MICHAEL T. RYAN, Subcommittee Chairman

21 J. SAM ARMIJO, Member

22 RONALD G. BALLINGER, Member

23 SANJOY BANERJEE, Member

24 CHARLES H. BROWN, JR. Member

25 HAROLD B. RAY, Member

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JOY REMPE, Member

PETER C. RICCARDELLA, Member

STEPHEN P. SCHULTZ, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

DESIGNATED FEDERAL OFFICIAL:

DEREK WIDMAYER

ALSO PRESENT:

EDWIN M. HACKETT, Executive Director, ACRS

ROBERT BOEHLECKE, DOE-NV

RUTH CHALMERS\*

CHRISTINE GELLES, DOE, Office of Environmental  
Management

MARVIN LEWIS

SHERRI ROSS, DOE-SR\*

ROGER SEITZ, Savannah River National  
Laboratory

JOHN TOTES, Neptune & Company\*

ANDREW WALLO III, DOE, Office of Health,  
Safety and Security

\*Present via telephone

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P-R-O-C-E-E-D-I-N-G-S

(1:02 p.m.)

→ CHAIRMAN RYAN: All right, we'll begin the meeting please. The meeting come to order. This is a meeting of the Advisory Committee on Reactor Safeguard Subcommittee on Radiation Protection and Nuclear Materials. I'm Mike Ryan, Chairman of the Subcommittee.

ACRS members in attendance are Sam Armijo, Dick Skillman, Steve Schultz, Charlie Brown, Joy Rempe, Harold Ray, Sanjoy Banerjee, Pete Riccardella and who did I miss? Oh, I'm sorry. I missed Ron Ballinger.

FEMALE PARTICIPANT: And Roland.

MALE PARTICIPANT: John Stetkar.

CHAIRMAN RYAN: John Stetkar. I have an incomplete list on my paper.

MEMBER STETKAR: Well it's complete, you have to read between the parentheses.

CHAIRMAN RYAN: Yes, it was here, thank you. The purpose of this meeting is to hear presentations from and hold discussions with representatives of the U.S. Department of Energy on their regulatory approach for near-surface disposal of low-level radioactive waste.

Subcommittee members will recall that in

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1 the Committee's last letter to the Commission on the  
2 proposed revision of 10 CFR 61, in July of 2013, the  
3 ACRS said it would conduct additional meetings on the  
4 subject to better understand the technical basis for  
5 some of the revisions being proposed by the staff.

6 This is our first of two subcommittee  
7 meetings planned to collect information toward that end.

8 The Subcommittee will gather information, analyze  
9 relevant issues, facts and formulate proposed positions  
10 and actions as appropriate. The Subcommittee meets  
11 again on December 3rd with other stakeholders on  
12 revision to Part 61.

13 Then the Subcommittee plans on composing  
14 a letter report on this matter for consideration by the  
15 full committee at the February 2014 full committee  
16 meeting.

17 Today's meeting is open to the public. We  
18 have not received any requests from members of the public  
19 to provide comments. However, I understand that there  
20 are folks on the bridgeline, or who will be on the  
21 bridgeline, who will be listening in on today's  
22 proceedings. An opportunity will be provided at the  
23 end of the proceedings for anyone listening to make a  
24 comment.

25 A transcript of the meeting is being kept.

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1 It is requested that speakers first identify themselves  
2 and speak with sufficient clarity and volume so that  
3 they can readily be heard.

4 Derek Widmayer is the designated federal  
5 official for this meeting.

6 I understand that one of our presenters  
7 today, Sherri Ross from the Department of Energy's  
8 Savannah River Field Office, is providing her discussion  
9 via the telephone meeting. Sherri, are you there? Can  
10 you hear us?

11 MS. ROSS: Yes, I'm here and I can hear you  
12 all.

13 CHAIRMAN RYAN: Okay. Great, if you would  
14 just kind of keep your phone on mute that would work  
15 for us. And when it's your turn we'll give you a holler  
16 and we'll go from there, okay?

17 MS. ROSS: Okay. Thank you.

18 CHAIRMAN RYAN: Oh, thank you. We will now  
19 proceed with the meeting and I call upon Christine  
20 Gelles, Associate Deputy Assistant Secretary for Waste  
21 Management in DOE's Office of Environmental Management  
22 to open the proceedings. Let me welcome you and all  
23 of your colleagues here, and our other participants,  
24 for giving up your time and your information to us.  
25 It's very important we hear from you and thanks so much

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1 for being here.

2 → MS. GELLES: Well thank you very much,  
3 we're pleased to be here. Thank you, Dr. Ryan. Thank  
4 you also to all the other members of the Advisory  
5 Committee.

6 I'm going to begin just by giving an  
7 introduction and teeing up what some of our key messages  
8 are and then I'm going to turn over the details to my  
9 best colleagues here. Roger Seitz from the Savannah  
10 River National Laboratory. Andy Wallo from our office  
11 of Health, Safety and Security. You already indicated  
12 Sherri Ross from the Department of Energy Savannah River  
13 site. And we have Rob Boehlecke from the Nevada Site  
14 Office, the Nevada National Security Site.

15 So we're going to begin the purpose of our  
16 presentation here. And again, thank you for the  
17 invitation. We're looking forward to providing you an  
18 overview of our integrated protection systems approach  
19 to near-surface disposal.

20 We've been employing the system for over  
21 25 years. We feel very confident about its technical  
22 efficacy. We're going to work hard to highly the use  
23 of defense-in-depth and the role that performance  
24 assessment specifically has as just one of our many  
25 inputs to our risk informed decision-making regarding

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1 near-surface disposal.

2 We're going to describe the emphasis that  
3 we have on consistency with promulgated requirements.

4 We're well aware of both other national standards as  
5 well as international standards and we work hard to  
6 harmonize ourselves with those.

7 And then through our presentation here this  
8 afternoon we're going to summarize our considerations  
9 on a few key topics.

10 One, that I think is of primary interest,  
11 the fact that we use a 1,000 year time frame for  
12 quantitative compliance followed by a transition to a  
13 more risk-informed interpretation that recognizes the  
14 increasing speculation and uncertainties of longer time  
15 periods.

16 We also are going to discuss how we rely  
17 on analysis related to inadvertent intruders. And we  
18 consider them within the context of optimization rather  
19 than a point performance objective.

20 And Radon is considered separately from the  
21 all pathways objective. Scott, please.

22 The structure of our presentation. Again,  
23 my introduction followed by a pretty detailed overview  
24 of our regulatory approach by Roger. A discussion of  
25 the history and implementation of our DOE regulations

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1 for near-surface disposal. And then some site-specific  
2 details by the Savannah River site and by the Nevada  
3 Field Office.

4 This is a graphic that we borrowed from the  
5 IAEA, a Safety Case Concept. But it's very consistent  
6 with the Department of Energy's approach to our  
7 low-level waste disposal regulations.

8 The box highlighted in the middle, or  
9 highlighted in red, Safety Assessment is analogous to  
10 our performance assessment terminology in the DOE. We  
11 do employ an integrated approach to the safety using  
12 a defense in depth similar to the safety case of the  
13 IAEA literature.

14 Performance Assessments are just one part,  
15 or one argument of the overall integrated safety case.

16 We are confident that our near-surface regulations are  
17 consistent with other regulatory frameworks for  
18 near-surface disposal and we do consider international  
19 recommendations.

20 And as I mentioned before, we have 25-year  
21 history in our employment of these regulations. We  
22 continuously review them and have strengthened them over  
23 time. And as you'll hear late in our presentation,  
24 we're in the process of updating our Department of Energy  
25 order on radioactive waste management.

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Continuing. Performance Assessments, they provide us a reasonable expectation that our disposal facilities will not exceed the quantitative performance objective within our DOE order. And we support our decision making with design, operations and closure. The PAs are part of that but they are not a single consideration in the decision-making framework.

We do use a two-tiered approach to the time frames with no specific cutoff. Our 1,000 year period, the quantitative period for compliance, is important to us. But we evaluate out to beat those so we do longer term calculations to consider the peak impacts to support our risk-informed decision-making in the context of the increasing uncertainties that --

CHAIRMAN RYAN: When you say for a longer period of time, how long?

MS. GELLES: There is no limit. There's no specified cutoff. So considering the specific inventories that we're modeling within our performance assessment, we're going to evaluate out to identify the peak impacts and use that information to inform decision-making related to the acceptance of the specific --

MEMBER ARMIJO: In the case of uranium where there is no peak, you know, how do you terminate

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1 that? I mean, what's the end-point for, let's say,  
2 depleted uranium? That's an issue that's been churning  
3 around here that, you know, it's always building up.

4 It's riskier in the future than it is today. All that.

5 What does DOE do?

6 MS. GELLES: Well can we table that for some  
7 detailed answered after Roger's presentation, if that's  
8 okay.

9 CHAIRMAN RYAN: Sure, if we're going to get  
10 to it that would be great.

11 MS. GELLES: And truly, with all respect,  
12 we will answer that question. It's just we're kind of  
13 laying out the overall framework right now. Thank you.

14 MEMBER ARMIJO: Okay, I got you. Thank  
15 you.

16 MS. GELLES: Please. You're going to see  
17 this graphic repeatedly, it's how we're going to present  
18 the defense-in-depth nature of our system. So at the  
19 very center of the bull's-eye is our site  
20 characteristics, that we make very careful  
21 consideration of what sites we select to host our  
22 near-surface disposal facilities.

23 We make those site selection decisions  
24 based on geologic and hydrologic considerations,  
25 facility design and engineered barriers then of course

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offer another expanded circle of defense. And then additionally, administrative and technical controls.

Moving out on the bull's-eye, we have employ a conservative bias in the objectives and assumptions that we use in constructing and calculating our performance assessments.

We set site-specific waste acceptance criteria and have rigorous waste generator certification requirements. And you're going to hear that in spades from Rob when he describes the Nevada Site Offices program.

Some additional controls that we have. We have federal ownership and specified buffer zones. Federal ownership in perpetuity until such time that the sites could be released, if in fact we ultimately make a decision to release them. And there are no decisions in the near-term, in the foreseeable future, about a future release of any of our decommissioned near-surface disposal facilities.

We have a commitment to continuous improvement of our performance assessments. We have a robust federal review group that consistently, annually, reviews our disposal site systems of controls.

And there's an expert peer-review process that we'll share with you.

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1           We have monitoring of our performance  
2 assessments. And we are very focused on permanent  
3 maintenance of our records to ensure institutional  
4 knowledge for future generations. So if we do have  
5 waste forms, such as uranium, that present very  
6 long-term hazards after our institutional controls have  
7 been terminated and we're just relying on federal  
8 ownership and records management, that information will  
9 be available for us.

10           And again you'll see that slide again. And  
11 you'll hear more about each of those details of that  
12 defense-in-depth system.

13           And I'll turn it over to Roger Seitz,  
14 please.

15           → MR. SEITZ: Okay. My name is Roger Seitz  
16 and I work at the Savannah River National Laboratory.

17           And I've been involved with radioactive waste  
18 management for more than 28 years. I started on the  
19 BWIP Project at Hanford. And then spent time at Idaho,  
20 Savannah River and also consult for the International  
21 Atomic Energy Agency.

22           I think one of the themes that we want to  
23 emphasize here is a lot of the information in this  
24 regulatory approach has evolved over time. And it  
25 reflect experiences. It reflects what has been

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1 implemented in DOE programs for more than 25 years.

2 We have what we call a Radioactive Waste  
3 Management Basis and that's very similar to the safety  
4 case that was introduced by Christine. And you'll hear  
5 this over and over. We view PA as just one piece of  
6 a much bigger case that demonstrates the safety of a  
7 disposal facility.

8 Defense-in-depth and a total systems  
9 perspective are two things that you'll hear emphasized.

10 This idea that we try to maintain consistency with  
11 promulgated requirements related to near-surface  
12 disposal.

13 And finally, as Christine mentioned, we are  
14 trying to be consistent and consider recommendations  
15 from international organizations.

16 Here's our defense-in-depth figure again.

17 There's a few key points I wanted to emphasize related  
18 to this. And I want to drill down a little more that  
19 within each of these different defense-in-depth  
20 considerations there's safety factors built in as well.

21 And I think one point that I like to make  
22 is when we look at the radioactive waste management  
23 industry, this industry goes to extraordinary lengths  
24 to consider potential consequences in the far future.

25 I think you're hard-pressed to think of many other

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1 industries that would be considering impacts hundreds  
2 or thousands of years in the future and making  
3 significant decisions based on that information.

4 PAs are one contributor. There's many  
5 different features that you can see in this  
6 defense-in-depth figure. PAs help us risk-inform  
7 decisions, along with all those other features. And  
8 within each of these, there's safety factors built in  
9 our dose constraints. There's safety factors built in  
10 those.

11 We build in conservative bias in our  
12 calculations that are done. And our assumptions about  
13 site performance. And just the fact that we also  
14 consider inadvertent intrusion, that's something that  
15 you don't see in other waste-management situations.  
16 So there's these other factors that are built in. Okay?

17 On this slide I'll drill down a little more  
18 -- Go ahead and hit it one more time, please -- On this  
19 safety case figure. And this really highlights, the  
20 box with the red line around it in the center, that's  
21 the PA. And it's just one piece of many different  
22 components.

23 And what I really like about this safety  
24 case concept is it captures this integrated approach.

25 But also from a perspective of explaining what we do

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1 for waste-management, it provides a very effective means  
2 to communicate all the different pieces that go into  
3 making these decisions. And help build confidence that  
4 we are making good decisions. Go ahead and click it.

5 At the top there, talk about the context  
6 and the strategy. And that's where you'll see things  
7 like robustness, defense-in-depth, our safety  
8 objectives, regulations. So these are kind of the core  
9 starting point.

10 And then we have one thing that it also  
11 highlights is the idea there's iterations and design  
12 optimizations that occurs as we learn more about the  
13 system. We can establish limits and controls and  
14 conditions based on information that we obtain or if  
15 we want to say a certain type of waste can't be disposed  
16 in this location.

17 And, finally, there's a box called  
18 management of uncertainty and you'll hear about our  
19 performance assessment maintenance process. And  
20 you'll hear more about that later. And, as I mentioned  
21 before RWMB, our Radioactive Waste Management Basis,  
22 is very consistent with this safety case approach.

23 Go back in history a little bit on  
24 Performance Assessment. We've been working on site and  
25 facility-specific performance assessments and they've

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1 been required by our regulations since 1988. And  
2 they've been risk-informed performance-based. We've  
3 always had an emphasis on reasonable expectation or  
4 reasonable assurance of meeting performance objectives.

5 And it's viewed in a graded an iterative  
6 approach. And what I've done, I've cut a figure out  
7 of a 1988 guidance for performance assessment that was  
8 drew up by Marilyn Case and Mark Otis. And even at that  
9 time there was a big emphasis on this feedback and  
10 working through the process and perhaps back stepping  
11 to get more information.

12 So this graded and iterative process has  
13 been built into our approach for many years. Over the  
14 years we've continued to refine it. And I think  
15 probably the most important refinement is we've really  
16 gotten much better at focusing on what really matters.

17 We use this process to really start to  
18 identify, what's driving performance, what are the  
19 things that we really have to understand.

20 MS. GELLES: If I could interrupt you for  
21 just one moment.

22 MR. SEITZ: Okay.

23 MS. GELLES: So I apologize for the  
24 interruption. But I realize too late that I failed to  
25 begin with we are very keenly interested in what the

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1 NRC staff are doing and the Commissioners are  
2 considering relative to revisions to Part 61. And we've  
3 been monitoring the ongoing rulemaking efforts for many  
4 years now it seems. I think since about the 2008 time  
5 frame when the depleted uranium unique waste effort  
6 began.

7 And we were very pleased to know that the  
8 NRC staff were giving very careful consideration to the  
9 use of site-specific performance assessments, because  
10 it has been such a central component of our system for  
11 over two decades. Thank you.

12 CHAIRMAN RYAN: Thanks.

13 MR. SEITZ: So time of compliance. This  
14 is one of the important questions that we're addressing.

15 As Christine mentioned, we've focused on a 1,000 year  
16 time of compliance. And that decision is based on a  
17 number of factors. And you'll hear different pieces  
18 of the story as we go through our presentations today.

19 But at its core, first we're consistent with  
20 our overriding radiation protection regulation. And  
21 we believe we're also consistent with promulgated rules  
22 from the NRC that are associated with near-surface  
23 disposal. And we're also, we believe, we bound what's  
24 considered for RCRA Subtitle (C) type disposal  
25 facilities.

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1 Part of this basis for 1,000 --

2 CHAIRMAN RYAN: Just to clarify, Roger, if  
3 I many. So you dispose mixed waste?

4 MR. SEITZ: Yes we do.

5 → CHAIRMAN RYAN: Okay. So I just wanted the  
6 Committee to be aware that there's a category of  
7 hazardous waste that's hazardous under RCRA. And  
8 radioactive waste, which is under DOE or NRC, or both.

9 MR. SEITZ: But our low-level waste sites  
10 are low-level waste sites, not mixed waste sites. We  
11 do have mixed waste sites. And I just want to make sure  
12 --

13 MS. GELLES: We do.

14 MR. SEITZ: We have --

15 CHAIRMAN RYAN: Yes, they're separate.  
16 Yes and I understand that. But I just wanted folks to  
17 realize that they're in the business of both.

18 MS. GELLES: Thank you. That's an  
19 important note.

20 CHAIRMAN RYAN: Yes, that's important to  
21 us for a couple of reasons when you think of time of  
22 compliance. The hard thing to get some folks to think  
23 about is 1,000 years is a long time. Well, forever is  
24 even longer, because uranium will be here when the planet  
25 is cleaved in half. It's 10 to the 9th year half-life.

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1 It's not going anywhere soon. So it's a forever waste.

2 I'll be curious when you get to that stuff.

3 We'd like to hear about your strategies for dealing  
4 with these longer-lived radionuclides and their  
5 persistence in the environment beyond almost any kind  
6 of engineering you can think of. So with that little  
7 tidbit laid out there for the future discussion, go  
8 ahead.

9 MR. SEITZ: Well I think the link to the  
10 mention of hazardous waste brings up that concern as  
11 well. Because when we're dealing with hazardous waste,  
12 a lot of that has no half-life. So its hazards are not  
13 going away.

14 MEMBER ARMIJO: Like uranium.

15 MR. SEITZ: Well uranium, or even metals  
16 and things like that.

17 CHAIRMAN RYAN: Of course uranium is  
18 regulated on its chemical toxicity, not on its  
19 radiotoxicity.

20 → MEMBER ARMIJO: I had a quick question in  
21 reading some of your material and want to make sure I  
22 understand it. In meeting your 1,000 year time of  
23 compliance objection, you have sort of reasonable  
24 expectation criteria that you meet as opposed to  
25 something more binding?

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1           You know, I like reasonable expectation,  
2           I think I understand that. But is there a distinction  
3           between the DOE approach and the NRC approach in meeting  
4           whatever the time of compliance is?

5           MR. SEITZ: I believe that, I think the NRC  
6           uses reasonable assurance. And there are, I think if  
7           you drill down to details there can be some little  
8           differences in interpretation. But at their core  
9           they're fundamentally similar.

10          MEMBER ARMIJO: Okay. Thank you. Thank  
11          you.

12          MR. SEITZ: But a lot of it is  
13          interpretation and that's a big part of what happens  
14          for these longer time frames. And you'll hear me  
15          mention that. But it comes down to how you interpret  
16          things.

17          CHAIRMAN RYAN: Well, and correct me if you  
18          don't agree, Roger. But to my way of thinking some of  
19          that interpretation is not specific to so much the  
20          agency, but specific to the waste form, the waste  
21          constituents of interest, the physical location. What  
22          part of the country, you know, wet/dry, north/south,  
23          hot/cold. All that sort of stuff really can shape what  
24          you think is reasonable.

25          MS. GELLES: Absolutely.

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1 CHAIRMAN RYAN: What could be reasonable  
2 at one site might be not good enough at another, right?

3 MS. GELLES: And that is absolutely the  
4 fact.

5 CHAIRMAN RYAN: Okay.

6 MS. GELLES: In the Department of Energy  
7 complex.

8 CHAIRMAN RYAN: Okay. That's very  
9 helpful, thank you.

10 MR. SEITZ: And I think as you look at those  
11 spheres that we showed, you'll see as we do the two  
12 examples, the defense-in-depth, the site sphere for  
13 Nevada will be much different than the site sphere for  
14 Savannah River.

15 CHAIRMAN RYAN: That's very helpful.  
16 Thank you.

17 MR. SEITZ: And part of this basis for 1,000  
18 years is that, you know, when we look at PA as one piece  
19 of the puzzle, so focusing too much on one piece of the  
20 puzzle you lose sight of all the other arguments that  
21 go into demonstrating the safety.

22 Probably from a technical perspective, one  
23 of the key factors is just the idea that we're trying  
24 to make decisions. And as you get into these longer  
25 time frames there's decreasing relevance and usefulness

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1 of information that's increasingly speculative and  
2 uncertain.

3 So I put it in the context of like a value  
4 of information. At some point you have to ask yourself  
5 how much do we really believe this information that we're  
6 using to support the decision.

7 → MEMBER REMPE: But it appeared that you had  
8 almost annual updates, is that right? Or semi, and then  
9 if something happens to change things you might even  
10 do it more frequently, is what I recall reading in the  
11 information.

12 MR. SEITZ: Yes.

13 MEMBER REMPE: Which is something we don't  
14 quite do, I think, at the NRC.

15 CHAIRMAN RYAN: No, that probably isn't  
16 quite right, but --

17 MEMBER REMPE: Annual updates?

18 CHAIRMAN RYAN: In the sites I'm familiar  
19 that are regulated through agreement states, it's  
20 sometimes more frequent than that.

21 MEMBER REMPE: Okay.

22 CHAIRMAN RYAN: They are are alive and well  
23 and they're running them all the time for one reason  
24 or another. So I would say it's probably on a par at  
25 least.

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1 MEMBER REMPE: How much is the annual  
2 update that the DOE requires from these sites? Is it  
3 an extensive document or is it a --

4 MR. SEITZ: It's an annual report. It's  
5 more of a summary of what has happened that year.

6 MEMBER REMPE: Okay.

7 MR. SEITZ: And I think Andy has a slide  
8 that gives you a little more perspective on it.

9 MR. WALLO: And one of the things to note  
10 is when you say we're running the models, actually we  
11 have a layered regulatory approach at DOE. At the top  
12 we have the headquarters, and I'm going to talk about  
13 the low-level waste review group, that looks at these  
14 annual summaries and then reviews each PA and all the  
15 monitoring plans and so forth on a periodic basis.

16 But are regulator in the field, the site  
17 office, is always following the sites and they may do  
18 special runs, as you'll hear from our sites, monthly  
19 on various things that come in. So it's not like we  
20 just even do an annual. We will do special runs all  
21 the time to determine if we need any kind of special  
22 treatment of the waste.

23 CHAIRMAN RYAN: And just on a commercial  
24 site, Joy, there's the same kind of thing between a power  
25 plant or another kind of licensee in getting their waste

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1 to a disposal facility, whether it's Washington or  
2 Barterella, wherever it might be. That there's on-site  
3 inspection at the point of generation and --

4 MEMBER REMPE: That's true for the  
5 commercial plants too. There's on-site inspections.

6 What I just am wondering is if that is a little more  
7 fuzzy in the DOE world and there's a lot more required.

8 You know, is that a difference that we need to consider.

9 Is just they're a little more oftenly done. I'm coming  
10 from a national lab as I'm asking that question, that  
11 the site office and the oversight and how rigid the rules  
12 are. And so sometimes fuzziness is more difficult is  
13 what I'm trying to say.

14 MR. SEITZ: Okay. And really it's an  
15 annual report. So as Andy was saying there may be a  
16 lot of things going on over the course of the year.

17 MEMBER REMPE: Right.

18 MR. SEITZ: But each year we publish an  
19 annual report that summarizes all these things that have  
20 happened over the year.

21 CHAIRMAN RYAN: So you don't really update  
22 your performance assessment every year? I mean that  
23 would be kind of --

24 MR. SEITZ: No necessarily. No, not  
25 unless there was a need. And, for instance, as I said

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1 in our layered approach, the site office could decide  
2 that they want to make a change, they want to do  
3 something, and then they come up through the regulatory  
4 process and we get the whole process rolling. Or the  
5 site can decide that it can handle it itself and do the  
6 approvals and that it isn't significant enough to bring  
7 up.

8 And if that's the case then we check into  
9 that at the annual reviews and say, oh yes, you were  
10 right. Or, wait a second, maybe you exceeded your  
11 authority here and we needed to look at this kind of  
12 approach.

13 CHAIRMAN RYAN: Andy, correct me if I'm  
14 wrong, but my recollection and knowledge from working  
15 at a few of the DOE sites over the years is that very  
16 often these waste-generating activities are part of  
17 decommissioning one thing or another. And any time you  
18 go to decommission all the facilities that have been  
19 bolted up for, pick a number 20, 30, 40 years, there's  
20 always surprises.

21 There's always inventories you didn't know  
22 were there. And then some of the other ones might not  
23 be there, they've already been taken care of under some  
24 other banner. And so it's a little bit tougher because  
25 the history is so dragged out in time that sometimes

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1 you've got to almost rediscover things, I think, before  
2 you really kind of say well now we've got the plan out.

3 We've figured out all the nooks and crannies and  
4 details. Is that a fair view?

5 MR. SEITZ: I think, actually, from my  
6 perspective, from the DOE perspective at a DOE site,  
7 it is much more dealing with exceptions. Dealing with  
8 something you haven't dealt with before. There's a lot  
9 of that. Where I suspect at commercial sites it may  
10 be a little more routine.

11 MS. GELLES: I think it's at the very core  
12 of why the Department of Energy is responsible for the  
13 disposal of Department of Energy generated waste as well  
14 as special waste from the Naval Reactors Program or  
15 classified Department of Defense wastes.

16 They recognize that we are in the best  
17 position, we have this robust performance-based,  
18 risk-informed, defense-in-depth system that allows us  
19 to deal with the unusual waste streams that are not  
20 generally generated by NRC licensed activity.

21 So absolutely, it's very routine operations  
22 for us to have a site that's operating as a disposal  
23 facility supported by a site-specific Performance  
24 Assessment and the regulatory system surrounding that  
25 reviewed and approved by the LFRG, which is the federal

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1 review group that I alluded to, that Andy will discuss  
2 in some detail.

3 And it has a waste acceptance criteria.  
4 And all of our sites will profile waste that would fit  
5 within that acceptance criteria and then some cleanup  
6 activity or some one of a kind mission activity will  
7 generate a waste stream that seems to challenge that  
8 WAC. And we have a process defined in our order and  
9 in site-specific regulations and procedures that allow  
10 for special analyses, special runs of our models,  
11 special consideration.

12  
13 Sometimes we modify waste package  
14 requirements. Sometimes we modify the disposal method.  
15 We might dig deeper. We might use greater engineered  
16 barriers in a trench before we place other waste  
17 attendant to it. We might isolate it from other waste  
18 within the same trench or in the same facility.

19 And that is what our system is set up to  
20 do because of the very historic and unique nature of  
21 our DOE missions. It's why we have a DOE disposal  
22 system.

23 CHAIRMAN RYAN: Thank you.

24 MS. GELLES: You're welcome.

25 MR. SEITZ: And back on the second point

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1 on this slide, it really gets to the core that 1,000  
2 years is by no means a cutoff. And I guess I've thought  
3 about this, how do we explain this. And I think from  
4 my perspective the best way to explain it is it's really  
5 a transition in how you interpret things.

6 There's some point where we go from this  
7 absolute quantitative compliance to recognizing that  
8 as uncertainties grow, as it becomes more speculative,  
9 you begin to get to more of this risk-informed decision  
10 making recognizing those uncertainties. So it becomes  
11 more fuzzy, it becomes a true decision framework.

12 And you go from this, I can say you go from  
13 this idea of from 1,000 years basically it's making a  
14 decision for you. If you don't comply the decision is  
15 made for you.

16 Beyond that time it informs your decisions.

17 It's not this idea of compliance/non-compliance. It's  
18 no longer a decision maker, it's informing your decision  
19 in the context of all these other factors.

20 MEMBER SCHULTZ: Roger, are you going to  
21 talk more about that? I'm a card-carrying PRA guy.  
22 And as soon as somebody says risk-informing I  
23 immediately go back to what can happen, how likely is  
24 it and what are the consequences and what are the  
25 uncertainties.

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1 MR. SEITZ: Yes.

2 MEMBER SCHULTZ: How likely is it tends to  
3 get into numbers. So I'm interested if you're saying  
4 that after 1,000 years you're transitioning from a  
5 quantitative framework to a risk-informed framework,  
6 I'm interested in understanding what that means.

7 MR. SEITZ: Okay. And I guess I'm not  
8 saying it's not quantitative. So you continue the  
9 quantitative calculations but even those calculations  
10 become more and more suspect.

11 MR. WALLO: But we're not necessarily --

12 (Crosstalk)

13 MR. WALLO: But we're not necessarily  
14 talking about probabilistic assessments. We are  
15 generally talking about consequence assessments in most  
16 cases. Though we do use probabilities sometimes in  
17 these analysis. But we're informing the decision by  
18 looking at the long-term consequences and numbers are  
19 involved, it's just that we don't use them to compare  
20 them against a performance metric or a quantitative  
21 metric. You don't have to meet 25.

22 CHAIRMAN RYAN: Correct me if I'm wrong  
23 again, but I think DOE has spent a tremendous amount  
24 of time, energy and funds on characterizing wastes,  
25 physical, chemical and most importantly radioactive

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1 material content. Whether it's tritium, which is, you  
2 know, fairly innocuous on the big scale up to those that  
3 are much more important from a health and safety and  
4 environmental protection perspective.

5 So is that kind of where you start? Is  
6 trying to develop the best sort of insight into the  
7 inventory that you have that you're dealing with? Or  
8 is that one of the term things you look at first?

9 MR. SEITZ: It's all part of the package.

10 CHAIRMAN RYAN: Right, okay.

11 MR. SEITZ: You really can't -- As you go  
12 further out in time you start looking at factors like  
13 that that all contribute to the safety.

14 CHAIRMAN RYAN: Okay. Thanks.

15 → MEMBER SCHULTZ: Roger, will you go back  
16 to that slide for a moment. And with regard to the 1,000  
17 year time frame for compliance, in the bullets there,  
18 you've got that this conforms with recommendations from  
19 ICRP and IAEA. Do those agencies also support the  
20 discussions related to beyond 1,000 years?

21 MR. SEITZ: I have some quotes coming up  
22 here.

23 MEMBER SCHULTZ: Okay.

24 MR. SEITZ: And I think you can't really  
25 pick out a number, which I think is by design when you

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1 look at the international recommendations. But I have  
2 some quotes that will give you some perspective. And  
3 then we can address it more if you'd --

4 MEMBER SCHULTZ: And are you influenced by,  
5 clearly the international agencies would have an  
6 influence, but other countries have chosen other time  
7 frames, other ways in which to perform their overall  
8 assessments. I presume you're reviewing those, are you  
9 going to discuss that later?

10 MR. SEITZ: Well yes, I have one example  
11 that illustrates a point about looking at other  
12 country's approaches.

13 MEMBER SCHULTZ: I'll appreciate that.  
14 Thank you.

15 MR. SEITZ: Okay. And this kind of leads  
16 into what you were just asking about. The next few  
17 slides I'm going to talk a little bit about the ICRP,  
18 some statements that they have in their recommendations.  
19 And one of them relates to the use of the term, the  
20 concepts of dose and risk as measures of health detriment  
21 over long periods of time.

22 The IAEA has some recommendations related  
23 to how long our calculation is really meaningful for  
24 surface, near-surface disposal facilities. And this  
25 fits with the questions about probabilistic

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1 risk-assessment.

2 One of the things that I found when we look  
3 at other countries, and countries or situations even  
4 for radiologic disposal, when people talk about much  
5 longer times it's not unusual in those cases to see them  
6 using probabilities, event probabilities or things.  
7 So that becomes part of the equation.

8 So it comes down to how, we may say we do  
9 it for a certain amount of time, but what you're doing  
10 for that amount of time can be different. And I've got  
11 an example coming up here.

12 So just a couple quotes, and I'll just read  
13 through them real quick. "Doses and risks, as a measure  
14 of health detriment, cannot be forecast with any  
15 certainty for beyond around several hundreds of years  
16 in the future."

17 They do on to say that that doesn't mean  
18 you can't use them to compare with things. You can do  
19 calculations longer. But I think what that, in my mind,  
20 what that says is there may be a change in how you  
21 perceive things after that time. How meaningful is this  
22 as an indicator at later times? We can use it for a  
23 comparison, but there may be a difference in how strictly  
24 you conform to it.

25 → CHAIRMAN RYAN: Again, just a question.

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1 To me it also implies that if you found that for whatever  
2 reason or reasons this 1,000 or 10,000 year period gives  
3 you some kind of an estimate of an impact that you don't  
4 like you can restrict the inventory.

5 MS. GELLES: Absolutely.

6 MR. SEITZ: That's true. Yes.

7 CHAIRMAN RYAN: So I think it's kind of,  
8 it's not just an arrow going one way. You know, your  
9 analysis and your thinking goes, you know, from what's  
10 happening long times in the future to what's happening  
11 today and kind of judging what's appropriate for that  
12 timeline, whatever it is.

13 MR. WALLO: Absolutely. But one of the  
14 things you think about is the decision is to try to  
15 isolate and dedicate as few of our natural resources  
16 to those as possible. I mean, obviously we could solve  
17 this problem by just diluting all the waste and making  
18 it --

19 CHAIRMAN RYAN: Oh no, I wasn't saying  
20 dilution.

21 MR. WALLO: No, I'm just saying, so when  
22 you decide to limit a waste inventory on a site because  
23 of a number 10,000 years in the future you're basically  
24 making more sites.

25 CHAIRMAN RYAN: Maybe. Maybe not.

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1 MR. WALLO: Yes, well it has to go  
2 someplace.

3 MS. GELLES: Or you could go deeper, which  
4 is the result of --

5 MR. WALLO: Yes, but then you're spending  
6 more resources.

7 CHAIRMAN RYAN: And you're digging more  
8 holes, but you're not --

9 MR. SEITZ: And I guess within the DOE  
10 system we have the capability that if we find that it's  
11 not, we don't believe that it should be disposed at one  
12 site there may be another location that's a better place  
13 for a specific waste.

14 In terms of time frames for modeling, the  
15 quote the ICRP recommendation talks about, "To evaluate  
16 the performance of waste disposal systems over long time  
17 scales, one approach is the consideration of  
18 quantitative estimates on the order of 1,000 to 10,000  
19 years."

20 And here they're not talking about  
21 quantitative calculation.

22 → MEMBER ARMIJO: Then when you do those  
23 calculations what's the benefit of it, you know? You  
24 can do calculations to any time period. You can get  
25 numbers and you may or may not believe them. But, I

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1 mean, so what's the safety benefit of doing that?

2 MR. SEITZ: I've got a slide coming up that  
3 maybe will talk about it a little bit more. But in  
4 essence you're trying to learn about the system. Are  
5 there things that we can improve in the design to address  
6 potential longer term consequences. Maybe there's  
7 things that can be done that are reasonably, kind of  
8 from an ALARA perspective, things that make sense to  
9 do.

10 CHAIRMAN RYAN: Well are they fairly  
11 straight-forward and not that expensive to add a fence  
12 in depth kind of barrier or something that might come  
13 in. So I think if you kind of inform your assessment  
14 based on those sorts of those things you might choose  
15 Barrier B or Barrier A, because it's going to be, you  
16 know, another 500 years or another 400 years. That kind  
17 of thing that can help you, you know, make the decisions  
18 I think Roger is talking about.

19 MEMBER ARMIJO: Well where I'm trying to  
20 go with this question is, with all the experience DOE  
21 has over the years in the design and operation of a  
22 variety of waste sites with all different kinds of  
23 barrier systems and waste forms, don't you already know  
24 the answer or the right way to handle this waste at this  
25 particular site?

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1           So why isn't it just a pure, deterministic,  
2           procedural thing that says, hey, we know how to handle  
3           this stuff. We put it in these kinds of cans and bury  
4           it this deep and all that. And so what's the need for  
5           an analysis out to 10,000 years just to do the analysis?  
6           Unless something new, you know, that you might benefit.  
7           But I find it hard to see how --

8  
9           MR. SEITZ: It's really hard to come up with  
10          a kind of a varying structured approach because it's  
11          different at every site. And, I mean, we can look at  
12          certain classes of waste forms and things and we have  
13          a general idea of what works. But at one site you may  
14          do something different that you do at another site.

15          There are situations which, from my  
16          perspective, personally as a technical and a  
17          decision-making rule, it becomes less relevant the  
18          farther out you go.

19          MEMBER ARMIJO: Sure.

20          MR. SEITZ: And so you're right. But there  
21          can be things out there that are relevant and will help  
22          you. But one of the things is the assurance. For  
23          instance I may see something that in 20,000 years is  
24          at 200 millirem you could get an individual dose. Am  
25          I worried about that? No I'm not.

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1 MEMBER ARMIJO: I hope not.

2 MR. SEITZ: No. So you see that and you  
3 see, you know, I'm going to talk a little later about  
4 the NAPA Study and one of the things they told us to  
5 look for was catastrophic events. So we provide that  
6 assessment to make sure there's nothing catastrophic.

7 And there's rarely a chance of that ever happening.

8 But it is that confirmation that we've met that goal,  
9 we know we're not doing something that's resulting in  
10 something that's catastrophic.

11 MS. GELLES: And I just want to clarify to  
12 make sure that there's not a misunderstanding. What  
13 Roger was presenting on the previous slide is the ICRP  
14 perspective. And we actually have a policy position  
15 that we don't believe 10,000 years is needed as a  
16 deterministic evaluation for every site because we do  
17 have great confidence in how the waste we generate and  
18 have safely disposed will perform in our disposal  
19 systems.

20 But we do have a requirement within our  
21 system to quantify to 1,000 and then continue to evaluate  
22 out to the peak impacts that are presented by the waste  
23 inventory that we're modeling. We do not run a PA and  
24 isolation for one individual waste stream, we're  
25 modeling the entire aggregated inventory that we have

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1 received, or are projecting to receive in the  
2 foreseeable future.

3 So 10,000 years we're not willing to say  
4 is necessary for every site, but we certainly are  
5 identifying where that point is beyond 1,000 years that  
6 is relevant to the inventory at the specific site.

7 And we do exactly what you've just  
8 described. The accommodate the specific challenges  
9 associated with that as appropriate within a  
10 risk-informed defense-in-depth system, whether it's  
11 greater depth, more engineered barriers, greater waste  
12 form stability, all to be determined by the specific  
13 set of --

14 CHAIRMAN RYAN: Well that's radioactive  
15 material.

16 MS. GELLES: Right.

17 CHAIRMAN RYAN: You could end up with two  
18 sites that could do -- might not be the right answer.

19 MEMBER BANERJEE: So one could be a  
20 catastrophic event.

21 MR. SEITZ: I think catastrophic's in terms  
22 of doses, right? A dose.

23 MEMBER BANERJEE: Is it a river running  
24 through the site suddenly or something?

25 MR. SEITZ: No, I don't think --

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1 MR. WALLO: Well we'll look at the NAPA  
2 Study. Frankly, for dealing with low-level waste I  
3 can't think or imagine an event that would be  
4 catastrophic.

5 MEMBER BANERJEE: That's what I look, is  
6 how do you define it?

7 CHAIRMAN RYAN: One interesting one was the  
8 Russian's concern was the meteor that hit Chelyabinsk.  
9 Chelyabinsk is a famous city for a lot of other reasons,  
10 but --

11 MEMBER BANERJEE: Chemical weapons.

12 CHAIRMAN RYAN: So, you know, 40, 30 miles  
13 difference, it could have been a whole different, you  
14 know, situation. So it's interesting to think about.  
15 You know, I don't know if Europe does kind of  
16 catastrophic sorts of things, but they're out there.

17 MR. SEITZ: I think that would fall in the  
18 category of a low probability event.

19 CHAIRMAN RYAN: Sure.

20 MR. SEITZ: Chelyabinsk could tell you the  
21 probability as well. Anyway it's a rare event, that's  
22 for sure. But, you know, I think --

23 MR. WALLO: But again, for low-level waste  
24 sites, even our biggest ones, I can't think even if the  
25 meteor hit it that that would be, the low-level waste

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1 would be a catastrophic result as a result. The meteor  
2 certainly would be.

3 MEMBER BANERJEE: Yes, that's the issue  
4 really. Would the low-level risk be the catastrophic?

5 MR. WALLO: No, again.

6 CHAIRMAN RYAN: Just spread it around.

7 MEMBER BANERJEE: Does it matter?

8 MR. WALLO: Well it may matter and we may  
9 have a cleanup, but again, the term catastrophic, are  
10 we destroying the planet? No. Are we destroying a  
11 significant part of the planet? No.

12 MEMBER ARMIJO: Killing a lot of people?

13 No.

14 MR. SEITZ: And Christine made a good  
15 point. I think the purpose on these slides is just to  
16 talk about kind of the modeling timeframes that are being  
17 discussed by the ICRP. And so they're talking on the  
18 order of thousands of years, you can learn from  
19 quantitative calculations. They don't mention  
20 compliance.

21 And you see similar things, the IAEA  
22 recently published their safety guide on safety case  
23 and safety assessment, which is performance assessment  
24 in our --

25 → MEMBER RAY: Can I interrupt you for just

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1 a second? Because I want to draw my colleague's  
2 attention to something you just said. They don't  
3 mention compliance. As I look at this and listen to  
4 all of it. That's the big difference that we have to  
5 bridge somehow. Because we have to live in a world of  
6 litigious challenges to compliance. More so that you  
7 got, I don't mean you disregard that, but that is a  
8 difference that makes some of this reasonableness a  
9 little more difficult to transfer.

10 MR. SEITZ: And I think that that's kind  
11 of the underlying point here, is they talk about you  
12 can do some calculations over these times. They may  
13 have meaning over a few thousand years. But how much  
14 meaning do you want to apply to it?

15 MEMBER SCHULTZ: That's an important point  
16 because each of these statements is surrounded by its  
17 own context. And if you read this in and of itself it's  
18 very interesting. It's suggesting that if you know a  
19 lot about what you've done and have performed a very  
20 careful Performance Assessment then you might be able  
21 to quantitatively perform a calculation that would be  
22 meaningful over a longer period of time.

23 If you haven't done all of that then, boy,  
24 ten years, 100 years. You're beyond uncertainty bounds  
25 of the situation. So it's an interesting concept.

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1 MR. WALLO: And the thing to remember is  
2 even if you did good calculations, had good uncertainty  
3 and you know, had some feeling for how the site and the  
4 system was going to perform, the question of your metric  
5 in the future what does 25 millirem mean in 500 years  
6 let alone 1,000 years. It is not a meaningful metric  
7 when you get out that far.

8 So you can gain insights about the  
9 performance of the safety system by seeing how things  
10 move and where they move. But in terms of relevance  
11 to today's standards it's of minimal value.

12 CHAIRMAN RYAN: Well I guess when I think  
13 about that question, Andy, which I've thought about a  
14 lot over the years, is predictability and stability is  
15 really what you're hoping for in a waste disposal system.

16 You know, whether it's absolutely  
17 rock-solid and there's not one atom of anything getting  
18 out. Or whether it's a 25 millirem per year commitment  
19 or 50 or whatever it is, within reason it's performing.

20 MS. GELLES: Right.

21 CHAIRMAN RYAN: So I take your point well.  
22 It really is something to think about for time horizons  
23 that are quite long that's different than say routine  
24 monitoring. And let's say the monitoring lies in the  
25 groundwater system, if something starts happening there

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1 fairly soon you need to act because it's not supposed  
2 to happen at all. That kind of thing.

3 So, you know, that's kind of a different  
4 sort of a strategy. You want to make sure it's working  
5 so it's a confirmatory measurement as opposed to a  
6 compliance measurement. I see those as very different.

7 MR. SEITZ: Yes. And I won't read the  
8 whole thing but there's a couple key statements. When  
9 we think about things on the ground surface or perhaps  
10 a facility that's on the surface or above-ground, they  
11 refer to timeframes of hundreds of years. And  
12 quantitative estimates may become meaningless beyond  
13 that time, of beyond maybe 1,000 years for that case.

14 If it's near the surface, slightly below  
15 ground, a few thousand years they're talking about, you  
16 know, maybe some useful calculations. When they talk  
17 about deep geologic disposal they actually refer to tens  
18 of thousands of years.

19 And that's a big distinction. We have to  
20 be careful of applying timeframes that are applied for  
21 geologic disposal with timeframes that are compared with  
22 near-surface disposal.

23 MEMBER ARMIJO: And what would you say,  
24 just kind of a rough estimate of what deep means for  
25 everybody's benefit?

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1 MR. SEITZ: What do we say? More than a  
2 few tens of meters?

3 MR. WALLO: Yes, 30 meters.

4 CHAIRMAN RYAN: So 100 feet plus?

5 MR. SEITZ: Yes, I think that's the  
6 terminology now, it's something like more than a few  
7 tens of meters. Yes.

8 MS. GELLES: Right, I think there's room  
9 for interpretation there. So near-surface is in the  
10 upper 30 meters. I mean there is a concept of  
11 intermediate depth, but clearly geologic is, you know  
12 --

13 CHAIRMAN RYAN: Yes, okay. Thanks.

14 MS. GELLES: -- not necessarily measured  
15 by the depth but so much as the reliance on the geologic  
16 barriers. But they all tend to be very deep.

17 CHAIRMAN RYAN: Okay.

18 MR. SEITZ: You get stability. When you  
19 go deeper things are going to be a bit more stable.  
20 So also stable.

21 CHAIRMAN RYAN: Okay.

22 MR. SEITZ: Okay, I mentioned I would show  
23 an example. And what I really want to highlight is it's  
24 really difficult to just take times. If you're looking  
25 at different countries and well, this country uses this

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1 time. This country uses this time. You really need  
2 to understand how they use those times. And I think  
3 all the countries believe they're being protective,  
4 they're genuinely trying to be protective, but it's just  
5 different approaches.

6 And the example that I have here is for the  
7 low-level waste repository in the United Kingdom. What  
8 you find in their regulatory system, the dose constraint  
9 applies through closure.

10 So although they do calculations, they  
11 assess safety, I don't think they establish a timeframe.

12 But in practice the dose constraint itself applies  
13 through closure of the facility. And I think their  
14 logic there is that this is when they can actually  
15 observe it. You can actually measure compliance with  
16 a constraint.

17 CHAIRMAN RYAN: And just for everybody's  
18 benefit, you're talking the Sellafield facility?

19 MR. SEITZ: It's near Sellafield, yes.  
20 They refer to it as the LLWR, which is located near Drigg.

21 CHAIRMAN RYAN: Yes, right.

22 MR. SEITZ: But this is from their  
23 assessment that was just completed a couple years ago.

24 So that first timeframe is the absolute dose  
25 constraint. Beyond that time for perspective

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1 calculations they talk about a risk guidance level,  
2 which becomes much more of this true risk where you add  
3 probabilities in.

4 And over that timeframe they actually  
5 consider the probability that someone would put a well  
6 somewhere. So it becomes more of a true risk  
7 perspective.

8 CHAIRMAN RYAN: Of course the interesting  
9 part of that example is it's on the beach.

10 MR. SEITZ: And that's the timing, and it's  
11 a coincidence, but their timing--

12 MEMBER STETKAR: Today it's on the beach.

13 MR. SEITZ: Yes. The timing there, for  
14 their reference case, they assume that coastal erosion  
15 is going to start impacting the facility in about 1,000  
16 years. And that's considered in their assessment.  
17 They have scenarios that look at the facility being,  
18 basically chipping away.

19 MEMBER BANERJEE: So what's the period of  
20 authorization for? Is it 1,000 years?

21 MR. SEITZ: They don't specify a time. So  
22 they're looking for things that are happening. But at  
23 1,000 years things start changing dramatically. And  
24 they have some calculations for doses in at 2,000 or  
25 3,000 years maybe where they use those for the risk

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1 guidance levels. They also ran a sensitivity case for  
2 what they call delayed erosion, which they looked at  
3 happening at 10,000 years.

4 MEMBER BANERJEE: The black box is notional  
5 box, they haven't put any numbers on the time scale.

6 MS. GELLES: The question is, is there a  
7 defined period of closure for the U.K. --

8 MR. SEITZ: Oh, I see. There may be but  
9 I don't remember what that is.

10 MS. GELLES: I believe it is. I don't know  
11 what the answer is but it is not a notional concept of  
12 closure goes on for an undefined period of time. There  
13 is a projected period of operations of several decades  
14 followed by a closure period, which I believe it's in  
15 the decades. It's not hundreds of years, right.

16 MEMBER BANERJEE: Not hundreds.

17 MS. GELLES: The point is that this is, our  
18 system of a point of compliance with the 1,000 years  
19 is more conservative than what the UK model is, because  
20 they have the dose constraint only for their operational  
21 and closure period. Correct?

22 MR. SEITZ: Yes, and it's all in  
23 interpretation. I think it's safe as well.

24 → MEMBER ARMIJO: This is rather  
25 interesting. One is institutional control, which means

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1 some organization, whether it's a government agency or  
2 business or whatever it is, that is paid or gains, you  
3 know, their livelihood or whatever you want to think  
4 about for providing these services. That's one.

5 And then the second part of that is well  
6 what if there is no institutional control and people  
7 lose track of where it is, you know. So I have a hard  
8 time sort of, how do I get from one to the other and  
9 when does that happen? Because that's tells you an  
10 awful lot about what's left or what's important or not  
11 important. So I'm guessing from your nod you're  
12 wrestling with the same kinds of questions.

13 MR. SEITZ: Yes, institutional. How much  
14 can we take credit for passive controls, active  
15 controls?

16 MR. WALLO: I mean, you know, there's one  
17 thing to take credit in the decision making in  
18 authorizing the site. But our plan is that these will  
19 be under, our sites will be under institutional control  
20 forever, or until they can be released.

21 Now, you say well you can't guarantee that  
22 the United States will be here forever. No. But part  
23 of that if it's, you know, and the point to the PA, the  
24 PA doesn't protect anyone. All the PA does is inform  
25 us on what kind of defense we need to put in place.

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1 And so if this is that important we've got  
2 to make very sure not only do we have the records in  
3 place and the passive institutional controls in the  
4 design, but we need to make sure we have a record of  
5 why we're isolating this place.

6 And one of the things we'll talk about later  
7 is we don't want to foreclose on future generations.

8 If they look at what we did and say that's nonsense,  
9 we don't need to isolate that, that's their choice.  
10 We just want to make sure they know in the future.

11 So that's where we would be putting our  
12 emphasis is to make sure, as we have this rolling future,  
13 that we inform the future generations of what we did,  
14 why we did it and why we think it needs to stay secure.

15 CHAIRMAN RYAN: So a loss of institutional  
16 memory would be the biggest challenge?

17 MS. GELLES: Yes.

18 MR. SEITZ: We have to address that. We  
19 have to address that possibility. And one point on  
20 this, I think from a high level this isn't so different.

21 The times may be different, they may shift. But  
22 philosophically there's a lot of similarities to what  
23 we do.

24 There's a recognition that at some point  
25 it becomes a more fuzzy argument. Okay?

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1 CHAIRMAN RYAN: Just we were stuck on the  
2 option of, you know, using copper canisters for waste  
3 and burying them so deep they would be real hard to get  
4 to. So they've kind of taken a different track but,  
5 again, I think the goals are the same.

6 MEMBER BANERJEE: For even low-level  
7 waste?

8 MEMBER ARMIJO: That's only for high-level  
9 waste.

10 CHAIRMAN RYAN: That's for high-level.

11 MEMBER BANERJEE: What do they do for low  
12 levels?

13 MR. SEITZ: They use geologic disposal.

14 CHAIRMAN RYAN: It's all one deal and the  
15 copper canisters are, I don't know, are they ten inches  
16 thick?

17 MEMBER STETKAR: I'm not sure.

18 MEMBER BANERJEE: So all radionuclides --

19 CHAIRMAN RYAN: And they pick copper  
20 because it fits in the geochemistry without having any  
21 real problems.

22 MEMBER BANERJEE: But isn't the volume very  
23 less?

24 CHAIRMAN RYAN: Not so much.

25 MR. SEITZ: Yes, I think that's actually

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1 in important point. In general we're not talking about  
2 a lot of waste, even relative to hazardous waste  
3 disposal. The quantities of waste that we're talking  
4 about are -- DOE may be more so with the cleanup  
5 activities but in general low-level waste is not huge  
6 quantities.

7 Okay. I just wanted to touch on a few  
8 things specific to Performance Assessments --

9 → MEMBER BANERJEE: Just going back, how much  
10 is it involving typically?

11 MR. SEITZ: Oh, I don't know the number.

12 MEMBER BANERJEE: Is it many football  
13 fields?

14 MS. GELLES: Are you asking about the  
15 Department of Energy's or the Swedish site?

16 MEMBER BANERJEE: No, the DOE. The  
17 Swedish site I assume is --

18 MR. WALLO: It depends. You know, I mean  
19 we clean up waste. Just like tailings are very  
20 voluminous, so we have very big sites for those.  
21 Clearly probably all our low-level waste could go to  
22 Nevada if it wasn't the transportation cost, and we could  
23 dispose of it all there. But then we have the tank  
24 cleanups and so forth. And the Saltstone at Savannah  
25 River. I mean --

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1 MS. GELLES: We would need to clarify the  
2 question, I'd be happy, we could provide you lots of  
3 historical information. But as an example the Nevada  
4 Field Office accepts nominally a million cubic feet a  
5 year of waste. And historically has received --

6 MR. BOEHLECKE: I think in 2012 we had, I  
7 think it was a little over a million and that represented  
8 about two percent of the DOE complex waste that year.

9 MS. GELLES: Of the total volumes of waste  
10 that we dispose?

11 MR. BOEHLECKE: Yes.

12 MS. GELLES: Thank you. So that's a great  
13 -- the vast majority of it is disposed at facilities  
14 at the site where it is generated to support our  
15 environmental cleanup activities. So a small portion,  
16 historically it's averaged about five percent of our  
17 annual generation, travels offsite to offsite disposal  
18 facilities like Nevada.

19 But all waste is not the same. So you'll  
20 hear Sherri talk about Saltstone and the way that that  
21 is stabilized and disposed is markedly different than  
22 the solid waste packages that are being transported to  
23 Nevada for disposal in the trenches there.

24 So we'd be happy if you want to refine the  
25 question a little bit, we could give you a more credible

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1 answer.

2 MEMBER BANERJEE: Well no, I don't even  
3 know --

4 CHAIRMAN RYAN: So the Barnwell site, which  
5 is taking quite a large fraction of the waste from  
6 reactors, except for fuel. All the operating waste,  
7 large components, is a 300 acre site that's got about  
8 40 feet of disposal height from the top down. And it's  
9 300 acres and it's, I don't know, 75 percent full. And  
10 that's from 1971 to the present.

11 MEMBER BANERJEE: That's reactor waste.

12 CHAIRMAN RYAN: And hospitals and  
13 universities and all that stuff. It's all materials  
14 used within the U.S. pretty much.

15 MR. SEITZ: I mean for hazardous waste, I  
16 think the last time I looked, you're talking billions.

17 CHAIRMAN RYAN: Oh absolutely. Hazardous  
18 waste far outspans radioactive waste.

19 MR. SEITZ: Okay. And I mentioned, we have  
20 a definition, and I think there was a question earlier  
21 about how do you use calculations, and I think this  
22 definition which came from the NCRP, it's after the NCRP,  
23 but two things in this. One part is demonstrating  
24 compliance, we use them for that.

25 But I think equally important, perhaps more

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1 important, is we use these calculation to gain a better  
2 understanding of what really matters. What can we do  
3 to improve performance and make our defensible,  
4 cost-effective and risk-informed decisions?

5 So you've got compliance on one side but  
6 part of it is this really this learning, understanding  
7 what really matters. Okay?

8 One thing with in defense-in-depth I  
9 mentioned that there are safety factors built in. And  
10 this slide's just a few examples of how these safety  
11 factors, that I think people forget about sometimes.

12 For example, our dose constraint, 0.25 millisievert  
13 per year.

14 It's 25 times less than the average annual  
15 dose received in the United States. So there's a factor  
16 of 25 less than what people are exposed to routinely  
17 from all sources of radiation.

18 MEMBER SKILLMAN: Where did that 6.3 come  
19 from? I thought it was three?

20 MR. SEITZ: It's changed with medical  
21 procedures.

22 MR. WALLO: Actually it's not a truly  
23 average dose, it's a per capita dose. So younger folks  
24 that don't get a lot of CT scans are only getting your  
25 360.

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1 MEMBER SKILLMAN: Okay. Thank you. But  
2 then the older folks are getting more like ten  
3 millisieverts.

4 MR. SEITZ: Thank you. And also our dose,  
5 the true dose limit is one millisievert so we have a  
6 factor of four there that's been built in to these  
7 disposal requirements. Okay. That's our constraint.

8 The next step we take is we assume --

9 MEMBER BANERJEE: What sort of dose would  
10 be expected from a typical mill tailings pile? Uranium  
11 mill tailings?

12 MR. WALLO: Actually the tailings pile  
13 standards are, as you know, flux rates. So it certainly  
14 depends on where you put your house and how much you're  
15 affected by the flux. I think we did some very soft  
16 analysis and that's why you'll see later in our standards  
17 where we say if our low-level waste sites dispose of  
18 radium-bearing wastes then they need to meet either the  
19 20 meter squared per second flux standard or a 0.5  
20 picocuries per liter at the fence line.

21 We think those are generally comparable,  
22 very soft modeling calculations, so if you wanted to  
23 use the fence line. The 0.5 picocuries per liter  
24 probably borders on something over 100 millirem. If  
25 you were staying there for a long time.

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1 MEMBER BANERJEE: Okay.

2 MR. SEITZ: Okay. So we have our  
3 constraints and then when we do our --

4 MEMBER BANERJEE: That's not the airborne  
5 --

6 MR. WALLO: Yes, that would be the rate of  
7 this decayed product, airborne.

8 MEMBER BANERJEE: Airborne. Okay.  
9 Thanks.

10 MR. SEITZ: So our constraint has some  
11 built in safety factors. Then we assume that all memory  
12 of a facility is lost. That's how these exposure occur,  
13 so at some point commitments, land use agreements are  
14 ineffective. And then when someone moves on the site  
15 we're assuming that they would no longer be testing well  
16 water or be able to recognize that they're on a waste  
17 site.

18 And then when we get into the actual  
19 calculations we consider highly exposed individuals as  
20 these receptors and oftentimes we're not talking credit  
21 for all the barriers or processes that may be involved.

22 Frankly, from a practical perspective, that  
23 it may be easier to just assume that they're not  
24 effective rather than spending the time and effort to  
25 defend every single process.

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1 MEMBER BROWN: When you say compliance  
2 decisions are made in context of assuming all memory  
3 of the facility is lost, does that mean after 1,000  
4 years. For relative to your overall assessment? Or  
5 does that mean even if a site is declared open after  
6 five years, I mean --

7 MR. SEITZ: Typically is 100 years.

8 MEMBER BROWN: Hundred years.

9 MR. SEITZ: Is our institutional control.  
10 And there can be some differences. It can be justified  
11 --

12 MEMBER BROWN: Okay. I need to get the  
13 institutional out of this, I'm sorry.

14 MR. SEITZ: Yes, that's a different, that's  
15 true. Yes, the memory of the facility will be lost when  
16 we assume controls have gone in --

17 MEMBER BROWN: Okay. So that's when you  
18 relinquish institutional control?

19 MS. GELLES: We have a requirement for  
20 active institutional controls for a 100 year timeframe.  
21 After that you assume that we have complete loss.

22 MEMBER BROWN: Oh, okay.

23 MS. GELLES: And this compliance decision  
24 is relative to the quantitative period of compliance.  
25 Can we demonstrate that this system, if you assume total

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1 failure, people access the site. Don't know it's a  
2 site. Drill into it and use water that is contaminated  
3 by the radionuclides from our disposal activities, we're  
4 determining if that exceeds our PA limits or not. Based  
5 on that 1,000 year timeframe.

6 MR. SEITZ: Yes, so we're intentionally  
7 biasing a lot of factors towards more of a worst case.

8 MS. GELLES: A worst case.

9 MR. SEITZ: I don't like to say worst case,  
10 but it's pushing it that way. And the next slide I talk  
11 a little bit more about the scenarios themselves. And  
12 within the scenarios it's a probability of one, we're  
13 assuming someone will reside at that site.

14 Typically we assume they drill a well at  
15 the point and time of peak concentration. So they're  
16 very precise in where they put their well. Then we  
17 assume that they're a resident farmer, typically. And  
18 you could argue that's not a typical person in the  
19 current society.

20 So there's a lot of exposure pathways there.

21 Some sites our stakeholders ask us to look at other  
22 scenarios that are specific to considerations there.

23 And of course we have our intruder, and I'll talk more  
24 about intruders later.

25 So there's a lot of safety factors built

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1 into this. And I think where this leads is how do we  
2 interpret things for these longer time periods. So for  
3 compliance time we use this. We agree, okay, we're  
4 going to work within this construct.

5 When you get to longer times maybe you walk  
6 back a little bit and say, you know, what's the real  
7 likelihood that someone is going to reside at this  
8 location. And you can start asking those kind of  
9 questions and risk inform the decision.

10 MS. GELLES: And just to reinforce --

11 MEMBER STETKAR: When you say you can, do  
12 you in fact?

13 MR. SEITZ: I think --

14 MS. GELLES: Yes. The answer is yes, we  
15 do.

16 MR. SEITZ: I think so, yes.

17 MEMBER STETKAR: I mean that leads you to  
18 a conclusion that 200 millirem is okay.

19 MR. WALLO: Yes, I mean if you don't take  
20 into those themes and you come up with 200 millirem in  
21 40,000 years I would say no, we shouldn't waste time  
22 refining or doing probabilistic assessments on when the  
23 other things.

24 Now, if you get something that's  
25 significantly higher it may be worth refining stuff.

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1       So that's, it's a decision making tool and you ask  
2       yourself, you know, data quality objectives. Do you  
3       have enough data to make a decision or do you need more?

4       And that's where the question is. And there's some  
5       relative, it's subjective judgement to some degree.

6               We don't have a hard line to say, yes, if  
7       you're above 25 rem then you need to do some more.

8               → MEMBER SCHULTZ: But the defense-in-depth  
9       discussion on this slide, as well as the last one, that's  
10      defense-in-depth as applied to future generations.  
11      It's not to say that we are creating the institutional  
12      controls or we're creating the allowable waste stream  
13      or usage of the facility within the first 100 years of  
14      institutional control to be affected by that. In other  
15      words --

16              MR. WALLO: We don't expect that to affect,  
17      I mean, again, our commitment is, in all our policies  
18      and our directives, is to control that site forever.

19      As long as it's hazardous. So this is only a planning  
20      tool in terms of deciding how many -- It's really a  
21      resource allocation tool. How many resources do we put  
22      into mitigating this risk for the future. Wherein our  
23      intent is as long as we own it we're going to make sure  
24      that this never happens.

25              MS. GELLES: Well but I'm not 100 percent

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1 sure I understood the nuance of your question. I  
2 apologize if this is off target. But what Roger just  
3 described is we're constructing our PAs with these worse  
4 cased assumptions. As a result of these PAs we're  
5 constraining our waste acceptance criteria to ensure  
6 that we don't exceed our quantitative limits for our  
7 1,000 year period, our point of compliance.

8 But then in our defense-in-depth system  
9 we're also ensuring that we don't lose, that we have  
10 institutional control so we don't have this kind of loss  
11 of institutional knowledge. That we are ensuring that  
12 these worst case instances never, ever occur.

13 So we've got conservatism built into the  
14 center of the target in the type of site that we select.

15 The constraints of the PA or the assumptions of the  
16 PA that we conduct. The waste acceptance criteria we  
17 arrive at deriving it from the PA and then all of the  
18 other system controls that we ensure in perpetuity.

19 So I believe there is defense-in-depth that  
20 is protective of the future generations but it also is  
21 effecting what we do today. If we didn't have such  
22 conservatism built in to these PAs we could probably  
23 tell ourselves that it's safe to accept more waste or  
24 greater concentrations of waste in this operational  
25 period. And we'll worry about it later.

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1 But we've built in conservatism at every  
2 step of our process. Is that responsive to your  
3 question? I don't think it was, but I think it's an  
4 important point for us to make because the  
5 defense-in-depth happens at every step of our system.

6 MEMBER BANERJEE: I guess I'm having  
7 trouble with -- Let's forget this for a moment but  
8 imagine that you're trying to put the waste in a place  
9 where you've got some form of an engineered barrier and  
10 you're preventing water runoff or something like that.

11 I can imagine that, I'm thinking of a mill tailings  
12 pond. You've populated your stuff and, you know, it's  
13 fallen to the bottom now you've got it in there and all  
14 this stuff.

15 This is going to deteriorate after a period  
16 of time. You know that. You can probably figure that  
17 out. So how are you going to ensure that it will not  
18 in 1,000 deteriorate and get somewhere into the water?

19 MR. SEITZ: Actually we look at it from,  
20 my personal perspective is, some deterioration is good.

21 We're better off with a gradual release than you are  
22 with something that happens quickly.

23 MEMBER BANERJEE: So you take that into  
24 account?

25 MR. SEITZ: Definitely.

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1 MS. GELLES: Yes.

2 MEMBER BANERJEE: All right. So you take  
3 iron exchange and all this sort of stuff.

4 MR. SEITZ: Oxidation.

5 MEMBER BANERJEE: And that's part of your  
6 model?

7 MR. SEITZ: And that's an example of  
8 something you can't always take credit for, but it's  
9 part of this thought process of --

10 MEMBER BANERJEE: So you set up sort of a  
11 geochemical model to take care of some of the dilutions  
12 and iron exchange and breakthrough curves and all this  
13 sort of stuff. The usual things people do. You do that  
14 for the level as well?

15 MR. SEITZ: Right. And it tends to be much  
16 more focused. We're going to go into more detail on  
17 what matters. And a lot of effort goes into identifying  
18 things that don't matter from things that do matter so  
19 we know where to focus our efforts.

20 CHAIRMAN RYAN: Sanjoy, I think there's  
21 been a lot of effort too in that concept that you're  
22 reaching for is that on the surface there's lots of other  
23 things to look at to understand the system. And as you  
24 go down in depth of burial it becomes a little bit simpler  
25 in the sense that on the surface weather processes are

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1 probably out of play, except when weather contributes  
2 to infiltration.

3 So all you need to know is the infiltration,  
4 so that one --

5 MEMBER BANERJEE: A little easier problem.

6 CHAIRMAN RYAN: So, you know, you're on the  
7 right track. But you almost have to say let's figure  
8 out what's for this system. And the point you made kind  
9 of at the beginning, is each one has to be looked at  
10 for its own parts, pieces and merits and strengths and  
11 weaknesses.

12 MR. SEITZ: Okay. And actually it's a  
13 really challenging problem. Because every problem has  
14 its different idiosyncracies.

15 MEMBER BANERJEE: Yes, because the  
16 geomorphology can change with time as well, right?

17 MR. SEITZ: Yes.

18 MS. GELLES: Absolutely right. I'm a  
19 little concerned about time, just because we want to  
20 make sure we get to the important aspects of Andy's  
21 presentation as well.

22 MR. SEITZ: And too, we're covering some  
23 of them.

24 MS. GELLES: And that's fine.

25 MR. SEITZ: Okay, we'll move through these.

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1       This one, I just wanted to make a couple statements  
2       about scenario development. And there's been a lot of  
3       discussion of the use of features, events and processes.

4               And I think from a DOE perspective our  
5       experience is we tend to start from a conceptual model  
6       focus. We want to start with describing the system and  
7       its evolution and then refine it as we go. Where we  
8       need to.

9               And then as Mike was referring too we look  
10      at it from a systems approach. So as we refine it it's  
11      not just one part of the system is interesting, we need  
12      to understand it. It's how does that part of the system  
13      contribute to the overall performance? So something  
14      on the surface that seems like it would be important,  
15      like a cover, you may think boy we really have to  
16      understand that.

17              But for example in a case like this with  
18      a tank, the cover's probably going to fail before the  
19      tank does. So it really doesn't matter. The cover  
20      performance is less important in a situation like this.

21      So you always have to keep perspective about the whole  
22      system.

23              MS. GELLES: Which reminds me of a point  
24      that perhaps we need to not assume everybody understand.

25      There's great diversity in the types of low-level waste

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1 disposal systems that we have across our sites. Much  
2 as you accounted for, we might have site-specific  
3 considerations or constraints at sites in the west than  
4 we would in the east relative to the constraints of our  
5 waste acceptance criteria.

6 There are great differences in the types  
7 of waste we're dealing with and the types of facilities.

8 Thank you. I apologize for the interruption.

9 MR. SEITZ: And the concept that's appeared  
10 more in the last few years internationally is the idea  
11 of safety functions. I think it's actually related to  
12 reactor concepts. And I think it's a very good concept.

13 It's how we really think about these systems. We're  
14 looking at the different parts of the system and then  
15 we try to think about which ones are we relying on?  
16 What is the function that's expected of that part?

17 For example, reducing grout in this case.

18 That's related to technetium release. If we keep it  
19 reduced it's not as mobile, it's not as soluble. So  
20 then you start to think, the FEPs come into it. Okay,  
21 well what could happen to change it from reducing to  
22 oxidizing. What kinds of things could happen that would  
23 change it and make it more mobile?

24 And the safety functions perspective helps  
25 you to think about these things as different safety

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1 layers in a system. And you can see we look at multiple  
2 levels of detail in our models as well.

3 I'll just go through these pretty quickly.

4 MS. GELLES: I'm not trying to rush you,  
5 I just want to make sure we continue it along.

6 MR. SEITZ: And in terms of scenario  
7 development, internationally there's been quite a lot  
8 of work in the last several years. And I think they're  
9 mirroring this idea that really what's been done in  
10 practice is more of a top down, bottom up. So kind of  
11 this conceptual model first. Development under initial  
12 conceptualization of the system.

13 And then once you have that  
14 conceptualization you refine it. Then you start  
15 looking at, okay, what can impact that. And the two  
16 codes basically in all programs, the starting point is  
17 development of a detailed description of the initial  
18 state of the system. So it reflects this conceptual  
19 approach.

20 And when they talk about FEP lists, FEP  
21 databases, it's in the context they've evolved, at least  
22 in more advanced programs, to become mainly a tool for  
23 checking completeness in a system and scenario  
24 description that's already been derived, rather than  
25 something that you're building from the ground up.

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1 I mentioned the PA maintenance process.  
2 This is how we manage uncertainties. And one that's  
3 become very clear over the years is, if you've been  
4 involved with radioactive waste management, we have to  
5 make decisions under uncertainty. There's always  
6 uncertainties involved.

7 And what the maintenance process does, it  
8 gives us a means to try and address those uncertainties.

9 And we've also, as a result of some of these  
10 uncertainties, we've increased the use of probabilistic  
11 modeling. And I'd like to emphasize, it's both for  
12 sensitivity analysis and uncertainty analysis.

13 And in my opinion, sensitivity analysis may  
14 play a more important role than in uncertainty analysis  
15 because using sensitivity analysis is how we get some  
16 priority. We can identify parts of the system that are  
17 important for the conclusion as well as parts that really  
18 have no bearing on the conclusion and don't warrant a  
19 lot of effort.

20 When talked about the maintenance process,  
21 in the early 90s the initial thought was, it's kind of  
22 per the previous discussion, we're constantly getting  
23 different kinds of waste, different waste forms. And  
24 we needed a formal approach that to be able to address  
25 these changes that would occur from our initial basis.

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1           It's evolved from that to more of a broader  
2 confidence building concept. And you'll about some of  
3 the maintenance activities and the site-specific  
4 presentations.

5           And confidence building, now we have  
6 demonstrations. We've got field studies. There may  
7 laboratory experiments or, this picture is actually,  
8 it's a mesoscale laboratory experiment. We have  
9 monitoring that goes on at the facilities. And we've  
10 developed a process that's modeled after the USQ process  
11 that really focuses on that initial idea of changes.  
12 We're trying to address changes.

13           And that's the unreviewed disposal question  
14 evaluations gives us a procedure to address, if we get  
15 a design change, a container that wasn't considered in  
16 the performance assessment, it gives us an approach to  
17 evaluate those.

18           MEMBER ARMIJO: Roger, I just want to just  
19 quickly go back to your Slide 22 and ask a quick question.

20           MR. SEITZ: Okay.

21           MEMBER ARMIJO: That's a pretty robust  
22 looking disposal. It's got grout, it's got some sort  
23 of concrete and steel container and high density  
24 polyethylene layers and all sorts of stuff. So you put  
25 something in there that you want, low-level waste, that

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1 you want to keep out of the environment but some time  
2 in the future then you have a scenario a probability  
3 that, one, somebody wants to drill right through that.

4 MR. SEITZ: In this case not. The drilling  
5 would occur nearby. This is actually a tank closure  
6 problem.

7 MS. GELLES: And this is a case we're not  
8 emplacing low-level waste in the tank. We've removed  
9 --

10 MEMBER ARMIJO: You're just vouching it's  
11 in place.

12 MS. GELLES: -- the liquid waste and we're  
13 leaving the tank structure in place as a low-level waste  
14 disposal system rather than exhuming the entire  
15 construct of the tank.

16 MEMBER ARMIJO: So for this particular case  
17 you do not consider that somebody is going to decide  
18 to plant his farm right on top of it and drill a hole?

19 MR. SEITZ: We do.

20 MS. GELLES: We do.

21 MR. SEITZ: No, we do. But one of the  
22 nuances for intrusion is you can take credit for  
23 engineered features. There may be, in certain  
24 environments if you have a solid concrete tank, like  
25 at Savannah River, it's unlikely someone's going to

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1 drill through it.

2 MEMBER ARMIJO: You'd think he'd stop at  
3 awhile.

4 MR. SEITZ: Right. And when you drill down  
5 and think more detailed about these intrusion scenarios,  
6 we kind of have these base scenarios that there may be  
7 engineered features that can change the timing of the  
8 scenarios or things like that.

9 MEMBER ARMIJO: Or make the intrusion event  
10 stop. Somebody's drilling and he grinds up a bunch of  
11 drills and says this is not a good spot and moves along.

12 MR. SEITZ: Exactly.

13 MEMBER ARMIJO: Okay.

14 MS. GELLES: But we don't assume that  
15 necessarily. We assume that he hits it and then moves  
16 over and drills somewhere nearby. There is some  
17 modeling in impact.

18 MR. SEITZ: And actually there is -- And  
19 we assume that they drill through a transfer line  
20 actually.

21 MEMBER ARMIJO: Okay. And then based on,  
22 after radioactive decay, time and everything else, then  
23 you calculate their dose assuming they'd lived there  
24 for a year?

25 MR. SEITZ: It's right back to this --

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1 MEMBER ARMIJO: So a one-year --

2 MR. SEITZ: Yes, and we have a little  
3 discussion later about the intruders.

4 MEMBER ARMIJO: Okay. Thank you.

5 MS. GELLES: Thank you.

6 MR. SEITZ: Okay. And the last slide for  
7 my part is one thing that we've found, as more and more  
8 people got involved with waste disposal and doing  
9 performance assessment it became apparent that we really  
10 needed to work hard to share information. And so we've  
11 created a Community of Practice.

12 And a lot of the reason for creating it is  
13 we saw that there's this potential for inconsistencies  
14 in how things are done. So we wanted to make sure people  
15 were aware of what was being done at other sites.

16 We also use it for continuous improvement.

17 If someone has a good idea at one site we want them  
18 to be using that approach at another site. And also  
19 it's a means for us to maintain some enduring capability.

20 We're all getting older and so this is an opportunity  
21 to share experiences in a more broader fashion.

22 So the Community is implemented through  
23 technical exchanges, workshops, we even have technical  
24 support for sites that are embarking on a new PA. And  
25 these meetings, we've had NRC staff participating in

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1 these meetings. We have state regulators, EPA,  
2 international participants. These meetings have been  
3 pretty well attended. It's proven to be a good approach  
4 to share this information.

5 Okay. Now we'll pass it on.

6 → MR. WALLO: Okay. As we move along here  
7 I may or may not read from the slides so if I skip over  
8 something you really wanted to talk about, I may get  
9 to it, but feel free to stop me if I don't cover something  
10 in a slide. I'm going to just use those as memory joggers  
11 and just kind of talk here.

12 The first slide basically talks about our  
13 authority, which as you know is the same as the NRC.

14 It's derived from the Atomic Energy Commission. But  
15 we had a little bit broader authority, unlike the  
16 Commissions, we weren't just charged to regulate special  
17 nuclear and source byproduct material, but rather we  
18 had additional charges under that AEA to protect the  
19 public from radiation and radioactive material as a  
20 result of our research, development and production  
21 activity.

22 So we do regulate, and have always  
23 regulated, accelerator produced materials. And  
24 various norm and T-norm materials.

25 One of the things we wanted to note about

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1 our regulatory structure is we do have a real regulatory  
2 structure. And it's not a random thing that everyone  
3 gets to do what they want. But we have a series of,  
4 it's as I said a weighed approach with many oversight  
5 organizations and many arms of the regulatory process.

6 We define responsibilities and  
7 authorities, which again come from the Atomic Energy  
8 Act primarily, but also the Energy Reorganization Act.

9 And our general protection standard, like NRC's, is  
10 the 100 millirem that we derive from the advisory groups.

11 And it's 100 millirem from all sources and all pathways  
12 combined, which is why we use dose constraints.

13 As Roger noted we try to look at others and  
14 try to design our standards to be both internally  
15 consistent as well as externally consistent to the  
16 extent we can.

17 And one of the things we really try to do  
18 is, within the Department, to make sure all our  
19 directives move ahead together. When a few years ago  
20 our occupational standard, 10 CFR Part 835 moved ICRP  
21 60, we moved our public standard which is the other  
22 element that would be equivalent to NRC's 10 CFR Part  
23 20 for the public, 458. We moved that to ICRP 60 and  
24 as this latest revision of 435 comes out it will be due  
25 in ICRP 60, we're moving our nuclear safety directives

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1 too.

2 So we really try to do it within a few years  
3 to keep everything consistent and in the same general  
4 timeframe. And that's how we design all these  
5 requirements, to try to help them move along.

6 Go ahead.

7 So I just want to talk briefly, and I'll  
8 go over this quickly, is our radiation protection of  
9 the public and environment. And this, as I said, is  
10 equivalent to the public protection side of 10 CFR Part  
11 20 in our C Space.

12 We have a general standard of 100 millirem  
13 per year for the public. And we set a dose constraint  
14 of 25 for DOE activities. And it's all sources and all  
15 pathways.

16 Radon is handled separately. As is in most  
17 standards. We don't count medical exposures or  
18 background radiation. And obviously those folks that  
19 are exposed under occupational exposure, that's dealt  
20 with under 10 CFR Part 835. And we also apply ALARA  
21 in all cases.

22 I do want to note that we do control radon  
23 separately. We have specific standards for cleanup for  
24 radium and radon. So even in our equivalent to Subpart  
25 E of 10 CFR Part 20, which we actually started developing

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1 back in 1985 and first issued in the previous order  
2 5400.5 in 1990. And have since updated to 458.

3 We had a cleanup standard that was  
4 approximately 25 millirem. Again initially because we  
5 don't feel models project anything beyond one  
6 significant digit we did start out with 30. But  
7 ultimately to be consistent with NRC we did change to  
8 25. I'd like to say it's one-quarter of the dose limit.

9 So I can still say we're using one significant digit.

10 And that's the same kind of concept that  
11 we're looking at in terms of looking at the low-level  
12 waste modeling as I get to talk about that, is really  
13 what are you getting, what is your model telling you  
14 and what's the significance of it. And the realism of  
15 it.

16 And it's the same thing we did with the  
17 public protection, except there we're not projecting.

18 Those limits actually apply at the time and true  
19 releases, those are not to real people. But they're  
20 to stylized the people just like we do in the 435.

21 I will briefly mention, we noted that  
22 actually the radioactive waste management concept that  
23 we have now dates back to '88. It was issued as one  
24 of our four-digit orders, 5820.2A. And in starting to  
25 implement that we learned a few things and there have

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1 been developments that led to the current 435 and then  
2 refinements that Christine will be talking about in what  
3 we anticipate from the next 435.1 Order.

4 We did get a recommendation now  
5 implementing 5820.2A from the Defense Board in  
6 oversight. And one of the major things about that was  
7 they wanted -- We were focusing on low-level waste sites  
8 and they gee, you're putting these low-level waste sites  
9 along with all your other sites.

10 Now, the predecessor to our public  
11 protection order took that into account because we have  
12 to look at all doses from the sites to identify who are  
13 maximally exposed individual. But the Board was saying  
14 well you're projecting things hundreds, thousands of  
15 years in the future, what happens to the combination  
16 of all of these sites in that period. So we took that  
17 to heart in the development of 435.1, as we did those.

18 Next slide.

19 So we began 435 in the mid-90s. It does  
20 cover high-level, transuranic, low-level and has  
21 general requirements in it. I'm going to talk mostly,  
22 and we've been talking mostly, about the low-level waste  
23 requirements.

24 In developing the revision to the 5820  
25 Directive we had many, many workshops. A lot of

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1 interaction with those that were being regulated by the  
2 orders and those that were the disposers and the  
3 customers of the disposal sites.

4 MEMBER BANERJEE: What do you mean by mixed  
5 low-level there?

6 MR. WALLO: Well the order also covers  
7 low-level waste that's mixed with hazardous waste. So  
8 any of the waste forms that we dispose of, which would  
9 include high-level waste, transuranic waste, low-level  
10 waste or chemical and radioactive waste mixed. There  
11 are requirements in this order to make sure we manage  
12 it appropriately.

13 The package with the order included the  
14 order itself, which gave the general and overarching  
15 requirements, the manual which was a requirements  
16 document and fairly substantial, that gave the detailed  
17 requirements of the order. And then there were  
18 technical basis documents and guidance materials that  
19 gave some insights of how you might best comply in a  
20 training program.

21  
22 And again, the goal of this order is to  
23 implement our radiation protection requirements that  
24 are in 10 CFR Part 835, for workers. And 458 for the  
25 public in the waste management area. This is the

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1 implementing order to make sure those things are all  
2 effective.

3 The order was effective in July 2000 and  
4 we've been implementing it ever since. One of the big  
5 outcomes, and partly influenced by the Board  
6 recommendation, was the creation of a Low-Level Waste  
7 Federal Review Group.

8 Previously under 458 DOE Office, deputy  
9 assistant secretaries were responsible to approving  
10 disposal authorizations. And the Department had in  
11 place a guidance group that was made up of contractors  
12 that would review each PA and go through a process with  
13 the site and the developers and the exchange.

14 Two things happened. First of all, we  
15 realized that that function was probably inherently  
16 governmental, hence the creation of a DOE Low-Level  
17 Waste Federal Review Group.

18 But also, the focus of this technical group  
19 really got to be very technical. And a lot of time there  
20 would be year's reviews done on a PA. The PA sent back  
21 and back and back, all for technical questions that maybe  
22 didn't make, wasn't a lot of value for the decision to  
23 whether to authorize the disposal or not.

24 And what we found was we needed to combine  
25 not only technical reviews, but we needed decision

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1 makers that were thinking of the process of what's  
2 important to authorizing this site. Not is that KD  
3 factor for that particular radionuclide exactly right,  
4 should we adjust it up and down.

5 And in all honesty those things did delay  
6 a lot of PAs back then, in the '80. And so one of the  
7 real benefits of the Federal Review Group is that focuses  
8 it. We still use contractors. We have review groups  
9 that we set up when a PA is ready for review and ready  
10 for authorization that includes contractors as well as  
11 the DOE staff.

12 And then the results of that review and its  
13 analysis come to the Low-Level Waste Federal Review  
14 Group, and basically just like a licensing procedure,  
15 the decision is do we recommend that the deputy assistant  
16 secretary authorize the operation, or the continued  
17 operation, of this disposal site.

18 In addition, part of that review covers the  
19 composite analysis that was the other element of the  
20 Board recommendation. We do look at all DOE operations  
21 impacting or that that low-level waste site may impact  
22 or those sites may impact in terms of an off-site  
23 receptor and asked the question is there potential for  
24 doses to exceed our dose limits over 1,000 year period  
25 as a result of combined operations for the facilities.

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1 Now, this is not a compliance decision  
2 because we're projecting these doses in the future.  
3 What it is is a decision to say, gee if this starts to  
4 exceed our 25 millirem constrain, or 30 millirem  
5 constraint, combined then we need some time in the future  
6 to figure out what we're going to do and we need a plan  
7 to do that.

8 → MEMBER BANERJEE: So is that authorization  
9 given for a period of time? Like 60 years or 100 years?

10 MR. WALLO: The authorization has to be  
11 re-reviewed at the time when the PA is resubmitted.  
12 There is an update on the PAs. Once it's closed then  
13 it will be the periodic reviews. But yes. And many  
14 times the authorization may include constraints or  
15 conditions. And those conditions then are reviewed  
16 annually to see that the site is meeting the conditions  
17 or taking actions that the conditions can be lifted.

18 MEMBER BANERJEE: But it's authorized with  
19 conditions for a certain period of time.

20 MR. WALLO: Yes, that's right. And the  
21 authorization will be revisited at some time.

22 CHAIRMAN RYAN: And then just for the  
23 member's benefit, that's not different by much of what  
24 the NRC does. They issue a license, there's license  
25 conditions for the same kinds of things Andy talked about

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1 for waste acceptance criteria, for operations. The  
2 requirements for monitoring, personnel, environment,  
3 all of that.

4 MEMBER BANERJEE: But then we have a review

5 --

6 CHAIRMAN RYAN: And that's inspected  
7 routinely by onsite inspectors who are there, for the  
8 most part, every operating working day. And then  
9 there's larger groups that come from the home office  
10 to do a more thorough and detailed review of paperwork  
11 and all the rest. So it's not atypical at all on either  
12 side of the DOE --

13 MEMBER BANERJEE: Is it typical to  
14 authorize for 40 years or something like that and then  
15 have a renewal process?

16 MR. WALLO: It's a function in the PA.  
17 Generally the PA includes an assumption of an operating  
18 period. So that's part of the review.

19 MS. GELLES: And how long that is is going  
20 to depend upon the functionality of that disposal system  
21 for the site to meet the site's needs. So a site like  
22 Nevada that is serving as a regional disposal facility  
23 is going to operate for a longer period of time than  
24 a low-level waste system devised at site that's going  
25 through a complete decommissioning and will be closed

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1 within a two-decade period of time.

2 So it's going to differ depending on the  
3 location and the mission of the facility.

4 MEMBER BANERJEE: The authorization comes  
5 from the deputy assistant secretary?

6 MS. GELLES: Right.

7 MR. WALLO: Generally the composite  
8 analysis is not as rigorous as a PA analysis. We use  
9 whatever data are available because things that are  
10 included may be plant cleanups or some estimates of  
11 residual activity. Some old disposal sites that may  
12 exist on our facility. Whatever information we have  
13 we do the best estimate we can to come up with a composite  
14 analysis and then determine what more needs to be done,  
15 if anything.

16 I just want to talk briefly again about the  
17 Low-Level Waste Federal Review Group. They are  
18 responsible for reviewing both the PAs, the CAs as well  
19 as monitoring the monitoring programs and the various  
20 updates that the sites do. And they track and report  
21 on the compliance documentation and then report back  
22 to, as we said, the senior managers.

23 This was, I feel, a real improvement in our  
24 regulatory system, was the development of a DOE  
25 functional Low-Level Waste Federal Review Group. Not

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1 that we didn't have technical experts and staff on hand  
2 that advised the deputies before, and the decision  
3 makers, but this kind of makes a little more formal and,  
4 I would say, institutionalized regulatory structure  
5 that we have at the Department.

6 All right. So what are the performance  
7 objectives in the Order? Basically it's 25 millirem  
8 total effective dose equivalent from all exposures  
9 excluding the radon. And then we have separate  
10 requirements, if you end up disposing of a radon  
11 generating radionuclide in your facility.

12 This is, as I said, consistent with the way  
13 we handle mill tailings and the way we do cleanups in  
14 our analysis for cleanup standards.

15 Next slide.

16 The air pathway, we have 10 millirem from  
17 the air consistent with the NESHAPS in addition to our  
18 25 millirem all pathways. So no more than 10 of it can  
19 go through the air pathway.

20 And then for radon the disposal sites,  
21 consistent with 40 CFR 192 and our 458.1 requirements,  
22 is a flex limit of 20 picocuries per meters squared per  
23 second. Or as an alternative you can demonstrate 0.5  
24 picocuries per liter.

25 I will note that the one difference between

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1 a low-level waste site that may have some radium  
2 generating wastes in it and another site is you  
3 demonstrate compliance with a mill tailing site by once  
4 you cap it you do the measurements. And you've done  
5 that and then you monitor forever, just watch the site  
6 and make sure the cap's still stable. You don't have  
7 to do any more major measurements to demonstrate  
8 compliance.

9 For the low-level waste site we allow them  
10 to model that dose and project it rather than measure  
11 it. So we don't wait until closure. They can  
12 demonstrate that they're going to comply with their  
13 design and their waste acceptance criteria by modeling  
14 as opposed to the measurement.

15 → MEMBER BROWN: Is this when you put the site  
16 into service or is this after it is, you talk about a  
17 representative member of the public or when the public  
18 has unrestricted access to that site? I ask the  
19 question --

20 MR. WALLO: The 25 millirem, the dose?

21 MEMBER BROWN: No, the 10 millirem in the  
22 air --

23 MR. WALLO: Yes, that's for operation and  
24 closure of the site. When we cap the site and --

25 MEMBER BROWN: When you cap it, does that

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1 mean --

2 MR. WALLO: Well if the site is closed the  
3 PA needs to demonstrate that they meet a 10 millirem  
4 per year offsite dose limits.

5 MEMBER BROWN: Okay, so it's open --

6 MR. WALLO: Yes.

7 MEMBER BROWN: So the public can now enter  
8 the site? When you say close, I'm trying to understand  
9 what you mean by close.

10 MS. GELLES: This is in the 1,000 year.  
11 We would distinguish, these are limits that we need to  
12 demonstrate we're meeting within that 1,000 year period  
13 of compliance.

14 MEMBER BROWN: This is not for the intruder  
15 though? This would be for the member of the public that  
16 lives around the site?

17 MR. SEITZ: And it will be controlled by  
18 the site monitor.

19 MEMBER BROWN: Okay. Nobody is on the  
20 site.

21 (Crosstalk.)

22 MEMBER BROWN: Nobody's on the site, okay.

23 MR. WALLO: But over time the site's going  
24 to --

25 MEMBER BROWN: Assume 1,000 years, how can

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1 you even know that even after 100 years is your --

2 MS. GELLES: It's our active institutional  
3 control requirement.

4 MEMBER BROWN: That's right, so after 100  
5 years and if you pick the 10 millirem and say the 20  
6 picocuries per meter squared per second for the radon,  
7 do you expect those numbers, if nothing else happened  
8 on the site, would those go down to what you would  
9 consider after 100 years public? Somebody could live  
10 on top of that?

11 MR. SEITZ: Your receptor location changes  
12 with time.

13 MEMBER BROWN: I have no idea what that  
14 means. I'm a person. After 100 years I go build a house  
15 on top of that site that had 20 picocuries per meter  
16 squared per second. I'm --

17 MR. WALLO: It would be assessed against  
18 the 100 millirem chronic standard, not against that 10  
19 millirem. The 10 millirem is for the operation of the  
20 site.

21 MEMBER BROWN: I'm trying to get a feel for  
22 after 100 years.

23 MR. WALLO: Yes, after 100 years we would  
24 an assessment and --

25 MEMBER BROWN: Can somebody go build a

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1 house on it if --

2 MR. SEITZ: There's a buffer zone that is  
3 assumed to be maintained over time. But say at 100 years  
4 the site boundaries may go away and the person who's  
5 getting exposed would be --

6 MEMBER BROWN: Not an intruder. This is  
7 a person.

8 MR. SEITZ: Right. The person, the member  
9 of the public that's getting exposed would be within  
10 about 100 meters. That's the location.

11 MEMBER BROWN: That's a arbitrary buffer  
12 zone?

13 MR. SEITZ: Yes.

14 MEMBER ARMIJO: So you assume they don't  
15 put their house right over?

16 MR. WALLO: That's correct. That's the  
17 intruder. The undisturbed performance individual is  
18 100 meters within the site.

19 MEMBER ARMIJO: But the intruder can go sit  
20 right on top.

21 MR. WALLO: Right. But these performance  
22 objectives are for the undisturbed performance and the  
23 member of the public that lives around the site.

24 MEMBER ARMIJO: Right. Okay.

25 MEMBER BANERJEE: You could live closer to

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1 the site.

2 MEMBER BROWN: Okay, if somebody was  
3 sitting right out in their background right at the  
4 boundary, they could get 20 picocuries per meter squared  
5 per second while they're sitting there having a beer  
6 or watching a ball game.

7 CHAIRMAN RYAN: Actually not enough to  
8 cause any problem because that's the radon flux rate,  
9 and the radon's going to whiz by his nose rather than  
10 just go up his nose.

11 MEMBER BROWN: Yes, I was trying to  
12 calibrate that with the publicly --

13 (Crosstalk)

14 MEMBER BROWN: -- four picocuries, to  
15 measure it in your basement, for instance.

16 MR. WALLO: I can't say that we've done it  
17 hard, but the 0.5 picocurie per liter has a general  
18 qualitative, I would say, order of magnitude estimate  
19 with, depending on the boundary of the site. But the  
20 0.5 picocurie per liter, which is one-eighth of the 4  
21 picocurie per liter indoor standard, is our boundary  
22 line standard.

23 MEMBER BROWN: Okay. All right. I've got  
24 it now. I'm just trying to put it in a practical context  
25 of --

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1 MS. GELLES: Clarifying question.

2 MEMBER BROWN: -- human being that might  
3 understand what you're talking about.

4 CHAIRMAN RYAN: Charlie, you've got to  
5 wrestle with another one. Outdoors that radon is going  
6 to dilute real fast.

7 MEMBER BROWN: I understand that.

8 MR. WALLO: Equilibrium. Go to the next  
9 --

10 → MEMBER SKILLMAN: Let me build on Charlie's  
11 question for a second. Point of compliance. The  
12 initial assumption or point of departure for point of  
13 compliance is DOE M 435.1-1. For performance  
14 assessments is the point of highest projected dose or  
15 concentration beyond a 100-meter buffer zone.

16 MR. WALLO: Right. That's, if you go to  
17 the next slide.

18 MEMBER SKILLMAN: Does this mean that  
19 there's a 200-meter radius around the point? Excuse  
20 me, a 200-meter diameter, a 100-meter radius? Is that  
21 how --

22 MR. WALLO: It's 100 meters from the  
23 boundary of the disposal facility.

24 MEMBER SKILLMAN: So if the boundary is as  
25 big as a football field, there's another 100 meter on

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1 each of the --

2 MR. WALLO: Each end of it, yes.

3 MEMBER SKILLMAN: Now I understand. Thank  
4 you. I was just curious.

5 MR. WALLO: And actually the next slide  
6 talks about the conditions. It's not an anything can  
7 happen kind of situation. The order actually defines  
8 certain conditions under which to do the compliance  
9 analysis. We define certain living habits of the  
10 critical group, the most highly exposed individuals.  
11 It's not just anybody random.

12 Yes, you can probably think of putting  
13 someone in the ground and covering them up and leaving  
14 them there for awhile and they might get a higher dose.

15 It's an actual average dose to a member of the critical  
16 group, somebody living near the site. The condition  
17 unless justified otherwise is 100 meters from the  
18 boundary of the disposal unit.

19 We evaluate reasonably foreseeable natural  
20 processes. We probably won't look at the meteorite  
21 hitting. But 100-year floods, if there's any seismic  
22 possibilities we may look at those things. And we do  
23 evaluate sensitivity and certainty.

24 And then we apply an ALARA process to make  
25 sure that our designs result in doses that are as low

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1 as reasonably achievable. Now let me say with that this  
2 is again kind of like the question of do you ever expect  
3 anything catastrophic?

4 Our ALARA requirements are tailored, and  
5 basically we say you do quantitative ALARA analysis and  
6 spend a lot of money if you have a lot to gain. If you  
7 don't have much to gain your ALARA is qualitative. We  
8 always do ALARA, but unless you're going to get, you  
9 know, we use \$1 to \$6,000 per person-rem as opposed to  
10 the NRC's two. We always talk in a range.

11 And if the analysis, if you're going to get,  
12 one person-rem benefit is the most you can get at it,  
13 and your analysis it's going to cost you \$1 million,  
14 you're probably not going to do a quantitative analysis.

15 → CHAIRMAN RYAN: Andy, one point that I  
16 think would help the members kind of put all of this  
17 into perspective is to answer the question of does DOE  
18 ever really walk away from these sites? You know, I  
19 think the program, correct me if I'm wrong, is that you  
20 develop a remediation plan, closure plan and then a  
21 monitoring plan for the future. So it sounds like to  
22 me that that doesn't really have an end.

23 MR. WALLO: No, it doesn't. As a matter  
24 of fact, the conditions that we state is the only time  
25 we will release these sites is if they can meet the

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1 clearance or release requirements stated in 458.1.

2 CHAIRMAN RYAN: I think that's a very  
3 important point because, you know, sometimes we get a  
4 little bit, sort of thinking about the details of how  
5 we're going to close this site, you know, what conditions  
6 we have to leave it in.

7 But the DOE's view is that they're not  
8 walking away from it. They're not going to lose  
9 knowledge that they're there, and there will be an  
10 ongoing process to make sure they are maintaining  
11 whatever requirements you set forth. Do you think  
12 that's fair?

13 MR. WALLO: Yes, it is. Absolutely. And  
14 we didn't state that there's a DOE institutional control  
15 policy where we basically did that in support of this  
16 order and 458 that states our position. Did we --

17 MS. GELLES: We did. It was in the first  
18 target. It was the outer ring in our defense-in-depth  
19 system in the slide that I presented. But that's one  
20 of our systems of control is institutional control in  
21 perpetuity, federal ownership.

22 CHAIRMAN RYAN: On the commercial side,  
23 there's a very similar requirement to maintain an  
24 institutional control fund which will operate for, at  
25 this point it's 100 years, plus any period deemed to

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1 be necessary after that.

2 MR. WALLO: Yes. I mean, keep in mind that  
3 EPA basically, we had some trouble, but their design  
4 standard for RCRA cells, initially they were talking  
5 about 30 years but that's evolved where they clearly  
6 state now, no, there is no release period. We will look  
7 at it every five years and make sure it's still safe.

8 So it's the same thing done for the hazardous waste  
9 sites that basically we're doing for our disposal sites.

10 MEMBER BROWN: And in light of that  
11 question never walking away. What did you all do with  
12 the Windsor site? That was a DOE site wasn't it?

13 MS. GELLES: What site?

14 MEMBER BROWN: There was a nuclear  
15 prototype up at Windsor at one time.

16 MALE PARTICIPANT: S1C.

17 MEMBER BROWN: S1C, yes. Totally was  
18 decommissioned and I thought it was Green Shield now,  
19 and that was --

20 MR. WALLO: We do release sites. He's  
21 talking about -- what I said was, under 458.1 we have  
22 release criteria just like NRC does under Subpart E.

23 MEMBER BROWN: Well, that's what I thought.

24 MR. WALLO: If they can meet those release  
25 requirements, yes, we will release it. But we will

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1 maintain a low-level waste site until it can --

2 CHAIRMAN RYAN: I wasn't talking about for  
3 free release forevermore. It's kind of what do you do  
4 with the waste site, you know.

5 MEMBER BROWN: I've got it.

6 MR. WALLO: We've decontaminated and  
7 released many sites.

8 MEMBER BROWN: Okay. Well, that's what I  
9 thought had happened, and all of a sudden I thought,  
10 no, you all hadn't walked away from that when I thought  
11 --

12 MR. WALLO: There's more to talk about,  
13 about the order, but I want to take time to just talk  
14 about Time of Compliance.

15 MEMBER BROWN: That's what I think we  
16 probably ought to touch on.

17 MEMBER BANERJEE: Could I just, you talked  
18 about air. Is it because near surface that becomes the  
19 determining dose and not water?

20 MR. WALLO: Actually, for the most time it  
21 always is water. The only site where air is the primary  
22 driver is Nevada.

23 (Crosstalk)

24 MR. WALLO: So we have to find some way to  
25 expose --

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(Crosstalk)

CHAIRMAN RYAN: I want to ask at this point, we're going to take a break somewhere along the line and I'll kind of let you folks maybe help me choose when that ought to be. I'm going to suggest we do it now rather than later. We've covered a lot of ground so far and maybe we can take a 15-minute break and kind of plan on coming back and starting up at about five after.

MEMBER ARMIJO: If we get into Time of Compliance now we're not going to get it.

MS. GELLES: I think that's a wonderful suggestion.

CHAIRMAN RYAN: All right, in 15 minutes we'll come back. We're off the record.

(Whereupon, the above-entitled matter went off the record at 2:48 p.m. and went back on the record at 3:03 p.m.)

CHAIRMAN RYAN: Thank you. We have had a very good discussion this afternoon so far, and I want to suggest that we let our presenters get through this Time of Compliance piece as best we can, because that way I think our questions will be tailored to the whole presentation as opposed to the first sentence or two. We can probably make a little bit of time up if we do

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1 that. So good luck.

2 MR. WALLO: I'm going to continue on with  
3 the Time of Compliance here. The summary of the point  
4 I want to make here is we didn't pull a 1,000 years out  
5 of the hat, we didn't pull the process out of the hat.

6 It was a very thoughtful exercise. And we looked at  
7 a lot of materials and even got some good advice, I think,  
8 in developing this.

9 As I told you before, one of the things is  
10 we wanted to maintain internal consistency. We already  
11 had in place our cleanup standards, the equivalent to  
12 Subpart E. Then we got feedback from many, many groups  
13 in the 435.1 working groups. We looked at NRC, EPA  
14 standards.

15 At the time we were doing this there was  
16 a lot of feedback on risk assessment and cost/benefit  
17 analysis and how we should make decisions, from OMB as  
18 well. I'll talk a little bit about that in a minute.

19 And then the NAS was doing some studies. They were  
20 particularly focused on high-level waste, but still they  
21 gave us some things to think about and I want to bring  
22 those up.

23 From the OMB perspective, one of the things  
24 that were most troublesome, not troublesome, but most  
25 interested us is at that time they were stressing the

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1 fact and concern that regulations were starting to cost  
2 the country a lot.

3 They wanted more cost/benefit  
4 considerations, and they thought that we should be  
5 discounting our analysis. Any cost/benefit or risk  
6 analysis we did, they were making recommendations at  
7 the time that we should use some discounting factors.

8 We didn't do that and we have never discounted either  
9 the cost or the health effects. I mean, we basically  
10 looked at them as flat.

11 But one question is, you know, is that one  
12 way of taking into account the future benefits and costs  
13 of something? Well, from our perspective it didn't,  
14 because in a matter of a 100 years you'll have discounted  
15 away any benefit of the health effects associated with  
16 these kind of regulations. They are virtually of no  
17 value if you use standard discounting. The  
18 other thing was the NAS, and flip to the charts. They  
19 had two studies going on at the time. One I thought  
20 -- yes, there we go. This was the first one from 1990,  
21 and again they were focusing on geologic disposal, but  
22 it still was an interesting thought.

23 A scientifically sound objective to  
24 geologic modeling is learning over time how to achieve  
25 long term isolation of radioactive waste. That is a

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1 profoundly different objective from predicting the  
2 detailed structure and behavior of a site. It is the  
3 latter use to which models have been put. The Board  
4 believes this is scientifically unsound.

5 We also are consistent with this. I mean,  
6 even then we were thinking that what we wanted to do  
7 with modeling is show how the system performed and give  
8 us some insights to that. The benefits of someone  
9 believing that you really could detail for a 1,000 years  
10 what's going to happen, for 10,000 what's going to  
11 happen, you're in a cartoon land then.

12 What happens is what you program to happen,  
13 and you try to make the models as realistic as possible.

14 But the further out you go, the more questions, plus  
15 what you're comparing them to. The next one?

16 This was the '95 study. And this first  
17 statement I personally like. Do we believe there is  
18 no scientific basis for limiting the time period of the  
19 individual risk standard to 10,000 years or any other  
20 value? Totally agree.

21 We note that although the selection of a  
22 time period of application has scientific elements, it  
23 is also policy aspects that are not addressed. And  
24 another issue is intergenerational equity. And then  
25 unfortunately, the third thing was they went on to

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1 recommend that we carry the calculations out to a peak  
2 dose or a million years.

3 MEMBER ARMIJO: It sounds like they're a  
4 little bit inconsistent.

5 MR. WALLO: So this basically led us to  
6 saying, you know, this raises a lot of questions for  
7 us. So what we did, go ahead. We actually said, you  
8 know, we agree this is isn't a science issue. Let's  
9 go to the National Academy of Public Administration and  
10 ask them to evaluate this issue in intergenerational  
11 equity.

12 So we actually went to them and said, take  
13 a look at this issue, and we're interested in getting  
14 some insights in terms of decision making. And they  
15 did a fairly -- go ahead.

16 → MEMBER ARMIJO: As you go through this,  
17 just keep this question in mind. You don't have to  
18 answer right now. From DOE's perspective, for  
19 low-level waste excluding long-lived, what's wrong with  
20 500 years?

21 MR. WALLO: Well, actually I'll answer that  
22 right now. One of the things -- and we'll get to this.  
23 We looked at this, and indeed the conclusion we came  
24 to is that the appropriate modeling period for doing  
25 these is a few hundred years. Now the question was,

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1 well, should it be 300, 500, 600, 700?

2 And what we said, well, wait a second. We  
3 really think in general terms, this is some of my  
4 thinking, that this is an order of magnitude decision.

5 We don't even have a significant digit. So 100 years  
6 is probably too short, and 1,000 years may be too long,  
7 but we're going to pick the 1,000 years.

8 So that's where we ended up. If we really  
9 think, and I think many of us think that a few hundred  
10 years is the appropriate time, and you'll see that's  
11 actually what the NAPA study said. For quantitative  
12 assessments--when we flip a little bit. They came up  
13 with the usual stylized standards.

14 There's a Trustee Principle. Every  
15 generation obviously is a trustee for future  
16 generations. The Sustainability Principle that  
17 basically said your goal is to have comparable life for  
18 future generations. But a Chain of Obligation, each  
19 generation is responsible for taking care of itself.

20 You can't sacrifice the current generation for future  
21 generations. And that near term concrete hazards have  
22 priority over long term hypothetical risks.

23 And then the Precautionary Principle  
24 basically said that look, that Chain of Obligation  
25 Principle, you don't want to do something that could

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1 have irreversible and catastrophic harm to future  
2 generations unless it has a compelling countervailing  
3 need to benefit either the current or future generation.

4 So basically -- go ahead and flip to the  
5 next charge. They were basically looking at this  
6 pragmatically, and in my words saying, look, first  
7 you've got to take care of current generations and the  
8 next near generations, and then you look more broadly  
9 and qualitatively as you go farther out.

10 In terms of their discussions and what they  
11 came up with was two to four generations and that distant  
12 future was 500 to 1,000 years. So technically we could  
13 have used that I guess to say, yes, let's stop at 500  
14 years, which I think is probably consistent with, as  
15 I recall, some of the initial Part 61 modeling in their  
16 EIS was out to about 500.

17 But anyway, the key was that future impacts  
18 needed to be weighted differently than current. You  
19 don't compare long term impacts against a near term  
20 metric. To take 25 millirem out to 1,000 years is  
21 probably too long. However, their finding was it was  
22 also inappropriate to use traditional economic  
23 discounting formulas for those long term risks. So we  
24 couldn't zero them away by discounting them.

25 And consideration of the future does not

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1 entitle anyone to impose injustice on the current  
2 generation. In general, the literature related to  
3 intergenerational equity clearly opposes making  
4 trade-offs favoring the future that fail to meet the  
5 crucial obligations to present generations, which in  
6 again, we're saying we need to focus on the predictable,  
7 reasonably predictable near term and appropriately  
8 weight those distant times where we make decisions.  
9 Go ahead.

10 And again, in terms of us doing the  
11 principle, the compliance time is not a simple matter  
12 of science but a public administration issue that needs  
13 to be selected to support good decisions. You don't  
14 just say, I can carry this number out and I'm going to  
15 compare it to a metric. It's not that kind of decision.

16 It's what is it informing you about the safety basis  
17 and your disposal site, the safety basis and your  
18 disposal system.

19 It's the question of intergenerational  
20 equity and resource allocation. That's what we're  
21 deciding on. How much are we going to spend today to  
22 avert some hypothetical risk in the future? How big  
23 does it have to be and how likely does it have to be  
24 before we spend a lot of our resources?

25 Decisions that cost little are easy to make.

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1       Decisions that are expensive is a little more  
2       difficult. And we want to basically extend the current  
3       resources to maximize both the benefit to the current  
4       and future generations.

5               I will stress again, which I stressed  
6       before, and this is a little redundant. That dose  
7       limits today are likely to have little meaning for  
8       protecting the public in 500 years, in 1,000 years  
9       certainly, and let alone in 10,000 years.

10           → MEMBER ARMIJO: Andy, I really want to  
11       understand what you're saying. If I get 25 millirem  
12       today I'll have probably no health effect. But let's  
13       make it 250 or 2,500. Whatever the dose I get today,  
14       and 10,000 years in the future somebody like me gets  
15       the same dose, they clearly have the same health effects.

16           MR. WALLO: No, they don't. Let me talk  
17       about that I guess in relative terms. For instance,  
18       if 200 years ago you got 25 millirem, it probably  
19       wouldn't impact your life expectancy because we were  
20       dying of other things than cancer.

21           Today, if we look at this slide, for  
22       instance, in 1900 the primary causes of death, for  
23       instance, in the U.S., were pneumonia, tuberculosis and  
24       diarrhea. Cancer ranked eight. In the 1800s it ranked  
25       way lower than that.

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1 Today, heart disease, cancer and vascular  
2 disease are the top three. Pneumonia's dropped to nine.

3 I know diarrhea isn't listed in the U.S., but I think  
4 worldwide it's probably still five.

5 But the fact is, in 500 years what are you  
6 going to project that means? Will 25 millirem risk of  
7 cancer to us have any meaning? We just don't know.  
8 Not only are there uncertainties in the calculation,  
9 there's uncertainty in the value of the metric we're  
10 picking.

11 MEMBER ARMIJO: I see what you're saying.

12 Yes.

13 MR. WALLO: Yes, I mean, you know, if 1900  
14 we wrote 10 CFR Part, or I mean 435, we might have said,  
15 gee, we've got to avert diarrhea, to keep the doses down  
16 below diarrhea. Well, it wouldn't be very important  
17 today.

18 MEMBER ARMIJO: I see what you're saying.

19 MR. WALLO: Yes.

20 MEMBER ARMIJO: But up to a point.

21 MR. WALLO: Yes. Well, I'm just saying  
22 it's all these factors that become uncertain.

23 MEMBER ARMIJO: Okay. Kaopectate.

24 MR. WALLO: Yes. Let's just go --

25 MEMBER ARMIJO: They might cure for cancer,

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1 right?

2 MR. WALLO: Yes, if we'd cure cancer then  
3 we'd have to look at a different thing to see what we're  
4 doing here.

5 MEMBER ARMIJO: Out of business.

6 MR. WALLO: Be spending a lot for cleanup.  
7 Let me see, do I want to go back? Dose limits.

8 Well, you'll see that the previous slide  
9 just basically summarized that there will be technology  
10 changes. And again, the slide we were just looking at,  
11 we talked about the fact that 10,000 years ago we were  
12 hunting mammoths to extinction probably, some would say.

13 And now we don't have any to hunt, but in the past 100  
14 years you see there have been major developments and  
15 changes.

16 So all we're saying is times are a-changing,  
17 and not only the modeling is uncertain, but the meaning  
18 of the end result of that modeling is uncertain. We  
19 can say, all right, we know the uncertainty of releasing  
20 so much of technetium, so much of that, but we don't  
21 know what that impact is.

22 CHAIRMAN RYAN: I think the point is that  
23 I take away from what you're saying, it's a very simple  
24 one. The framework for any model is static at a given  
25 point in time. If you want to stretch that out to a

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1 very long time, let's say 500 years plus, forget it.

2 It's not simple. You can't do it. Because you're  
3 stretching the framework of the model to some new thing,  
4 and then you've got to figure out what all the parts  
5 and pieces are of --

6 MR. WALLO: Yes. What I'm saying is, while  
7 you can understand in a certain confined time frame the  
8 meaning of the results, as you expand them out you have  
9 to broaden your understanding and reinterpret what they  
10 mean.

11 CHAIRMAN RYAN: I would say it's worse than  
12 that. You have to start over because you've got a whole  
13 new framework. You can't do it. I mean if you're going  
14 to take the guy that was hunting the mastodon and, you  
15 know, snap him into 2013, he's lost.

16 MR. WALLO: Well, that's true.  
17 Absolutely.

18 CHAIRMAN RYAN: So I challenge you to  
19 rethink that a little bit.

20 MEMBER SCHULTZ: Well, I think the comment  
21 on metrics is very important because it's thought that  
22 the metric is universal, that it's not changing with  
23 time, and of course it will. If we had a cure for cancer  
24 in 50 years so that any effects related to radiation  
25 could be cured, it would change the dynamic markedly.

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1 I mean this is the goal of lots of human endeavors right  
2 now to make that happen.

3 MR. WALLO: And one would argue that maybe  
4 we should spend more on curing cancer than we do on  
5 researching a KD for a disposal site.

6 MEMBER SCHULTZ: Thank you for saying that.

7 MR. WALLO: It's certainly not a DOE  
8 position by the way.

9 MEMBER SKILLMAN: Before you go on, what  
10 you've done with the first line there has kind of  
11 convinced us that 10,000 years is a number that's not  
12 really worth considering. But what you haven't said  
13 is here's why 1,000 is the right number.

14 MALE PARTICIPANT: I think you did.

15 MR. WALLO: I did. What I said to you  
16 basically was we thought a few hundred years was the  
17 right number. That's what we thought when we did our  
18 modeling, what we thought when we did our uncertainty.

19 We even, for ALARA analyses say we shouldn't carry our  
20 ALARA when you're looking at collective dose, not  
21 individuals out beyond a few hundred years in our  
22 guidance.

23 But when it came to the ultimate decision  
24 of what the compliance point would be, basically we said  
25 we're going to do it on an order of magnitude basis.

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1 So we're going to pick ten to the one, ten to the two,  
2 ten to the three, ten to the four.

3 Ten to the two is too small. Ten to the  
4 three borders on too big. And we never want to go to  
5 ten to the four.

6 MEMBER SKILLMAN: Okay. And until now, I  
7 didn't hear your order of magnitude discussion. But  
8 I understand it. And I agree with the use of 1,000 or  
9 600 or 800. Thanks, okay.

10 MR. WALLO: Okay. And to save time, I'm  
11 going to, oh well, I want to summarize this last one.

12 You know, just the cost of increasing  
13 compliance time doesn't just mean you run the model  
14 longer. We run the model longer, yes. That doesn't  
15 cost.

16 What costs a lot is arguing over the various  
17 parameters you put in the mill, the scheduled delays  
18 for trying to readjust parameters and assessing the  
19 extended licensing, in your case or in the NRC's case.

20 In our case it would be the authorization reviews.

21 And as I said, we had, in the early 80s,  
22 a lot of experience with that happening over just  
23 technical arguments, where you just extended and  
24 extended the process and never got to a decision.  
25 Because you didn't focus on what really needed, what

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1 was important to decide on.

2 And obviously, the farther out you go, the  
3 more uncertainty there is, the more chance of litigation  
4 you're going to have.

5 MEMBER BANERJEE: Will it have a sort of  
6 a fund for this going on to take care of expenditures  
7 in the future?

8 MR. WALLO: We go under continuing  
9 resolution.

10 (Laughter)

11 MR. WALLO: No, it's DOE's budget. And it  
12 will be --

13 MEMBER BALLINGER: But that's all. It's  
14 not a fund?

15 MR. WALLO: Yes. We do not have a fund that  
16 we put aside money. The Federal Government will  
17 continue to fund it based on the importance of this  
18 decision until they decide that it's no longer  
19 important.

20 CHAIRMAN RYAN: Sanjoy, you've got to  
21 recall too this is not for a commercial waste. This  
22 is just for Government waste that they put in and he's  
23 talking about. The commercial waste still --

24 MEMBER STETKAR: By definition, DOE  
25 existed 10,000 years ago when we were hunting the

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1 mammoth.

2 MEMBER ARMIJO: Dr. Banerjee, you are their  
3 funding agent, a source.

4 MALE PARTICIPANT: Or taxpayer.

5 MR. WALLO: You know, we're not just  
6 talking about DOE. We're talking about the Federal  
7 Government and society.

8 And I want to say, that in these kind of  
9 cases, you know, there's a lot of, well, people thought  
10 the pyramids could remain safe. But they were intruded  
11 and taken.

12 Well, one of the problems with the pyramid  
13 is people knew there was valuables in them. And they  
14 wanted them. So they took them. That wasn't a good  
15 justification.

16 What our goal here is to make sure society  
17 knows the value of this. And in general, society has  
18 done a good job at protecting itself. Even if you look  
19 at, you know, the New York incident that caused the  
20 formation of CERCLA, there we had a situation where  
21 institutional controls failed.

22 But it was a short term failure. Society  
23 discovered it and arguably created a solution to it with  
24 the CERCLA program.

25 But anyways, what I'm saying is society does

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1 respond to challenges that they think are important to  
2 respond to. And they ignore challenges that they feel  
3 are not important to respond to. And that's probably  
4 appropriate.

5 MEMBER SCHULTZ: So we reference the NAPA  
6 study. Have there been similar studies since that we  
7 would reference today? Because --

8 MR. WALLO: I don't there's been any real  
9 follow-on to the NAPA study. I think there were some  
10 proposals. But obviously didn't have the resources at  
11 the time. Ed, do you --

12 MR. HACKETT: I don't know of any similar  
13 studies.

14 MR. WALLO: Okay. Let me just go on. I'm  
15 going to go over these additional requirements.  
16 Basically we have requirements in the order to protect  
17 water resources and then we talked about the inadvertent  
18 intruder. And Roger's going to summarize that a little  
19 later. So I'm going to just jump over it here to save  
20 some --

21 MEMBER ARMIJO: Yes. But you labeled not  
22 a performance objective.

23 MR. WALLO: Exactly.

24 MEMBER ARMIJO: So protection of the  
25 inadvertent intruder is not a performance objective?

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1 MR. WALLO: No. It is a management tool.  
2 It's how we decide how much, "defense in depth" and  
3 how many controls we need. But it's not a quantitative  
4 requirement that has to be complied with under the  
5 directive.

6 You don't have to demonstrate in 1,000  
7 years. What you have to do is do an assessment of the  
8 intruder analysis, determine what you can do to make  
9 sure that the projected doses, we're not protecting the  
10 intruder. We're basically limiting projected doses  
11 under this model.

12 MEMBER ARMIJO: If such an event happened.

13 MR. WALLO: Yes, for this event, for a  
14 stylized event that we've --

15 MS. GELLES: This is important in the  
16 distinction we were making about the receptor and how  
17 close he was, or he or she was to the point of exposure,  
18 so the 100 meters away from the boundary of the disposal  
19 facility.

20 CHAIRMAN RYAN: But that's still exposure  
21 on --

22 MR. WALLO: Roger's going to do more on this  
23 in just a few minutes. So let's --

24 CHAIRMAN RYAN: If we don't run out of time.

25 MR. WALLO: Well, that's why I'm doing

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1 this. So he can get the details. And I'm going to go  
2 ahead and not go over this slide. Again, the focus of  
3 this slide is --

4 MEMBER ARMIJO: Go back to it. Somebody  
5 can come back to it.

6 MALE PARTICIPANT: Oh, okay. Now it's  
7 over.

8 MR. WALLO: What do you want to go back to?

9 MEMBER ARMIJO: No, when you mention we get  
10 to inadvertent intruders.

11 MR. WALLO: Yes. Then we can talk about  
12 that. Next one. Oh, no, I'm sorry, the one before it.

13 I just want to briefly note, again, PA and  
14 CAs are part of the analysis process that provide us  
15 some insights. They are not what protects the public.

16 All these different things form designs and  
17 institutional controls and all have input to our  
18 disposal authorization system, the monitoring plan, and  
19 the continued monitoring and continued assessment of  
20 the sites are all key to protecting the public. So it's  
21 not one element or one analyst. It's everything here  
22 and all the reports.

23 Go ahead. This is summary of the annual  
24 summaries, all the things that we do annually for each  
25 disposal site. I'm not going to go through it. We can

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1 talk about it. But I think we've talked about it before.

2 We look at the monitoring, we look at the  
3 unresolved disposal questions, and so forth and so  
4 forth. And now we're going to get to the update with  
5 Christine. And I'll make her talk as fast as me.

6 MS. GELLES: Actually, we're going to, we've  
7 agreed to skip this. So if you have any questions about  
8 this, this is just a summary of where we are in revising  
9 our DOE order.

10 Andy gave you a good detailed history of  
11 it. This has been a multi-year process informed by  
12 another cycle of the complex-wide review.

13 We expect a public comment process  
14 beginning this winter before we finalize it and put it  
15 into our formal approval system in the Department of  
16 Energy.

17 So if you have more questions, we'd be happy  
18 to talk with you about it. There will be no substantive  
19 changes to any of our performance objectives.

20 → MEMBER SCHULTZ: How long is the public  
21 comment period? When does it begin? Do you have a date  
22 yet?

23 MS. GELLES: We haven't determined it.

24 MEMBER SCHULTZ: Do you know how long it  
25 will be?

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1 MS. GELLES: I don't know that we have just  
2 --

3 MR. WALLO: Last time it was 90 days and  
4 extended. But I don't remember.

5 MS. GELLES: Yes. We haven't fully scoped  
6 that out. I apologize for not --

7 MEMBER ARMIJO: Just a quick question.  
8 Since NRC is a regulator in private sector, do they  
9 comment on the update to the DOE order? Are they in  
10 some way, do you communicate or --

11 MS. GELLES: We've been in very close  
12 communication with the low-level waste branch of the  
13 NRC staff, working very closely with Larry Camper.  
14 We've participated in their rule making efforts.  
15 They're aware of what we've been doing through our  
16 complex-wide review process.

17 The fact that they're happening in  
18 parallel, I think, makes it very important since we share  
19 stakeholders. And of course we're all aware that there  
20 are commercial facilities, the fact that we co-located  
21 with DOE facilities in the same geology, hydrology.

22 So it's critically important that we be able  
23 to plan it. So will they comment? I don't know. Will  
24 they be invited to participate in the process?  
25 Absolutely. And they have been.

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1 CHAIRMAN RYAN: And we have a number of the  
2 staff members from all over, which I appreciate their  
3 attendance.

4 (Crosstalk)

5 MEMBER ARMIJO: You raised the issue of  
6 consistency in low-level waste regulation between major  
7 Government agencies, the Department of Energy and NRC,  
8 as being something that would be very valuable as opposed  
9 to big differences. And so it's good that you're --

10 MS. GELLES: Thank you. And we work hard  
11 for that. And we also believe that, if not consistency,  
12 being complimentary and not in opposition is critically  
13 important.

14 And that's why we care so much about this  
15 period of compliance issue. Because I hope we've  
16 convinced you. We are very confident about the  
17 technical efficacy of our 1,000 year period of  
18 compliance.

19 And notwithstanding what might happen, the  
20 NRC adopts something that is closer to 10,000, we would  
21 have a significant difference between our systems. So  
22 we're hoping to inform that to the extent that we can.

23 Thanks. So any questions on 435 in the  
24 future, we'd be happy to speak with you more.

25 CHAIRMAN RYAN: Thank you.

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1 MS. GELLES: It'll be a transparent  
2 process.

3 CHAIRMAN RYAN: Okay.

4 MS. GELLES: Aren't you going to get into  
5 inadvertent intruders?

6 → MR. SEITZ: I'll just say a little bit more  
7 about inadvertent intrusion. And as Andy mentioned,  
8 it's not considered a performance objective. And  
9 that's consistent with the international viewpoint.

10 And there's some concern that people are  
11 kind of, it's becoming something real. And it never  
12 was intended to be something real. It's a hypothetical  
13 construct to evaluate, okay, if we do lose control, let's  
14 do something that kind of gives an impression of what  
15 could happen, what kind of consequences could occur.

16 And internationally they further specify,  
17 which we agree with, that we're protecting an  
18 inadvertent intruder, not someone that's deliberately  
19 getting into a facility.

20 → CHAIRMAN RYAN: Well, I mean, my question  
21 for, I don't know, a decade or more, has been when does  
22 an inadvertent intruder become an advertent intruder.

23 MR. SEITZ: And that's a very good  
24 question. Because I would consider an inadvertent  
25 intruder as someone that does not realize they're

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1 getting into something that's waste. And that's an  
2 important distinction. That affects your scenario.

3 CHAIRMAN RYAN: Oh, absolutely.

4 MEMBER ARMIJO: Well, you know, maybe I'm,  
5 I don't see the difference.

6 (Crosstalk)

7 MEMBER ARMIJO: Let me finish.  
8 Historically I've been trying to think about the  
9 pyramids. You know, those people were grave robbers.  
10 Or they were archeologists. Okay, so they would meet  
11 your advertent, all right.

12 CHAIRMAN RYAN: Yes.

13 MEMBER ARMIJO: Okay. But then these  
14 tombs, this Chinese tomb where they found all these  
15 statues buried for a thousand years or more, that was  
16 a farmer digging around. He found a statue.

17 Then everybody came in and started digging  
18 it up. And so that was inadvertent leading to  
19 advertent. So what's the difference? You know, if you  
20 want to consider them, you know, just --

21 (Crosstalk)

22 MR. WALLO: The difference is the  
23 responsibility of the individual against, we don't want  
24 to foreclose on future generations.

25 If somebody goes to the sweetest repository

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1 and decides they want to recycle the copper that all  
2 that material is stored in, they're doing it on purpose.

3 That's their responsibility. That's not something  
4 that we would plan for in the modeling.

5 So if somebody wanted to come into our  
6 geologic disposal and mine the nickel in the canisters  
7 that we're going to put waste in, they're free to do  
8 that. But we're not going to plan to protect them.

9 MEMBER ARMIJO: You're not going to worry  
10 about that.

11 MR. WALLO: That's right. That's up to  
12 them.

13 MEMBER BALLINGER: Do we want to do what  
14 the pharaohs did, the two booby traps?

15 (Laughter)

16 MALE PARTICIPANT: No traps.

17 MR. WALLO: All we want to do is inform  
18 them. And they can come and steal us blind.

19 (Off microphone discussion)

20 MEMBER BANERJEE: We can make the  
21 inadvertent advertent. Let it blow up in their face.

22 MEMBER ARMIJO: Okay, so we're looking at  
23 the totally innocent bystander, very small group, one  
24 person, ten persons. We're not talking thousands of  
25 people.

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1 MR. SEITZ: Yes. And it's a very stylized  
2 view point. And I think that's another thing that  
3 people are losing sight of.

4 But when they talk about intrusion,  
5 internationally there's a big focus on, okay, when we  
6 look at these types of scenarios, these types of  
7 conditions, what we're really trying to do is if  
8 something like this were to occur, how can we reduce  
9 the potential that it would occur and how can we reduce  
10 consequences if it would occur.

11 It's not about meeting some specific limit.

12 It's about looking, how can we make it more robust  
13 against this type of --

14 (Crosstalk)

15 MR. SEITZ: For those familiar with --

16 MR. BROWN: Why is that inconsistent with,  
17 it seems to be inconsistent. If somebody wants to come  
18 in and mine for nickel in a big tank that they happen  
19 to know it's there, and it's been there for 500 years,  
20 but yet you say you're not going to do anything to protect  
21 that. If they want to do it, they can go rip the lid  
22 off and mine down, pull the chunks out --

23 MR. SEITZ: Until they find out it's not  
24 --

25 MR. BROWN: Until they find out it doesn't

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1 have nickel in it, or it doesn't have copper or whatever  
2 it is. But yet you just said you're going to do something  
3 that takes care of the consequences of somebody doing  
4 that. It seems to me those two statements are a little  
5 bit inconsistent.

6 MR. SEITZ: No, it's branded towards  
7 inadvertent, I think.

8 MR. BROWN: Is it, okay.

9 MR. WALLO: In terms of nuclear safety  
10 space, I would say that the intruder analysis is akin  
11 to us doing accident analysis for a nuclear facility  
12 where you're saying, okay, we're going to look and we're  
13 going to put more resources to that facility, to the  
14 safety systems.

15 We're going to put safety significant,  
16 safety class systems in when it starts to approach or  
17 exceed 25 rem, the accident. Whereas if the accident  
18 can't cause more than 5 rem, we're not going to deal  
19 with those expensive systems necessarily. Standard  
20 defense in depth can happen.

21 So it's a tool to decide, again, how many  
22 resources you put to averting, or controlling or  
23 mitigating that kind of event.

24 MR. BROWN: Thank you.

25 MR. SEITZ: It's a difficult topic, because

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1 it's something that the industry has committed to  
2 internationally, that we would consider this  
3 potentially occurring.

4 But internationally there is good agreement  
5 that it is considered as an optimization issue in  
6 radiation protection parlance. And it's not a  
7 performance objective or a dose constraint. They're  
8 pretty clear about that.

9 CHAIRMAN RYAN: That's a very important  
10 statement you just made, Roger. That to me is a very  
11 important takeaway for everybody, is that it's not a  
12 dose constraint.

13 It's guidance on how to think about the  
14 system you're trying to manage. And that's a whole big  
15 different story than you've got to meet some number.

16 MR. SEITZ: Well, and I mean examples of  
17 optimization could be, okay, we have this waste form.

18 If intrusion occurs we're showing that a dose could  
19 be 600 millirem. What can we do? Oh, well, if we put  
20 that package lower in the facility we can reduce that.

21 So you're looking for things that can help mitigate  
22 it.

23 On its own, that wouldn't disqualify a site.

24 And actually, that's another way of looking at this.

25 A big concern is if this becomes too much

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1 of a what if game for intrusion, you could potentially  
2 dream up scenarios that would disqualify what is an  
3 excellent site and an excellent disposal facility. And  
4 that's really not the intent.

5 CHAIRMAN RYAN: Well, that's the Achilles  
6 heel is that, you know, that can happen. And that's  
7 not a good thing. Because you can disqualify very good  
8 sites for no reason, you know, no real reason whatsoever.  
9 It's constructed, and that's conjecture.

10 MR. SEITZ: And that's part of the basis  
11 for behind it not being a dose constraint.

12 MS. GELLES: That needs to be compounded  
13 as well if you were dealing with a longer period of  
14 compliance.

15 CHAIRMAN RYAN: I need to move along.

16 MR. SEITZ: Okay. And so there's  
17 agreement, one or more stylized scenarios. Let's come  
18 up with, we've got acute, chronic scenarios. Acute is  
19 simply a member of the public that would actually be  
20 drilling. Chronic is something gets brought to the  
21 surface, a resident establishes a home there.

22 Next slide. For us in DOE, we look at it  
23 from the perspective of waste acceptance criteria, how  
24 we can improve designs. But as I mentioned, it's not  
25 a performance objective.

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1           It's consistent with EPA's feedback on Part  
2   20. They said it shouldn't be an objective. And as  
3   I mentioned, international recommendations are pretty  
4   consistent on that.

5           (Off microphone discussion)

6           MS. GELLES: Okay. We're transitioning  
7   out of inadvertent intruder and into a comparison of  
8   --

9           MR. SEITZ: It's kind of a last remark on  
10   time frames --

11          MS. GELLES: Yes.

12          MR. SEITZ: -- just from the perspective  
13   of consistency with other standards for near surface  
14   disposal.

15          MEMBER ARMIJO: Just one quick question.  
16   Can we come back to the one year occupancy? Does this  
17   inadvertent intruder analysis assume one year in the  
18   either chronic or acute case?

19          MR. SEITZ: Acute could be shorter.  
20   There's no, you notice on the acute standard there's  
21   no time. It's not per year.

22          MEMBER ARMIJO: Oh, it's just --

23          MR. SEITZ: Yes.

24          MEMBER ARMIJO: -- one, one event.

25          MR. SEITZ: Yes. It's an event. The

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1 chronic could be a longer term, but it's averaged over,  
2 it's a year's exposure.

3 We wanted to try and have something that  
4 kind of illustrated what's done for near surface  
5 disposal, what do other regulations say. And at the  
6 top, we've got the ICRP, just this concept of how long  
7 do dose and risk have a real meaning as a measure of  
8 health detriment.

9 CHAIRMAN RYAN: Just for clarity's sake,  
10 I feel like it is not a regulation, it's guidance.

11 MR. SEITZ: Yes, it's a recommendation,  
12 yes. So that's not really a time frame. That is more  
13 just perspective of this is when they think is a  
14 reasonable amount of time for dose and risk to be  
15 somewhat representative of a health effect.

16 So starting with hazardous waste disposal,  
17 in that case it's a design standard. You design the  
18 facility a certain way, it's okay. And they rely on  
19 the controls. So they have the 30 year control period  
20 and then commitments to control it as needed beyond that  
21 time frame.

22 In our order, DOE order 435.1, it's 1,000  
23 year time of compliance. We do extend calculations out  
24 for longer time frames to inform things. We have a  
25 commitment for 100 years of active controls. But

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1 there's also this longer term commitment to control it  
2 as needed into the future.

3 → MEMBER ARMIJO: But the presumption there  
4 is that the Federal Government as we currently know it  
5 will exist during that time.

6 MR. SEITZ: It's for both actually, for  
7 hazardous waste and for us.

8 MEMBER BALLINGER: Then why such huge  
9 difference in, hazardous waste to me is no different  
10 than low-level waste. Why such a short time for  
11 hazardous waste?

12 MR. WALLO: It's a design standard.  
13 Basically they say build it, you know, and they'll  
14 monitor it for 30 years. And, I mean, physically you  
15 require monitoring the owner. And then they will watch  
16 it from then on.

17 MEMBER BALLINGER: That's exactly what  
18 you're doing.

19 MR. WALLO: Well, the only difference is  
20 we don't have a design that you say we build it to.  
21 We basically make our design based on our performance  
22 assessment.

23 MR. SEITZ: If a liner leaks a collection  
24 --

25 (Crosstalk)

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1 MR. WALLO: And I'm not sure which would  
2 be, that might be cheaper, you know.

3 MEMBER BANERJEE: A hundred years is --

4 CHAIRMAN RYAN: It's very important to  
5 recognize that RCRA sites have double liners, and cover  
6 liners and all that good stuff. And they monitor them.  
7 And when they fail, they fix them, period. They don't  
8 want the waste problems.

9 MEMBER BANERJEE: Fix a double liner.

10 CHAIRMAN RYAN: So it's a much different  
11 strategy and system. So that's very important to not  
12 lose track of. That might as well be on another planet  
13 as far as this discussion is concerned.

14 MR. SEITZ: That's true, okay.

15 MR. WALLO: Well, no. I don't see any  
16 difference between, except the fact that we don't have  
17 the design standard. We design based on our performance  
18 assessment. But we do the same monitoring and the same  
19 corrective actions.

20 MR. SEITZ: That's all they do.

21 MR. WALLO: Well, I know.

22 MEMBER ARMIJO: They don't do a performance  
23 assessment.

24 MR. SEITZ: They don't do a performance  
25 assessment.

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1 MR. WALLO: They don't require it, that's  
2 right. And they certainly don't consider intruders.

3 CHAIRMAN RYAN: Right, so it's a very  
4 different system. It's not anything like, you know,  
5 what you do for rad material.

6 MR. SEITZ: And that's where the red line  
7 just went back there.

8 CHAIRMAN RYAN: Okay. Well, I just wanted  
9 the numbers to not take away, confuse the message of  
10 what's what.

11 MEMBER BANERJEE: But what is the  
12 justification for the dual standards between hazardous  
13 waste and say your DOE order?

14 MR. SEITZ: In my mind it's a design  
15 standard versus a performance based standard.

16 CHAIRMAN RYAN: And two different agencies  
17 thinking two different ways. That's part of it.

18 MR. SEITZ: Yes, basically, I mean, and one  
19 of the reasons there could be the design standard is  
20 easier to implement across a much broader group of  
21 people.

22 MR. WALLO: Yes. And let's note that, you  
23 know, the standards for mill tailings, they are based  
24 on, you know, that we listed in 10 CFR 40, but it's 40  
25 CFR 192 EPA standard.

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1           Those are basically design standards.  
2           It's not a performance assessment. They say you shall  
3           design it this way, measure it, and once you demonstrate  
4           measurements then you watch it.

5           MR. WIDMAYER: The only consideration was  
6           there were going to innumerable amounts of these  
7           facilities in tons of varieties of places. So they said  
8           there's only one way to do this, is to come up with a  
9           design standard.

10          MEMBER BANERJEE: So mill tailings would  
11          go under hazardous waste, you're saying?

12          MR. WALLO: Well, I'm saying it's a similar  
13          kind of system, more similar than --

14          (Crosstalk)

15          CHAIRMAN RYAN: It's different. Because  
16          it's confusing everybody.

17          MR. WALLO: Yes, okay.

18          CHAIRMAN RYAN: It's different. It's not  
19          the same. It's not the same as a performance based  
20          system.

21          MR. WALLO: I agree.

22          MEMBER BANERJEE: Where will the mill  
23          tailings go here?

24          MR. SEITZ: They're Part 40.

25          MEMBER BANERJEE: Part 40.

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1 MR. SEITZ: They would be part of that.  
2 And the note there is addressing what Andy had said  
3 earlier. Radon isn't assessed over this long period.  
4 It's assessed at closure.

5 MEMBER BANERJEE: At closure, okay.

6 MR. SEITZ: Right. But they do have, in  
7 cases where there's multiple radionuclides involved,  
8 they do have a 1,000 year assessment period.

9 MEMBER BANERJEE: So for example, this is  
10 an internal discussion, but why are we suggesting  
11 something so different from mill tailing, what they do  
12 for mill tailing?

13 CHAIRMAN RYAN: Because radioactive --

14 MEMBER BALLINGER: Yes. This is not a discussion  
15 for them but --

16 CHAIRMAN RYAN: -- material decays. A  
17 lot of the radioactive waste that's disposed decays.  
18 And then it's of no consequence. Uranium --

19 MEMBER BANERJEE: No, all I'm saying is why  
20 are we saying 10,000 years, our staff, instead of --

21 CHAIRMAN RYAN: Why do we think what? I'm  
22 sorry, Sanjoy.

23 MEMBER BANERJEE: Ten thousand years.

24 MR. SEITZ: We haven't yet.

25 MS. GELLES: He's focused in on, our core

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1 message in this is slide is look how different the NRC  
2 staff period of compliance is from these other  
3 regulatory regimes.

4 MEMBER BANERJEE: I think it's not a  
5 discussion.

6 MEMBER BROWN: Is proposing, not is, is  
7 proposing.

8 MS. GELLES: Right.

9 MEMBER ARMIJO: And that's what you're  
10 considering.

11 MR. SEITZ: And likewise, Part 20 has  
12 provisions for disposal or of granting exemptions for  
13 disposal of radioactive material in near surface  
14 facilities. And they specify 1,000 year compliance  
15 period there as well, or assessment period.

16 MEMBER BANERJEE: So do you get a lot of  
17 public comment on this and stuff like that with your  
18 orders?

19 MS. GELLES: Well, they're not readily  
20 available for public comment. I mean, we engage the  
21 public in a very continuous basis as we're doing clean-up  
22 level, or clean-up actions or making clean-up decisions.

23 And, you know, this ongoing multi-year  
24 effort of the NRC to revise Part 61 raises questions  
25 with some of our shared stakeholders. But they're

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1 questioning how our system is different or how this  
2 change would affect our system.

3 We'll see when we put our revision, or order  
4 revision, out for comment this winter. That will be  
5 really the first opportunity for folks to provide  
6 focused comment on the specifics of our regulatory  
7 system.

8 I think we all have to go to the conclusions,  
9 and I'd rather not brief these, but just remind folks  
10 that these are echoing the same points that I teed up  
11 before Roger and Andy started going into depth.

12 But we feel very confident about our 1,000  
13 year process. Performance assessment is just one  
14 element of our system. It's an informing tool for  
15 decision making. It is not, in and of itself, ensuring  
16 the protection of the public or the worker.

17 We've got lots of detailed experience and  
18 we brought two of our sites to this panel to sort of  
19 acquire lessons, our system, and give you some hopefully  
20 really meaningful illustration.

21 And through this, we hope also to answer  
22 some of those questions we took for the later part of  
23 our presentation. So if we don't answer them, let's  
24 bring them to the table again.

25 In the interest of time, I think, Mike,

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1 you'd like us to end at 4:30 so the members have time  
2 to discuss. So we'll spend about 20 minutes each site.

3 CHAIRMAN RYAN: Okay, we'll kind of make  
4 that decision when we get there.

5 MS. GELLES: Okay, that's fine. We'll go  
6 as fast as we can. And if you need us to go slower let  
7 us know.

8 MR. SEITZ: There's a couple of backup  
9 slides there with some quotes from the regulations  
10 related to radon and time frames.

11 CHAIRMAN RYAN: Okay, good.

12 MS. GELLES: Okay, so we're going to begin  
13 with Rob Boehlecke from the Nevada Field Office. And  
14 I said this earlier, but I think it warrants repeating.

15 Nevada is a very important facility within  
16 our Department of Energy complex. Because it operates  
17 as a regional disposal facility and can accept waste  
18 from any of our DOE generating sites as long as they  
19 meet the waste certification requirements and comply  
20 with the waste acceptance criteria which is, of course,  
21 an element of the low-level waste disposal system at  
22 Nevada. So, Rob?

23 → MR. BOEHLECKE: Okay, thanks, Christine.

24 MS. GELLES: Thank you.

25 MR. BOEHLECKE: I'm going to talk a little

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1 bit about how we comply with 435.1 in Nevada. Again,  
2 we've got the target graphic here that you've seen a  
3 couple of times.

4 As you'll notice on this graphic, our center  
5 circle which represents the site characteristics is a  
6 bit bigger than in the previous graphics. And that's  
7 to key in on that our site characteristics are uniquely  
8 good for low-level waste disposal and the fact that it's  
9 very arid.

10 The rainfall, which averages about five  
11 inches a year, is greatly outweighed by the potential  
12 of evapotranspiration which is up to 12 times that.

13 And the depth of the ground water is about  
14 700 feet or more. So we do not have a ground water  
15 pathway under current conditions. And in fact, the arid  
16 environment provides a significant buffer to potential  
17 climate change as well.

18 We use engineered barriers to enhance the  
19 natural barriers. I'm keying in on that defense in  
20 depth. Our performance assessment shows that the  
21 facility complies with the performance objectives.

22 And we use our PA, our performance  
23 assessment is used daily to help review waste profiles  
24 that come in from generator sites that are choosing to  
25 or selecting to send waste to us.

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1           The maintenance program, which Roger talked  
2 a bit about, allows for continual improvement. Each  
3 year we evaluate that performance assessment. We look  
4 at our assumptions or models, all that stuff that goes  
5 into the PA to determine if it is still a reasonable  
6 representation of the disposal site. And again, that  
7 allows for continuous improvement.

8           We do have a strong working relationship  
9 with several external stakeholder groups, including our  
10 advisory board and the State regulators.

11           State has authority for the mixed waste  
12 component. We do dispose of the RCRA component. But  
13 they've also got agreement in principle. They have  
14 access to look at any of our documents, including our  
15 PA, and weigh in on profiles, waste profiles that we're  
16 considering accepting.

17           The site is, for those of you not familiar  
18 with the Nevada National Security Site, it's a rather  
19 large site, about the size of Rhode Island, about 1,300  
20 square miles. We have the additional buffer of the  
21 Nevada Testing Training Range, which surrounds the site.

22           And there'll be a graphic a little further on that shows  
23 you where our disposal site is within that.

24           The Area 5 Radioactive Waste Management  
25 Site, or RWMS, I might say Area 5 on occasion, because

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1 that's the location within the National Security Site  
2 that it's located, we've actually been disposing waste  
3 since 1961.

4 The first disposal authorization statement  
5 was issued in 2000. It had some conditions in it that  
6 were talked about a little bit earlier. As we resolved  
7 those conditions, it reissued the PA, and the second  
8 disposal authorization statement was issued in 2002.

9 The 2007 change was to update our PA from  
10 a deterministic to a probabilistic modeling to help us  
11 quantify uncertainty and reduce the conservatism in the  
12 model.

13 The PA, I think it was discussed earlier,  
14 is revised when we determine that a significant change  
15 has occurred that requires an update. And we can  
16 determine that locally or, as was discussed, during the  
17 annual review process that may be picked up on by the  
18 members of the LFRG group.

19 The PA and composite analysis, again,  
20 prepared to understand the hypothetical projections,  
21 the dose calculations. The Area 5 PA determined the  
22 disposal facility dose calculations, and the CA looks  
23 at the dose from surrounding areas.

24 I'll mention that the disposal facility is  
25 located in Frenchman Flat in Area 5 where there were

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1 ten above ground nuclear tests or, I'm sorry, 14 above  
2 ground nuclear tests and ten below ground nuclear tests.

3 So those source terms had to be considered.

4 Again, the above ground is there at the  
5 surface. But it's not moving very far. And the stuff  
6 below ground is deep below ground. And there's no  
7 current pathway to bring that to the surface.

8 Again, the PA looks at post-88 waste. And  
9 the CA looks at all the waste that was disposed of prior  
10 to 1988.

11 I've got something out of order  
12 here, so not good. I'm going the wrong way.

13 Okay, so some of the other documents that  
14 we're required to have for compliance of 435 include  
15 our maintenance plan which was discussed a bit earlier.

16 That contains our assumptions and our  
17 process that guide our day-to-day operations. And our  
18 closure plan, including our monitoring plan, looks at  
19 how we will close the facility. It has a planned cover  
20 design.

21 Final closure would be revisited at the time  
22 necessary. Currently it's assumed closure in 2028.  
23 But that will depend on decisions made down the road  
24 at other sites in terms of disposal need at the Nevada  
25 site.

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1 MEMBER BANERJEE: You said 2028?

2 MR. BOEHLECKE: Currently that's the plan.

3 It's our planning date. It's based on when we will  
4 finish our environmental restoration activities within  
5 the Nevada site. Other sites may go on further. And  
6 if the choice is made to keep the facility open, it'll  
7 have to be re-looked at then.

8 CHAIRMAN RYAN: You'll be out of current  
9 space in 2028?

10 MEMBER BANERJEE: Yes, based on space?

11 MR. BOEHLECKE: Right now, no. We've  
12 currently, and I think I talk about this a little further  
13 on, we've used about 174 acres. And we've got 760 acres.

14 CHAIRMAN RYAN: Oh, okay. So you're not  
15 going to run out of space.

16 MR. BOEHLECKE: And we still have room --

17 CHAIRMAN RYAN: That's an administrative  
18 decision.

19 MS. GELLES: Right. It's not a capacity  
20 constraint.

21 CHAIRMAN RYAN: Got it, thank you.

22 MR. BOEHLECKE: The Nevada waste  
23 acceptance criteria is our document that we use to  
24 communicate to all the generators about what they can  
25 send us. It has everything in there from the

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1 concentration levels to packaging criteria,  
2 transportation criteria, all of those things we want  
3 to communicate to our generators on how they should send  
4 waste to us.

5 MEMBER SCHULTZ: Rob, how would  
6 characterize, this is Rev 10?

7 MR. BOEHLECKE: Yes.

8 → MEMBER SCHULTZ: So how would you  
9 characterize the revisions that had been made, is it  
10 new waste forms or what?

11 MR. BOEHLECKE: Many different things,  
12 yes. It could be new waste forms. The waste criteria  
13 reflects what's in our safety basis documents as well.

14 So if we look at something else on the safety  
15 basis side in terms of how we want to operate the  
16 facility, what kind of packages we want to accept, how  
17 we want to receive the trucks, something as simple as  
18 having uncovered or covered trucks that would  
19 potentially change. It also aligns with our RCRA  
20 permit, so waste codes and that kind of thing.

21 So we're currently on Revision 10 which was  
22 published this past summer. And that's over, what time  
23 period would that be, 16 years or so, I think.

24 MS. GELLES: Right. And all revisions are  
25 not equal. So this last revision was to align it with

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1 the documented safety analysis when we had realized we  
2 could handle larger concentrations of radioactivity  
3 within a single container.

4 Previous ones, a really significant  
5 revision was when we obtained our new permitted mixed  
6 low-level waste facility in the 2008 time frame. That  
7 was a significant change in the waste acceptance  
8 criteria. Because now we could accept offsite mixed  
9 waste.

10 Some changes have been more administrative  
11 in nature. When the Nevada Test Site ceased to be the  
12 Nevada Test Site and became the Nevada National Security  
13 Site, that required a revision to our documents.

14 MR. BOEHLECKE: Absolutely. There's  
15 always administrative changes. The technical changes  
16 in the last revision, we're looking at Type A containers,  
17 and also classified waste, and how we wanted to receive  
18 that and the process we wanted generators for classified  
19 waste to go through.

20 → CHAIRMAN RYAN: Does the State have any  
21 licensing or authority over the site, State of Nevada?

22 MR. BOEHLECKE: As far as the RCRA  
23 component, yes. They have regulatory authority for our  
24 mixed level waste disposal on the RCRA component. And  
25 we do have a RCRA design cell that we were talking about

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1 earlier.

2 But again they can, through our agreement  
3 in principle, have access to any of our documentation,  
4 or we provide the WAC to them for review. They don't  
5 concur to it. But we address their comments.

6 They sit on our panel that reviews all of  
7 our waste profiles that come in. Again, they don't have  
8 approval authority, so to speak. But they do comment  
9 and are free to comment. And we try to address all those  
10 comments.

11 MS. GELLES: But they have no formal  
12 regulatory authority over our disposal of straight  
13 radioactive waste.

14 CHAIRMAN RYAN: Got it. Thank you.

15 MR. BOEHLECKE: A little bit on the natural  
16 site conditions that I spoke about earlier. Again,  
17 we're about 700 feet above the water, the ground water  
18 table, five inches annual rainfall a year, high  
19 evapotranspiration rates leading to no ground water  
20 pathway.

21 The water vapor flow is actually up in the  
22 upper regions of the vadose zone. And so there's really  
23 limited pathways for the buried waste to get to the  
24 surface.

25 You actually have to combine a couple of

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1 pathways in terms of the water vapor coming out.  
2 Because the actual top feet are not conducive to, it's  
3 so dry the water vapor can't get out.

4 So it has to combine with a biological  
5 pathway such as, I think it's on the next page here,  
6 such as rodent burrowing or root uptake, that kind of  
7 thing. You can see the liquid diffusion and advection  
8 stops at about the two meter mark.

9 So this is our conceptual site model,  
10 potential transport mechanisms. Again, outflow is  
11 upward in the waste zone and limited pathways, so I'll  
12 mention also both seismic and volcanic activity in the  
13 area. Key point, no ground water pathway.

14 Some additional characteristics, there you  
15 can see a layout of our site. And right now you can  
16 see that there's a flood control berm around the 184  
17 acres in use. The remaining 740 or what's left of the  
18 740 acres are to the west of the facility there in the  
19 undeveloped area at this point.

20 Unique to the rest of the land on the Nevada  
21 National Security Site, this is actually owned by the  
22 NNSA. Several years ago the deed was taken as opposed  
23 to, you know, use of the BLM land. But the deed is held  
24 by NNSA.

25 Again, I'll mention the disposal facility

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1 is located within an area that was previously used for  
2 nuclear testing. There are other sources of  
3 contamination in the area that were considered in the  
4 CA.

5 Only the land and the fact that there's this  
6 large buffer around the land, we feel helps ensure the  
7 long term management of the site and reduce the potential  
8 for those inadvertent intruders we've talked about a  
9 bit.

10 In addition, there are no attractive  
11 resources in the area. This is a closed basin, no  
12 surface water, ground water's at 700 feet or more.  
13 There's no historical evidence that this area has been  
14 used for any kind of settlement.

15 You see the blue lines on there, maybe if  
16 they show up. We actually have three wells around the  
17 area that are not necessarily for the low-level waste  
18 monitoring but were required as part of the RCRA, the  
19 hazardous waste monitoring.

20 Although the waste and contaminants is not  
21 ever expected to reach the groundwater, if it does the  
22 ground water table is relatively flat. You can see  
23 there from the northwest to the southeast corners, about  
24 8,500 feet, and the travel time's been calculated to  
25 be over 13,000 years. And that's with data collected

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1 over 20 years at this point.

2 We also have a lot of data in the ground  
3 water in the area because of the nuclear testing program,  
4 a lot of data on the geology. And the modeling done  
5 for the ground water has shown very flat water table  
6 well.

7 MEMBER ARMIJO: You show a number of pits  
8 there. How deep are they, typically?

9 MR. BOEHLECKE: Typically our current  
10 practice is to dig them down to about 25 feet below grade.

11 In the past, some have gone deeper. And for special  
12 wastes where we want to limit the radon flux to the  
13 surface we'll put those deeper as well.

14 This graphic shows you where in the site  
15 the facility is located. It's kind of down there to  
16 the southeast corner in an area called Frenchman Flat,  
17 as I mentioned.

18 We really don't have any communities that  
19 are close, the closest being Indian Springs which is  
20 about 24 miles away across the Air Force land there.

21 I will note too, again, not that ground  
22 water's an issue from the waste, but we do not share,  
23 we're not hydrologically connected to Las Vegas, or  
24 Indian Springs or Pahrump which are the major  
25 communities in the area.

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1           As Roger talked about a little bit earlier,  
2 we've got some conservative bias in our assumptions.

3           These include that all radionuclides are available for  
4 immediate release at transport.

5           We don't take credit for the container  
6 delaying the source term. We don't take credit for  
7 inadvertent intruders recognizing the waste. These  
8 aren't in our scenarios.

9           And for the member of the public scenario,  
10 we assume that there's continuously present at the 100  
11 meters from the site, even though, as I mentioned before,  
12 there's no evidence of any long term habitation in the  
13 area.

14           And the last point there is we don't take  
15 credit for dilution of transport to that 100 meters.

16           So whatever the model shows might be in the cover, any  
17 contaminants that might be in the cover, is what we look  
18 at 100 meters from the site.

19           Again, as Roger pointed out, it would only  
20 serve to dilute it further. And because we're in  
21 compliance already, we don't need to go through that  
22 process.

23           Again, conservative bias is used for  
24 compliance. The probabilistic model is used to help us  
25 quantify uncertainty and reduce conservatism over the

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1 long term.

2 So in 2007, we used the concentration  
3 levels. And I think Roger hit on this as well. We used  
4 the concentration levels that come out of the model to  
5 help set our WAC concentration limits. That helps to  
6 protect the inadvertent intruder.

7 So again, we're not protecting the  
8 inadvertent intruder through compliance but setting our  
9 disposal limits using that.

10 Again, as I mentioned, as we move away from  
11 kind of the conservative bias and more realistic, we  
12 also looked at our resident farmer scenario being highly  
13 conservative for our specific site. Because, again,  
14 there's no resources there that you would ever have a  
15 farm. So we looked at a resident scenario with no  
16 agriculture.

17 This graph is a representation of the mean  
18 air pathway total affected dose for the compliance case.

19 You'll note on the left hand side that's a log scale.

20 So a compliance level which is our resident  
21 light blue line there, if you can make that out, is three  
22 orders of magnitude below the performance objective,  
23 again for a non-farming resident.

24 MEMBER ARMIJO: Not much worse for a  
25 farming resident.

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1 MR. BOEHLECKE: No. No, it's not. Again,  
2 for uncertainty in maintenance, kind of inform our  
3 decision making, we look at all of our model runs out  
4 to much longer times.

5 Here you can see the representation of the  
6 all pathways dose and the 25 millirem performance  
7 objective still below that. This is under the chronic  
8 intruder scenarios.

9 We look at things. For sensitivity  
10 analysis we'll look at the option of no cover versus  
11 various cover thicknesses and run the additional member  
12 of the public scenarios. And we can run these out.  
13 And I've got a slide that shows a little bit further  
14 on that we've run them out to peak impacts. It's the  
15 next slide.

16 It actually gives you the time for the peak  
17 impact, all in the millions of years. You can see that  
18 the pathways that don't require transport, those are  
19 the intruder pathways, are the earliest in terms of peak  
20 impact, because somebody's actually digging down to the  
21 waste. And these peak impacts are determined with 100  
22 realizations of the model.

23 A little bit more on the inadvertent  
24 intruder analysis, we looked at the two scenarios that  
25 Roger described, the construction scenario where a

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1 basement is dug into the disposal unit and the acute  
2 drilling scenario where a drill crew actually drills  
3 through the waste to gain access to water, exposure  
4 occurring as they're augering for the surface casing.

5 Again, these scenarios, not compliant, not  
6 driving compliance, but we used them to help set our  
7 action levels in our waste acceptance criteria if you  
8 look at the concentration limit that sets the lowest  
9 level for whatever scenario that turns out to be.

10 Moving on to our -- I'm sorry, what was your  
11 question? Okay. Moving on to the waste acceptance  
12 program, two important aspects of that program is our  
13 radioactive waste acceptance program in general and then  
14 what we refer to as our waste acceptance review panel.

15 The program itself goes out and looks at  
16 all the generator facilities through an assessment  
17 program. We'll go out and visit each assessment facility  
18 to ensure that they've got processes in place to  
19 adequately characterize both the radiological and  
20 chemical component of the waste, look at their quality  
21 assurance process.

22 We'll look at, as well, their traceability,  
23 their training of their people and how they certify waste  
24 that is to be sent to us.

25 Once we're confident that a site has a

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1 program in place to meet all our requirements, then they  
2 can submit a waste profile.

3 When that waste profile comes in, it's  
4 reviewed by the same guys that go out and do the facility  
5 evaluations. Or it's also reviewed by our operational  
6 people, the people that put together the PA and run the  
7 PA, nuclear safety personnel, Federal personnel.

8 And, as was pointed out earlier, the State  
9 of Nevada has three people that will sit on that panel  
10 as well and look at that. So the review panel will look  
11 at the waste profile, discuss it, ask the generator  
12 questions. The generator has to respond to those  
13 questions before it can move forward.

14 At this point, we have 24 approved  
15 generators. We may receive waste from more than 24  
16 sites. Because some generators act as kind of middle  
17 men. They have compliance programs in place that meet  
18 our requirements. And they'll help sites that don't  
19 want to pay for that full program ship waste to us.

20 MS. GELLES: I think this warrants a  
21 distinction from some commercial disposal facilities'  
22 operations in that we do not have confirmatory  
23 statistical sampling at our receiver site with the  
24 exception of mixed waste verification activities which  
25 are subject to the State's regulations.

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1           So straight low-level waste is not sampled  
2           upon receipt to confirm its acceptance. We do that  
3           quality control through this generator acceptance  
4           program that Rob just described.

5           CHAIRMAN RYAN: It's kind of the same  
6           function Baroque has played in the commercial site.

7           MS. GELLES: Thank you.

8           MR. BOEHLECKE: So when a waste profile  
9           comes in, the process it'll go through, again, it's very  
10          wide. This slide pretty much focuses on the PA portion,  
11          making sure it complies with the performance assessment  
12          and the disposal authorization statement.

13          We'll look at four questions for each of  
14          these profiles. Does the profile change the  
15          radionuclide inventory? And this is the assumed  
16          inventory at closure.

17          And then does it require a change to the  
18          facility design, or closure plans or the imposition of  
19          operational constraints and conditions? That might  
20          mean spacing for specific waste or burying it deeper.

21          We'll look at whether it alters the  
22          likelihood of a feature, event or process or  
23          significantly changes a parameter value. And we'll  
24          look at whether it requires a change to the waste  
25          acceptance criteria or the disposal authorization

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1 statement.

2 If the answer is yes to any of those, we'll  
3 run it through our own review disposal question process  
4 which includes primarily looking at the inventory  
5 changes.

6 Screening will be done. If it meets the  
7 WAC it doesn't need to go through this process if it  
8 meets the straight criteria in the WAC. But if it  
9 exceeds, we'll look at a screening process using some  
10 fractions based on the WAC action levels.

11 Again, if it passes here, then we don't go  
12 further. If it fails that, then we can go through our  
13 special analysis process where we put it in the model,  
14 run the model. This would be done for radon producing  
15 radionuclides and heat producing potential.

16 Some of the waste, one waste stream in  
17 particular we received in the past couple of years with  
18 some radiothermal electric generators which have a  
19 potential to produce heat in the soil insulating it,  
20 can cause a problem.

21 And so we looked at those through a special  
22 analysis. And I think I talked a little bit about that.

23 MEMBER ARMIJO: Are those the PU-238  
24 sources or --

25 MR. BOEHLECKE: No. These were strontium

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1 sources.

2 MEMBER ARMIJO: Strontium, yes.

3 MR. BOEHLECKE: So through that process we  
4 can impose operational conditions, again, depth and  
5 spacing.

6 In the case of the RTGs, we looked at spacing  
7 from each other, spacing from other waste and continue  
8 to monitor the heat that is produced by those units.  
9 We'll also look at radionuclides that may not have been  
10 analyzed in the PA when it was first set up.

11 Example of a special analysis, look at  
12 thorium nitrate waste that was disposed in Cell 13 a  
13 number of years ago, quite a large waste stream with  
14 several radionuclides exceeding the action levels that  
15 were in our waste acceptance criteria.

16 And through our special analysis process,  
17 we determined that it would be effective to limit the  
18 radon dose or radon flux at the surface by burying the  
19 waste in a bit deeper trench in a single layer with no  
20 waste on top of it.

21 So you've got that additional soil  
22 counteracting the radon flux at the surface. So you  
23 can see how the disposal was modeled there, the waste  
24 thickness and the total cover representing over 25 feet.

25

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1 MR. SEITZ: That's an example of what  
2 happens if you get calculations that are above a standard  
3 at some time.

4 → MEMBER ARMIJO: You just fix it with a depth  
5 or something. In this case, is a form of the thorium  
6 nitrate such that it is releasing the radon so it can  
7 diffuse out slowly? Or is it encapsulated or what?

8 MR. BOEHLECKE: I don't have the details  
9 on that. It was disposed of some time before me.

10 MEMBER ARMIJO: Just curious.

11 MS. GELLES: We can get the answer to that  
12 question.

13 MEMBER ARMIJO: I'm just curious about it,  
14 whether you want it to accumulate or just routinely  
15 release.

16 MR. BOEHLECKE: Diffuse out and decay by  
17 the time it reaches the surface.

18 MR. SEITZ: Confining it is the goal.

19 MR. BOEHLECKE: Our PA maintenance program  
20 includes ongoing field study, environmental monitoring  
21 where we've used the PA and CA to look at those things  
22 that we may be able to get more information on, further  
23 refine or model.

24 One example of that is we were able to  
25 conduct field investigations to determine how the roots

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1 actually work to bring up moisture in the distribution  
2 for burrowing animals.

3 We've also had a continuously running  
4 vegetative cover on a long term lysimeter. I believe  
5 it's over 20 years that that's been collecting data.

6 We have not have water reach the bottom of that.

7 The annual summaries document all of the  
8 updates to the modeling, the inventory updates, the  
9 monitoring and operations of the facility and any new  
10 studies that have gone into it.

11 Additionally, the PA update looks at all  
12 the conditions and comments that have been previously  
13 provided by the LFRG group and how we've addressed those.

14 So even in today's summary for this latest year, you  
15 can go back and see how we've addressed the previous  
16 comments.

17 MEMBER REMPE: Has there ever been any  
18 major differences between the data and the modeling,  
19 and then you've had to make changes to the modeling?

20 MR. BOEHLECKE: I don't know about major,  
21 but the new, you know, radionuclides we haven't looked  
22 at before. We'd certainly have to then consider those.

23 MR. SEITZ: I think for a site with ground  
24 water there's, I guess, I would say there tend to be  
25 differences. Because what we're trying to do with the

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1 modeling is provide a conservative bias.

2 So where we'll get concerned is if we start  
3 seeing concentrations that begin to approach what the  
4 model showed. And occasionally you'll get point  
5 measurements. And that actually triggers quite a  
6 process.

7 Anytime there's a point measurement that  
8 starts to challenge a model assumption, we'll take a  
9 closer look at that. And it could cause a need for more  
10 frequent sampling.

11 MS. GELLES: Yes. And I can't think of any  
12 significant differences at Nevada, with the exception  
13 of where we've introduced a new radionuclide to the  
14 inventory.

15 And, you know, there's some detectable  
16 presence of it, but not from a release standpoint.  
17 Because that would be different than what we had modeled  
18 before.

19 MR. BOEHLECKE: And our monitoring has not  
20 identified any transport at this point.

21 MS. GELLES: I just don't think that's  
22 happened.

23 MR. BOEHLECKE: And for ground water sites,  
24 you get point measurements. Mother Nature doesn't  
25 cooperate a lot of the time.

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1 CHAIRMAN RYAN: So what do you expect in  
2 the long haul at this site? Is it a diffusion site?

3 Is anything in your waste containers ultimately going  
4 to diffuse? Or is water close to the bottom of the  
5 disposal cell? I'm trying to just get a feel for it.

6 MR. BOEHLECKE: No. I mean, the modeling  
7 shows that, you know, it's going to basically remain  
8 there on --

9 CHAIRMAN RYAN: I'm not interested in the  
10 model. I want to physically understand the site a  
11 little bit better. What's the depth of the saturated  
12 zone from the bottom of the trench?

13 MR. BOEHLECKE: Over 750 feet.

14 CHAIRMAN RYAN: Seven hundred and fifty  
15 feet, okay. So clearly you don't have to worry about  
16 it.

17 (Crosstalk)

18 MR. BOEHLECKE: Precipitation that comes  
19 down never reaches the ground water.

20 CHAIRMAN RYAN: Right.

21 MR. BOEHLECKE: It's evaporated back out  
22 or taken up by the plants. So there is no ground water  
23 pathway, which makes it an excellent site.

24 CHAIRMAN RYAN: Sure. Again, I'm just to  
25 understand it.

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1 MR. SEITZ: It's extremely depositional,  
2 isn't it?

3 MR. BOEHLECKE: It is in a depositional  
4 valley. It's a closed basin range area. So there's  
5 no surface water outflow. There's a dry lake bed in  
6 the middle of the valley.

7 CHAIRMAN RYAN: And there's the 40 inches  
8 of rain a year. So I'm envious.

9 MR. WALLO: Tectonic plate movement could  
10 move the site to California in about 2 billion years.

11 (Laughter)

12 → MEMBER RAY: To introduce just a little  
13 more soberness here, you know, I was involved in the  
14 low-level waste siting in California for a regional  
15 site. You guys are familiar with a different geologic  
16 setting, but temporally it seems the same, a dry desert  
17 site. It's not like this but close enough.

18 The problem that I see is this is all very,  
19 very responsible and complete. It's the best job you  
20 could imagine.

21 But transferring it into the world where  
22 a low-level waste site has to be sited in a different  
23 context, I just don't see how you do it. Because you  
24 can't say many of the things that you've been saying  
25 about the responsibility that DOE will exercise over

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1 time.

2 CHAIRMAN RYAN: The batting average is  
3 definitely not good.

4 MEMBER RAY: Anyway, in theory, as you  
5 know, so to me it does very much depend on whether you're  
6 in Utah or in California what the outcome is going to  
7 be.

8 CHAIRMAN RYAN: Oh, sure. Illinois,  
9 Pennsylvania, North Carolina too.

10 MEMBER ARMIJO: Okay.

11 MS. GELLES: All right.

12 MEMBER ARMIJO: here's Savannah River,  
13 that's not a --

14 MS. GELLES: Yes. We're very, very close  
15 to Savannah River.

16 MR. BOEHLECKE: Two more slides. So  
17 again, we have used research and development to do some  
18 looking through our model.

19 And we're able to optimize our cover when  
20 the facility first went through an authorization  
21 statement. They assumed a four meter cover.

22 Looking at using the model and the inputs  
23 over the years, we were able to optimize that and show  
24 that a two and a half meter cover still meets the  
25 performance objective, and there's very little

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1 additional dose. And that extra meter and half would  
2 cost a significant amount.

3 And final cover decisions will be made at  
4 the time of closure. But we're able to show that right  
5 now a two and a half meter cover would make a lot more  
6 sense.

7 Again, the PA revision is driven by a  
8 magnitude and significance of changes.

9 And final slide, just a kind of summary,  
10 again, the natural and engineered barriers, and the fact  
11 that it's sparsely populated, make it an excellent site  
12 for low-level waste disposal.

13 The WAC compliance, again, going into our  
14 defense in depth principles, aid to help protect  
15 inadvertent intruders.

16 The site assessment, PA and CA, again, makes  
17 up one part of the whole system to look at defense in  
18 depth strategy, and our maintenance program that allows  
19 for continual improvement and refinement of the model  
20 through the iterative process and taking into account  
21 whatever you may have learned over the course of the  
22 previous year.

23 MS. GELLES: Okay. So to transition to  
24 Savannah Site, another DOE site that has multiple  
25 low-level waste disposal facilities within it, Sherri's

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1 going to give us a presentation on a subset of those,  
2 but a couple of really significant differences,  
3 different hydrology, different mission purpose.

4 Because the facilities she's going to talk  
5 about are accepting only waste streams that are part  
6 of the liquid waste system from Savannah River.

7 Whereas what Rob was describing,  
8 particularly his daily use of the PA, had everything  
9 to do with the fact that he's receiving waste from 24  
10 approved generator sites. And there's great  
11 heterogeneity amongst those waste streams, so same DOE  
12 system, same DOE defense in depth concepts, but applied  
13 very differently.

14 Are you with us, Sherri?

15 MS. ROSS: I am. Can you hear me?

16 MS. GELLES: We sure can.

17 → MS. ROSS: Well, I appreciate you all  
18 making the effort to allow me to participate by phone.

19 And please let me know if you've got any questions.

20 I'm going to start with Slide 2. Again the  
21 defense in depth approach here was the multiple systems  
22 in the program that provides protection to the public.

23 But at Savannah River site, as Christine  
24 mentioned, it is a very different site from Nevada, our  
25 site being very humid in nature, we do take credit for

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1 both natural and engineered barriers to demonstrate  
2 compliance.

3 And all our disposal and closure facilities  
4 do comply with performance objectives. The PA and the  
5 maintenance program supports continuous improvement and  
6 continued compliance.

7 And so we'll take a look at those things  
8 that we have uncertainties about in the out-year peaks  
9 and see what we know about those and run those in our  
10 maintenance program, what R and D do we want to go get,  
11 what new information do we want to know, and update our  
12 analysis.

13 We have a strong external stakeholder  
14 involvement here with the State, and EPA, NRC and the  
15 public. And one of the members asked a question about  
16 feedback from the public related to doses and out-year  
17 dose and risk. And I'd like to answer that question.

18 Our citizens advisory board, which is one  
19 of our public avenues for getting information to the  
20 public, is very concerned with the current risk  
21 associated with our waste being stored in underground  
22 aging tanks versus, you know, being real concerned about  
23 the model showing results way out in the out-years.

24 They want us to concentrate on the current  
25 risk versus long-term risk, so just as a feedback point

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1 from our members of the public here at Savannah River.

2 Going on to Slide 3, a very large site at  
3 Savannah River, 310 square miles, Federally owned and  
4 controlled land, access is controlled on to the site.

5 Communities are located approximately six  
6 miles from the closure and the disposal facilities which  
7 are located predominately in the center of the site.

8 If you look at F, and H and Z, those purple areas sort  
9 of in the center of the site, those are the facilities  
10 I'll be referring to today.

11 All site waterways do flow to the Savannah  
12 River which forms a western boundary for the site on  
13 the southwest side. Anyway, any questions about the  
14 site in general?

15 MS. GELLES: You're okay.

16 MS. ROSS: All right, Slide 4. So  
17 compliance with the DOE order, liquid waste facilities  
18 are either disposal facilities such as Saltstone or  
19 closure facilities, the F and H Tank Farms.

20 And they are very different. Saltstone is  
21 designed to receive waste for disposal. And the waste  
22 is homogeniously blended in a grout form.

23 The tank farms are actually, the tanks are  
24 cleaned and they're emptied, they're cleaned and then  
25 they are closed with, you know, the residual source term

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1 is left there by filling the tank with reducing grout  
2 so the waste predominately under the surface areas that  
3 are contaminated is located predominately on the bottom  
4 of that tank.

5 All facilities have performance  
6 assessments. I've listed the major dates here for the  
7 PA revisions, 1992 and 2009 for Saltstone, F Tank Farm,  
8 2008, revised in 2010, H Tank Farm, 2011, revised in  
9 2012.

10 We do have a composite analysis on the site  
11 that covers all radioactive residues that were left on  
12 the site. That encompasses not just Saltstone and F  
13 and H Tank Farms, but our E area low-level waste disposal  
14 facilities and any other radioactive material that'll  
15 be left on site. And again, Andy had talked about some  
16 of the requirements of those.

17 So moving on to Slide 5, annual performance  
18 assessment maintenance plan and disposal facility  
19 summary reports are prepared to assess what have we  
20 learned, what do we need to know, what operations have  
21 occurred, and evaluate our compliance against where we  
22 stand in operations against that performance  
23 assessment.

24 There's also a disposal facility that does  
25 include disposal authorization, document, waste

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1 acceptance criteria, the radioactive waste management  
2 basis, closure plan and monitoring plan. And that is  
3 your typical disposal facility.

4 The tank farms are actually closure  
5 activities. So we are not receiving waste into the tank  
6 farms. We're closing with the residuals that are there,  
7 that only order requires Tier 1 and Tier 2 closure  
8 authorization plans. Again, we do also have a  
9 monitoring plan associated with that.

10 And for these three facilities I'm  
11 referring to, they are permitted by the State of South  
12 Carolina. And so they are very much involved and  
13 approve and authorize those activities as well.

14 We continuously ensure conditions remain  
15 as evaluated in our documents through this program of  
16 continuous improvements, your annual reviews, your  
17 maintenance plans.

18 I've got, on Slide 6, a detail of natural  
19 site conditions. Closure facilities range from usually  
20 within the water table to approximately 20 feet above  
21 the water table. So that's what I've got shown.

22 On the bottom left-hand picture there is  
23 four H Tank Farm tanks. Tanks 9, 10, 11 and 12 are  
24 actually in the water table as constructed. It was  
25 during a period of drought.

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1           These were designed for gravity feed from  
2 the canyons. They were recognized that they might be  
3 in the water table. They were treated. And you'll see  
4 the historical water table level there depicted above  
5 the top of the tank.

6           So we do have four that are in the ground  
7 water. We have four other tanks in H Tank Farm that  
8 the feet are in the ground water. The other tanks are  
9 above the elevation.

10          On the right hand side of the slide, there's  
11 a picture of Vaults 1 and 4 at Saltstone. And you'll  
12 see the blue line depicts your average water table.

13          And then we do have a tan clay underneath  
14 ground water flow. And the wells are located around  
15 those units. So we do have ground water monitoring,  
16 actively has been for a long time in the F Tank Farm,  
17 and H Tank Farm and around Saltstone. But again, the  
18 disposal facilities are about 50 feet above the water  
19 table.

20          And we do have a lot of water, you know,  
21 rainfall. I guess I've got another slide that's covers  
22 that, yes, Slide 7. So a humid environment, about 49  
23 inches average rainfall annually, about 16 inches  
24 infiltration rate.

25          We have multiple potential exposure

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1 pathways from some of the material over time. Ground  
2 water is our predominant pathway at Savannah River.  
3 Natural soil characteristics such as the clay in the  
4 ground does provide a barrier to movement of certain  
5 contaminants. And the site has low seismic and volcanic  
6 activity.

7 So on Slide 8, engineered features, we do  
8 have design engineered features for the disposal  
9 enclosure facilities as part of the system performance.

10 Examples are closure caps, the disposable cells like  
11 the vaults for the tanks or the Saltstone vault, and  
12 engineered waste forms such as the reducing grout that's  
13 used at Saltstone and used to fill the void space in  
14 the empty grouted tanks.

15 And you can see there sort of a depiction  
16 of the conceptual model with the multi-layer closure  
17 caps, back-filled soil around the grouted tank. You  
18 can see that the entire tank is filled with grout.

19 The large contamination zone is at the  
20 bottom there. There's a base mat, still monitor.  
21 There's a concrete vault on the outside of that for all  
22 waste types, undisturbed soil and, you know, vadose zone  
23 and saturation zone underneath the tank system. And  
24 all these are modeled in our model.

25 Going to Slide 9, conservative biases, some

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1 examples of some of the evaluations the conservatism's  
2 replaced in the model to support our decision making  
3 process.

4 We do evaluate compliance 100 meters from  
5 the edge of the facility. And to go show as  
6 stakeholders, we are planning for Federal ownership of  
7 the site. But we just do not take credit for more than  
8 100 years in our performance assessment.

9 And even though the site also was six miles  
10 from the boundaries, and we have boundary controls, we  
11 assume we lose institutional controls and the intruder  
12 or the members of the public actually get onto the  
13 facility, at 100 meters for the public, intruders  
14 actually on top of the site.

15 We do use peak aquifer concentrations,  
16 although wells normally are typically not placed in the  
17 shallow aquifers. There's three aquifers around these  
18 systems.

19 And though we will take the highest  
20 concentration, which is normally in the upper aquifers,  
21 you know, our ground water's so shallow, and it's easy  
22 to drill here that normally wells are placed to the lower  
23 aquifer just in times of drought. They don't want the  
24 wells to go dry. But we do use the highest concentration  
25 in the upper aquifers for determining dose.

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1           Intruder resides directly on the facility.

2           And we also assume for like F Tank Farm has 22 tanks,  
3           three different tank types. We assume those tanks fail  
4           at the exact same time.

5           And Saltstone, same thing, the SGE is a  
6           similar design, all fail at the same time. That gives  
7           us is some conservatism in the contaminants moving at  
8           once.

9           I'll give you peak doses. Moving on to  
10          Slide 10. So modeling, include anticipated conditions,  
11          robust sensitivity and uncertainty analysis. We're  
12          doing both deterministic and probablistic analysis in  
13          our performance assessment.

14          We do include detailed characterization of  
15          the residual material during disposal and closure  
16          operations.

17          The disposal facility, we do use a waste  
18          acceptance criteria very similar to what Nevada was  
19          explaining to evaluate proposed disposed streams and  
20          ensure that those streams are going to maintain  
21          compliance with the performance assessment and is  
22          against those objectives through the controls that are  
23          established through our waste acceptance criteria.

24          Closure facilities, we do have an overall  
25          PA for the whole tank farm. But as we clean the specific

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1 tanks, we will go in and characterize those and, you  
2 know, actually look at the final residual material and  
3 how it was inventoried in the previous modeling or update  
4 that modeling to address any changes in the actual source  
5 term.

6 So Slide 11, let's give this one some  
7 numbers here. Slide 11 is a depiction of a H Tank Farm  
8 performance assessment, the base case. It's a  
9 deterministic run.

10 These doses, these lines are not additives.  
11 They do depict the Sector A through F, which are the  
12 colored lines on the graph, are individual locations  
13 100 meters around the facility if you were to draw a  
14 circle around the facility. We've just depicted  
15 segments of that line by Sector A, B, C, D, E and F.

16 And so what we're showing here, this is  
17 1,000 year graph. We do have multiple tanks. We have  
18 29 tanks, three evaporators, miles of transfer lines  
19 which are all source terms that are feeding the results  
20 here.

21 So this is a large scale graph. And for  
22 1,000 years not much dose is actually coming from it.

23 We do, as depicted and described earlier, we will model  
24 to peak.

25 So you can see on Slide 12 the 100,000 year

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1 graph. And this, again, is a large scale. It's water  
2 pathway, again, the H Tank Farm base case deterministic  
3 run. So it includes all those source terms.

4 And again, it's not additive and it's the  
5 same Sector A thorough F. So you can see, you know,  
6 the doses are approaching around 100 in the out-years.

7 Typically, you know, 10,000 years or below, even out  
8 to 25,000 years, you're below ten millirems as your  
9 average expected dose from this case and set of  
10 assumptions.

11 I do want to state that, you know, DHEC,  
12 and EPA and the public, you know, we describe our  
13 analysis to the public. They're all very much aware  
14 of the results in our analysis.

15 We'll depict both the base case and  
16 alternate sensitivity cases and the probabilistic run  
17 and show that, you know, what's the doses in the short  
18 term, what are the doses in the long term.

19 And they're very comfortable with moving  
20 forward based on the results, even if they're showing  
21 some higher risk in the out-years.

22 → MEMBER REMPE: So, Sherri, I've got to ask.

23 On Slide 11, what happened between 150 and 200 years  
24 with Sector C and Sector A?

25 MS. ROSS: You're talking about the 100

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1 year doses?

2 MEMBER REMPE: Yes, 150 to 200 years after  
3 closure.

4 MS. ROSS: Yes. What we've got is some  
5 transfer lines that are in the tank farms which we know  
6 are contaminated. We're not assuming that those  
7 transfer lines are grouted. Because even if we grouted  
8 them, the grout would be on the inside, and your  
9 contamination's on the pipe walls. Those pipe walls  
10 will degrade.

11 So that source term is also not nearly as  
12 deep. And it's going to corrode. Those are going to  
13 be one of the first release of contaminants. So what  
14 you've got is a little bit of more mobile radionuclides  
15 being released from the transfer lines when they corrode  
16 in the ground.

17 MR. SEITZ: It's the lines that connect the  
18 tanks to other --

19 MEMBER REMPE: So something happened and  
20 the dose went away between 150 and 200 years.

21 (Crosstalk)

22 MS. ROSS: Well, it's not really going  
23 away. It's just so low it's not really showing it up.

24 MEMBER REMPE: Okay. I just was curious.  
25 Because they're trying to sell the land.

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(Laughter)

MEMBER ARMIJO: Well, you got me started.

Between 550 and 650 years there was a lot of ups and downs. What happens there? Is some physical --

MS. ROSS: Well, there're different source terms. Remember we've got 29 different tanks. They're all located at different distances from the 100 meters.

You've got evaporators, you've got diversion boxes, you've got transfer lines. These have different source terms, different rads or different mobility. They travel at different rates. Also in H Tank Farm, what was I going to say --

MEMBER ARMIJO: Well, just talk about Sector E. It goes through this undulation. And what's actually physically happening? Is there --

MS. ROSS: Well, also in H Tank Farm, a couple of the tanks, the liners are failed at Time Zero.

And other tanks are failing at different times. So what you've got is different rads, different source terms are being released at different points in time.

And you lay it out on a graph and this is what's occurring. But again, in the 1,000 year window, the doses are all less than one. The scale is really blown up.

MEMBER ARMIJO: Well, I understand.

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1 MS. GELLES: But the variability for Sector  
2 F, or Sector E, is a function of where that sector is  
3 located in the tank farm in relative proximity to  
4 different types of tanks that have different release  
5 rates or different radionuclides. And we probably  
6 presume too much. So there's, how many tanks total are  
7 there in H, Sherri?

8 MS. ROSS: Twenty-nine tanks.

9 MS. GELLES: So 29 tanks which are not  
10 identical in terms of the residual material, not an  
11 identical design, not identical integrity of liners.  
12 So each one is going to perform a little bit differently  
13 in the model. And these sectors are different locations  
14 within that tank farm. There's one single PA for the  
15 entire tank farm.

16 MEMBER ARMIJO: So these are composites.

17 MS. GELLES: They are composites, thank  
18 you. I was coming to --

19 MS. ROSS: Yes. This is for the entire H  
20 Tank Farm, for all source terms.

21 MR. SEITZ: Yes. It's more than tanks.

22 MS. GELLES: Right, and transfer lines.

23 MEMBER STETKAR: I hate to ask about this,  
24 but I'm required to.

25 MS. ROSS: Okay.

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1 MEMBER STETKAR: These are nice lines,  
2 little colored lines, and they go all over the place  
3 like over 100,000 years. And you say you've done a  
4 probablistic analysis.

5 Do you count for uncertainties? I mean,  
6 how do I interpret these lines? Are they the mean value  
7 of an uncertainty analysis? Or are they just a line?

8 MS. ROSS: Okay. This evaluation is the  
9 base case deterministic line. We have other lines on  
10 sensitivities and the probablistic analysis. I'm not  
11 showing those here.

12 MEMBER STETKAR: Okay, thank you.

13  
14 MS. ROSS: They're all inside our  
15 performance assessment. We do account for uncertainty  
16 and variability.

17 MEMBER STETKAR: It's just I read the title  
18 on Slide 12 that says risk informed. And that always  
19 means something --

20 MS. GELLES: We probably should have  
21 provided a little bit more narrative context for this  
22 specific graph. But Sherri does have a few slides --

23 MS. ROSS: I'm going to get more into --

24 MS. GELLES: -- that compare.

25 MS. ROSS: -- out-year doses and what we

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1 do to address this. So we're informed in making our  
2 decisions. But we haven't actually made decisions to  
3 close H Tank Farm yet. Because we're consulting with  
4 NRC actually.

5 But we're aware that, you know, in the  
6 40,000 year out time frame that the doses are approaching  
7 100 millieme. We know that's, you know, approximating  
8 the public standard. It's above 25. And we'll factor  
9 that into our decision making.

10 But again, we will concentrate on the risk  
11 reduction today and knowing that what in the model is  
12 causing these peaks. We want to be informed by what's  
13 causing the peaks, how high are they and what can we  
14 learn to address those uncertainties and hopefully  
15 remove any concerns associated with that.

16 I've got some more examples I'm going to  
17 get to in just a couple of slides. I hope to explain  
18 that, what we've done with out-year peaks associated  
19 with F Tank Farm.

20 So on Slide 13, ongoing compliance, we do  
21 have a rigorous unreviewed waste management question.

22 It's the same thing as a UDQE that was previously  
23 discussed at Nevada to evaluate new information or  
24 proposed activities against unexpected conditions.

25 When we find something new, your KD was off

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1 or we had more waste in the tank than we thought we would,  
2 anyway, we can evaluate those through this process.

3 And it can result, depending on the  
4 complexity of the new information, in determining that  
5 there was no impact, that activity can continue. Or  
6 we just need to do a more detailed evaluation. Or it  
7 may result in a special analysis which is an addendum  
8 to your performance assessment where you rerun your  
9 model to provide new information.

10 So on Slide 14, let me get into some more  
11 detail on how we might address out your doses. And this  
12 is a 10,000 year graph. And this is graphed from our  
13 Tanks 5 and 6 special analysis. And what is showing  
14 here is the rem line, is the original F Tank Farm PA  
15 base case, all pathway base case analysis.

16 We also ran, in Tanks 18 and 19, special  
17 analysis, the same case with new inventory from the  
18 actual inventories. We cleaned Tanks 18 and 19.

19 In Tanks 5 and 6 the solid darker blue line  
20 is the exact same base case with the actual inventory  
21 after cleaning Tanks 5 and 6. So you can do a comparison  
22 there.

23 Again, this is a log scale. These are not  
24 additive doses and they do reflect the entire F Tank  
25 Farm, 22 tanks and ancillary equipment, source terms

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1 over a 10,000 period.

2 So what we did in the Tank 5 and 6 special  
3 analysis, we also did a composite sensitivity analysis  
4 to determine the impact. And that's the light blue  
5 line. And not much difference really in the 10,000 year  
6 window.

7 But if you go to the next slide, on Slide  
8 15 for the 100,000 years, the exact same model run from  
9 the Tank 5 and 6 special analysis just plotted over  
10 100,000 year window, we were looking before about the  
11 500 millirem doses occurring around 40,000 years. And  
12 you'll see that's now dropped below ten based on the  
13 new information that we did consider.

14 So looking at the graph, if you will again,  
15 not an additive dose, and it does represent the whole  
16 tank farm.

17 The peaks are occurring around 25,000  
18 years, that red and blue dotted line, which from tech-99  
19 from the Type 1 tank, we have eight Type 1 tanks in F  
20 Tank Farm, and we have put a tech-99 source that we didn't  
21 think was real. But we wanted to determine where the  
22 impact was if we did leave some tech-99 in the tank farm.

23 And it did show that we would have a high  
24 peak, about 500 millieme. But based on the actual,  
25 tech-99 is very soluble, it's very mobile in the

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1 environment. And we do use several million gallons of  
2 water physically to clean a single tank. And so we  
3 thought the tech-99 would come out of the tank.

4 And we were able to confirm that with the  
5 Tank 5 and 6 cleaning and characterization data. So  
6 that peak actually goes away in the Tank 5 and 6 special  
7 analysis.

8 So the second large peak there around 500  
9 in the 40,000 year window was occurring from plutonium  
10 239. And so we had a solubility expert review with some  
11 recommendations. And so we changed solubility release  
12 numbers based on the NEA database that was fed into our  
13 Geochemist's Workbench to update the solubility numbers  
14 and the release mechanism for the radionuclides.

15 We also updated KDs in soil based on cement  
16 leak shape at a higher PH. Because each of these tanks  
17 range between 750 and 1.3 million gallons a piece. And  
18 we do believe that, you know, roughly a million gallons  
19 of high PH cement will affect the leaking of the rads  
20 that are located underneath that material.

21 So as a result we were able to address some  
22 of the uncertainties and come up with an analysis that  
23 now is predicting the doses will be less than ten  
24 millirem.

25 So this is an example of, you know, we are

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1 informed by the out-year doses. And we will continue  
2 to evaluate the risk in our decision making process as  
3 well as remove that uncertainty with new information  
4 as it becomes available. Any questions on Slide 15?

5 MR. SEITZ: Sherri, I just wanted to make  
6 one point. I think it's important to realize that there  
7 was quite a lot of time and effort spent to address those  
8 potential peaks at the long times.

9 MS. ROSS: They were.

10 MR. SEITZ: And in the end, nothing really  
11 changed. There was a refinement --

12 MEMBER ARMIJO: Nothing physically, but  
13 the models were --

14 MS. ROSS: Right.

15 MEMBER ARMIJO: -- refined, if you will.

16 MS. ROSS: Exactly.

17 MR. SEITZ: So it's a refinement of  
18 assumptions.

19 MS. ROSS: Right.

20 MR. WALLO: And it was not a small task  
21 though.

22 MEMBER ARMIJO: It was a lot of effort.

23 MS. ROSS: It was a lot of effort.

24 MR. SEITZ: And a lot of resources put into  
25 it.

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1 MS. ROSS: Yes. We spent quite a bit of  
2 money and about six months to address this before we  
3 closed Tanks 18 and 19 and --

4 CHAIRMAN RYAN: Correct me if I'm wrong,  
5 but was a lot of that --

6 MS. ROSS: Yes. The regulatory agency,  
7 the EPA and DHAC were not concerned at all with these  
8 out-year peaks. They wanted us to go ahead and take  
9 actions.

10 Because again, like I said, they really do  
11 focus on the short-term risk. They're informed of the  
12 out-year risk, but they're not overly concerned. And  
13 they don't want us to wait and make closure and risk  
14 based decisions to address it.

15 In this case, we actually had a 18, 19  
16 special analysis sensitivity run as well. I'm showing  
17 the five and six sensitivity state here in this slide.  
18 But we did address that before closing Tanks 18 and  
19 19.

20 MS. GELLES: Sherri, there's a question.  
21 Hang on once sec.

22 MS. ROSS: Sure.

23 CHAIRMAN RYAN: It sounds like part of this  
24 was maybe some, you know, transfer lines and other kinds  
25 of hardware failures that you sort of discovered as you

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1 moved stuff around in the tank farm. Is that right?

2 MS. ROSS: Yes. You've got to remember  
3 there's multiple types of tanks, that each are failing  
4 at different times, they're different distances from  
5 the 100 meter. Your transfer lines are failing earlier  
6 and so your different source terms, and each  
7 radionuclides is being held up. There's multiple  
8 barriers here. But each barrier will perform  
9 differently based on the radionuclides.

10 CHAIRMAN RYAN: But the transfer lines,  
11 Sherri, were mostly the earlier time periods.

12 MS. ROSS: That's correct.

13 CHAIRMAN RYAN: These late time periods,  
14 it was just the modeling of the various parameters there  
15 in the tanks themselves.

16 MS. ROSS: That's correct. And what we had  
17 done eventually, basically, is we had turned the  
18 plutonium, we had made it soluble. And it really  
19 doesn't ever become soluble. We just wanted to know  
20 what it would do in the out-years. So we fixed that  
21 with the sensitivity analysis.

22 CHAIRMAN RYAN: Thank you.

23 MS. GELLES: All right, girl, bring us home  
24 on PA maintenance.

25 MS. ROSS: Okay. So on Slide 16, I've just

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1 got some pictures here of ongoing science work that we've  
2 done to support our PA and special analysis.

3 So up on the top hand left corner is a  
4 technetium column test being done at PNNL. And on the  
5 bottom left hand column is some field activities and  
6 a lysimeter that actually is exposed to rainwater.  
7 That's being done through our National lab here on site.

8 In the field in the center of the graph is  
9 a mockup core drill that's going to support our Saltstone  
10 disposal unit activities. Top right is Clemson  
11 University research on technetium. It's a batch  
12 experiment ongoing.

13 And then in the bottom right is, at the  
14 National lab, an oven that can control both exterior  
15 temperature and humidity to support our Saltstone  
16 disposal activities as well.

17 But what I'm trying to portray here is that  
18 we do have ongoing R and D research to try to find out  
19 additional information that's important to the  
20 performance of our facility so that we can roll that  
21 back into, you know, additional modeling or the next  
22 PA update if we need to, so just some examples there.

23  
24 So the PA and maintenance program, Slide  
25 17, is evaluating update on an annual basis to look at

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1 what our available funding is and what's the priority.

2 And sometimes we may have to push off things for another  
3 year.

4 But again, we're addressing out-year, you  
5 know, risk. We think we can wait a little bit to address  
6 that. But we do have a program to identify that.

7 Annual summaries are conducted on the  
8 disposal facility document, the actual operations, any  
9 science work that's been done and monitoring. We do  
10 annual monitoring of immediate conditions to see are  
11 we seeing something different than we anticipated.

12 So in summary, on Slide 18, you know,  
13 special analysis of performance, key information  
14 becomes available and performance assessments are  
15 revised on a periodic basis.

16 But they're entirely being driven by the  
17 magnitude and the significance of the changes in the  
18 model system. So we won't do a PA revision if we don't  
19 need to. But based on the annual reviews, if we find  
20 out some new information, we're concerned with maybe  
21 the impact, then we'll go ahead and run a new PA or  
22 special analysis.

23 And that's pretty much it. So any  
24 questions?

25 CHAIRMAN RYAN: That was a very thorough

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1 review. Thank you.

2 MS. GELLES: Thank you, Sherri.

3 MS. ROSS: Thank you.

4 MS. GELLES: Thank you for your patience  
5 with our very long presentation.

6 MALE PARTICIPANT: No, it was very  
7 interesting.

8 CHAIRMAN RYAN: No, it's all very  
9 interesting. I appreciate it. Shall we go around?  
10 Let's see. Well, any questions or comments?

11 → MEMBER BALLINGER: Not really. I thought  
12 it was great, very, very, very thorough. This is  
13 excellent.

14 CHAIRMAN RYAN: Good.

15 MS. GELLES: Thank you.

16 CHAIRMAN RYAN: Harold?

17 MEMBER RAY: Well, I've already said, but  
18 I think I want to underscore it again, agreeing with  
19 what Ron has said and also the fact that what's being  
20 described here is comprehensive. And I can't see any  
21 way that it could be improved. Transferring it into  
22 our world is what I find daunting for a whole variety  
23 of reasons that I won't go into.

24 CHAIRMAN RYAN: Oh, gloveboxes aren't  
25 exactly in the reactor scheme of things.

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1                   MEMBER RAY: Well, I'm more dealing in the  
2 process environment and the fact that you have, we're  
3 talking about something prospective instead of Savannah  
4 River which is retrospective.

5                   And we're talking about setting up rules  
6 that are enforceable and can be met by proponents with  
7 some confidence that they're not going to get stuck after  
8 three years with a failed enterprise like I went through.

9                   And that's just the difficulty I am  
10 struggling with. Nevertheless, this is good  
11 information. And hopefully we can make some  
12 application of it to the environment that we're  
13 concerned with.

14                   The last thing I'll say, and then I'll quit,  
15 is also I think that the perspective here is, although  
16 we saw the charts going way out in time, and I do mean  
17 way out in time, I don't know that we can replicate those  
18 for the things that we're having to address with the  
19 same certainty that we need, or with the degree of  
20 certainty that we need in order to be successful in  
21 licensing a low-level waste site in the public arena.

22 I'm done.

23                   MEMBER SKILLMAN: Thank you for a very  
24 comprehensive briefing. I just want to make three  
25 points.

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1 I have a good buddy who worked for Dr. Ray,  
2 Dixie Lee Ray. And Dr. Ray had a piece of copper wire  
3 about so long on her desk. My buddy said what is that?

4 And she said, well, that's the speed of light in one  
5 nanosecond.

6 And light is about 300 million meters a  
7 second. And if you divide by a billion, you get a piece  
8 of wire about that long, but the point is a practical  
9 application.

10 We've been kicking this 10,000 year versus  
11 1,000 year around for months now. And I've been trying  
12 to get to a place in my mind where a number makes sense.

13 The Magna Carta was presented in about in  
14 1250 AD. That's about the first time a stone was laid  
15 for the cathedral in Cologne. So there's a document  
16 that is actually part of our law today and a building  
17 that you can visit tomorrow if you were to fly to Cologne.

18 There's evidence of a period of control,  
19 a structure, something that we can see and put our hand  
20 on that's 750 years old. It makes sense. So I think  
21 maybe 1,000 years is something that is supportable.

22 Because there is evidence that men and women  
23 have been able to maintain a chain of custody, or an  
24 oversight or some collaborative effort to keep that  
25 thing in tact. So I've kind of come to a point where

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1 I think this 700, 800 years is probably a pretty good  
2 number. And it certainly beats 10,000. Thank you.

3 MS. GELLES: Thank you.

4 CHAIRMAN RYAN: Thank you. Steve?

5 MEMBER SCHULTZ: I want to echo that I  
6 really appreciate the presentations today. They were  
7 very well done and provided us a lot of information.

8 For me it was extremely thought provoking,  
9 especially as we've already heard from members of the  
10 committee, the far reaching process of thinking that  
11 is looking at that long time horizon and trying to put  
12 it in perspective with regard to our current knowledge,  
13 past knowledge and what our future knowledge might be  
14 about not only what ought to be done but also what the  
15 metrics might be and how they might change. It's very  
16 thought provoking. Thank you.

17 CHAIRMAN RYAN: Thanks, Steve. Joy?

18 MEMBER REMPE: I think my colleagues have  
19 said it better than me, but I also learned a lot from  
20 the discussion today. And I'd especially like to say  
21 that I appreciated the emphasis on how the metrics have  
22 changed over the years in looking at the future.

23 I have a question though. I agree that the  
24 10,000 year is difficult to be showing. Why do you even  
25 go beyond and show plots that are even beyond 10,000

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1 years when we all agree that it's not worth doing. And  
2 doesn't that just cause you heartburn? And what would  
3 happen if you suddenly would quit showing those types  
4 of graphs in your annual reports and --

5 MR. SEITZ: Let's let Sherri --

6 CHAIRMAN RYAN: Sherri, do you want to  
7 answer why you're showing plots out beyond 10,000 years?

8 MS. ROSS: Sure, sure. We do, actually.  
9 We do want to be informed. We want to know what's  
10 causing the peaks. When would the peaks happen and why?  
11 What assumptions went into the model that's causing  
12 that peak?

13 So what barrier is failing that's causing  
14 those peaks. And how high are they? Can we redesign  
15 the barrier? Is it some feature of the barrier that's  
16 very important? Is it one isotope?

17 So it informs our design, and our disposal  
18 operations and our closure activities so that we can  
19 take actions if necessary.

20 MS. GELLES: So since our policy is to,  
21 period of compliance is 1,000 years, but then evaluate  
22 and model out to peak impacts.

23 To curtail that by any point cut off,  
24 whether it was 15,000, 10,000, you know, 12,500, would  
25 suggest that we have somehow decided that everything

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1 after that is not relevant.

2 And as long as those peak impacts don't need  
3 to be mitigated for purposes of demonstrating  
4 compliance, but can be used to inform and improve our  
5 ability to comply, it's still useful information.

6 Does it raise questions that we have to  
7 answer? Absolutely. But we hope that the gain of it  
8 in terms of additional information that helps us  
9 engineer our system outweighs the pain of having to  
10 explain it to people.

11 MEMBER REMPE: I can appreciate it,  
12 although I heard discussion. We spent a lot of money  
13 on something rather --

14 MALE PARTICIPANT: A concern.

15 MEMBER REMPE: -- and so sometimes it, yes,  
16 it sounds like you have a good perspective on it. But  
17 it's just something --

18 MEMBER ARMIJO: And it might be, you know,  
19 what I got out of it is you got smarter. But physically  
20 nothing changed. And if the analysis hadn't been done  
21 at all, nature would behave pretty much like your more  
22 final analysis, and there'd be no problem anyway.

23 CHAIRMAN RYAN: I think I can provide some  
24 insights that might really nail it down. I mean, she  
25 talked about different radionuclides being important

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1 at different times. And she got some insights that were  
2 qualitative rather than analytic, I think.

3 MEMBER ARMIJO: Nothing wrong with being  
4 smart. I have nothing against it. But it's expensive.  
5 And in a commercial low-level waste site, does it really  
6 add much to require that on a --

7 CHAIRMAN RYAN: The only difference is she  
8 --

9 MEMBER ARMIJO: -- something that doesn't  
10 have the Treasury of the United States behind it.

11 MEMBER STETKAR: In this case, you know,  
12 I think the observation was nothing, in an engineering  
13 sense, changed.

14 On the other hand, there could have been  
15 an analysis of a different facility where perhaps, and  
16 again in Harold's term, a prospective analysis rather  
17 than a retrospective analysis where perhaps, you know,  
18 subtle changes in the difference of a design or  
19 difference in the burial depth, you might learn  
20 something.

21 And I think that's a little bit of what I  
22 heard Sherri saying, what I hear the whole group saying.

23 MEMBER ARMIJO: I think in the case of the  
24 DOE, they handle such a variety of complex waste compared  
25 to what I would expect in a civil or a commercial, but

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1 I don't know.

2 CHAIRMAN RYAN: You might be surprised.

3 MEMBER ARMIJO: There might be more payoff

4 --

5 CHAIRMAN RYAN: I think the broad spectrum  
6 of users that use a commercial low-level waste site is  
7 fairly substantial, everything from veterinary  
8 hospitals to you name it. I mean, there's all kinds  
9 of different waste streams.

10 So it's probably not as comprehensive a set  
11 of streams as the Savannah River site, of course. But  
12 it's not one or two either.

13 MEMBER ARMIJO: Yes. But, you know, the  
14 thing that's, from a regulatory standpoint, if we were  
15 requiring similar type of in depth analysis, very  
16 expensive analyses for low-level waste sites,  
17 commercial, I just wonder if that's the right way to  
18 spend our resources.

19 MEMBER RAY: But, Sam, it's not just the  
20 cost of the analysis. What I'm suggesting is the  
21 analysis has to be agreed upon not only by us but all  
22 the other parties to the decision.

23 And therefore, you know, you can say well,  
24 we ought to do it maybe. It only costs this much, do  
25 it. But then it becomes now, all right, what do the

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1 results mean? Does everybody agree with it? Is it  
2 another basis for controversy?

3 That's where I think DOE largely, I know  
4 they have internal controversy, but in a forum that we  
5 have to deal in, I'm more concerned about putting things  
6 like that on the table than I am the cost of getting  
7 them on the table. Because how do you then get them  
8 resolved? You can't, is what it boils down to. That's  
9 all.

10 MEMBER BALLINGER: Now I have a question.  
11 Can I have a question?

12 CHAIRMAN RYAN: No, you can't.

13 (Laughter)

14 MEMBER STETKAR: You'll get over this in  
15 awhile.

16 MEMBER BALLINGER: In your interaction  
17 with the public, what spun the public up the most, the  
18 long-term analysis and they were worried about that or  
19 the short-term?

20 MS. GELLES: Are you asking that of Sherri?

21 MEMBER BALLINGER: Yes.

22 MS. GELLES: Because she's got a very  
23 specific experience.

24 MEMBER BALLINGER: Because you had a lot  
25 of public interaction. So where did the public get

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1 exercise?

2 MS. ROSS: The public is much more  
3 concerned with the short term. And their concern is  
4 it's going leak before I empty them and close them.  
5 But they want me to get on with it.

6 MS. GELLES: Right. Until you can, that  
7 prolonged analysis, you know, perturbs our ability to  
8 progress and empty the tanks. And they get very  
9 concerned.

10 MR. SEITZ: No. They're more concerned  
11 with delay than with assessment.

12 MS. ROSS: They'd rather me not spend a lot  
13 of money on R and D on those out-year, you know, 30,000  
14 year doses. They'd rather me spend the money emptying,  
15 and cleaning and closing tanks.

16 MEMBER BALLINGER: So they're smarter  
17 than we are, is what you're saying.

18 MEMBER REMPE: It sounds like your public's  
19 pretty good.

20 (Laughter)

21 MS. ROSS: They think that I'm trying to  
22 be open and having, you know, a well rounded program.

23 MEMBER RAY: If we all could only live in  
24 South Carolina it would be, the world would be much  
25 better.

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1  
2 CHAIRMAN RYAN: Okay, any other questions?

3 (Off microphone discussion)

4 CHAIRMAN RYAN: Anything else?

5 MEMBER REMPE: No more, thank you though.

6 CHAIRMAN RYAN: Okay. I guess I'll make  
7 one comment considering a ran a program for 20 years  
8 that did the same kind of stuff.

9 Ground water is a very difficult thing to  
10 figure out. It takes lots of samples, lots of wells.  
11 What's a geologist's only desire, one more core please,  
12 just one more. Fifty feet right here, I'm good. I'll  
13 be done. And a week later on, two more.

14 So it's a never ending process of discovery.

15 But it's also a good one. Because you can get an awful  
16 lot of good information that can help you over time,  
17 and I mean over decades, of improving your processes  
18 and improving your facility so it does what you want  
19 it to do as opposed to what it is going to do if you  
20 don't pay attention.

21 So that's just, I think you've got a very  
22 good program. And it sounds like you've got the right  
23 folks involved with it. So congratulations on that.  
24 That sounded great.

25 MS. GELLES: Thank you. We're privileged

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1 to have a lot of talent at the labs and at the sites.

2 CHAIRMAN RYAN: Absolutely. So thank you.

3 And with that, are there any other comments from our  
4 --

5 MEMBER ARMIJO: I would just like to add  
6 my thanks to DOE in bringing a good, excellent, terrific  
7 package. I can use that a lot to address the issues that  
8 are a concern to me as a, you know, period of compliance  
9 and as well as the intruder assessment type, what it  
10 actually is. It's not nearly as bad as what I thought  
11 it might be. So you cleared a lot of things up for me.  
12 So I really very much appreciate your work.

13 CHAIRMAN RYAN: And the whole program, I  
14 mean, the entire, you know, effort for 435, sorry, 435.1  
15 and your presentations there were great. We got a lot  
16 of insights that'll help us in formulating views for  
17 the commission here.

18 So we really appreciate your time and the  
19 effort you put into making our presentations very high  
20 quality. And you've responded to every question. And  
21 I think you're batting 1,000.

22 MS. GELLES: That was our goal. We're very  
23 glad to be helpful. And thanks again for giving us so  
24 much of your time.

25 CHAIRMAN RYAN: Oh, absolutely. Thank

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1 you. With that, we're adjourned. Oh, yes? I'm sorry?

2 MR. WIDMAYER: You have to ask for public  
3 comments.

4 CHAIRMAN RYAN: Are there any public  
5 comments or speakers on the phone that would like to  
6 make a comment? Is the bridge line open?

7 (Off microphone discussion)

8 MR. WIDMAYER: It's the usual delay for  
9 opening the bridge line.

10 CHAIRMAN RYAN: Okay. Well, nothing like  
11 tradition.

12 (Off microphone discussion)

13 CHAIRMAN RYAN: We are on the record now.

14 (Off microphone discussion)

15 MEMBER ARMIJO: Well as long as we're  
16 waiting, I'll add a little anecdote about 1,000 years  
17 being about the right number.

18 I was in Salamanca, Spain, and they have  
19 a nuclear fuel factory over there. And they told me  
20 about this. Go visit the cathedrals. And I said, well,  
21 which ones should we visit? I don't have a lot of time.

22 He said, well, they're right across the  
23 street from one another. One is the old cathedral,  
24 one's the new cathedral. I said, okay, which one should  
25 I visit? Well, first you should start with the new

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1 cathedral which was built in 1400. And then go see the  
2 old cathedral. That was built in 1100.

3 And I did. And they're both looking really  
4 good. So I think Dick's right. At about a 1,000 years  
5 things are sensible. Going beyond that it's just  
6 nonsense. So calculate all you want.

7 MEMBER RAY: Well, you can go to Egypt and  
8 things get a little longer there.

9 MEMBER ARMIJO: Well, yes, Egypt.

10 MEMBER RAY: The Roman aqueducts are still  
11 around. And they still feed the water --

12 MEMBER ARMIJO: The aqueducts.

13 MEMBER RAY: -- and the Roman roads.

14 MEMBER ARMIJO: But we've got to be  
15 realistic about where we spend our money. And in fact,  
16 I think you're probably making the right decision.

17 MEMBER RAY: Well, it's the uncertainty  
18 that becomes more and more problematic with time, that's  
19 the greater concern to me than, as I said already, than  
20 it is the cost. I think the cost of the analysis is  
21 something that's debatable. But the uncertainty is --

22 MEMBER ARMIJO: It's not real, even after  
23 you spent the money, you can argue --

24 MEMBER RAY: What do you have?

25 CHAIRMAN RYAN: You want to say something,

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1 Derek?

2 MR. WIDMAYER: I was going to open a can  
3 of worms. So you want to tell us about uranium 233 in  
4 Nevada? No?

5 MS. GELLES: On the record?

6 (Crosstalk)

7 CHAIRMAN RYAN: We're on the record.

8 → MR. TOTES: Opportunity for public  
9 comment.

10 CHAIRMAN RYAN: Yes.

11 MS. CHALMERS: Yes, I'm on the line.

12 MALE PARTICIPANT: Oh, Hi, Bill. Are they  
13 not hearing us?

14 CHAIRMAN RYAN: We hear you.

15 MALE PARTICIPANT: No, they're not.

16 CHAIRMAN RYAN: We are.

17 MALE PARTICIPANT: I'll call Roger  
18 tonight.

19 CHAIRMAN RYAN: No, no, no, no. We can  
20 hear you well.

21 (Crosstalk)

22 CHAIRMAN RYAN: Hold on, one at a time.  
23 The gentleman first.

24 MR. TOTES: There're a couple of us. Are  
25 you asking for public comment now?

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1 CHAIRMAN RYAN: Yes, we are.

2 MR. TOTES: Oh, very good. We weren't sure  
3 what was going on. My name's John Totes with Neptune  
4 and Company. I just had a couple comments here.

5 One is to the gentleman who had been doing  
6 low-level waste work in California. I didn't catch your  
7 name. But you had the comment that all this work with  
8 DOE is very interesting and wonderful. But it wouldn't  
9 translate well to the public sector.

10 I think that your point was that it would  
11 be very expensive. And I would agree that it, having  
12 written performance assessments for both DOE and for  
13 private entities that are regulated by NRC, I would agree  
14 that it could be expensive.

15 But the stakes are very high in both cases.

16 And defensability is very important for all types of  
17 regulators. So I just wanted to add that comment.

18 And one for Sherri Ross with the Savannah  
19 River DOE office. I was surprised to hear that  
20 stakeholders in Savannah River care very much more about  
21 the present than about the future.

22 And I'm interested to know what that says  
23 about this whole conversation of how far into the future  
24 we are supposed to protect people. Apparently it's  
25 something that might vary from site to site. I'm

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1 curious about any responses to those comments.

2 MR. WALLO: I think the answer to Sherri's,  
3 but the issue was people are more concerned about risk  
4 reduction than risk assessment. You know, if you have  
5 a choice whether you want to reduce risk or assess risk,  
6 the choice is let's reduce it first and worry about  
7 assessing it later.

8 And so that's the point. Again, it's the  
9 issue of how much to spend on modeling versus getting  
10 the job done.

11 MR. TOTES: Okay. I can appreciate that.  
12 It seems that if one, there's a possibility or a danger  
13 there that one might be short sighted and reduce current  
14 risk while increasing future risk.

15 MR. WALLO: Again, that's part of the issue  
16 we're trying to raise, is that you don't want to develop  
17 requirements or regulations that force you not to reduce  
18 risk while you're analyzing time periods that are of  
19 questionable value.

20 Clearly, you want to do a complete enough  
21 analysis to make a good decision. And that's the issue.

22 That's where you have to ground the issue, is where  
23 can you make a good decision.

24 CHAIRMAN RYAN: We had one other speaker  
25 or one other call that wanted to ask a question.

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1 MR. LEWIS: Go ahead and ask your question.

2 CHAIRMAN RYAN: I'm sorry.

3 MR. LEWIS: There's a speaker on by the name  
4 of Ruth. I was telling her to go ahead of me. My name's  
5 Marvin Lewis. I have a question.

6 CHAIRMAN RYAN: Okay. Ruth? Do you want  
7 Ruth to go first? Where's Ruth?

8 MR. LEWIS: If she's still on.

9 MS. CHALMERS: Right here. I've been here  
10 all along.

11 CHAIRMAN RYAN: Well, great. What's your  
12 question, Ruth?

13 MS. CHALMERS: Well, I heard a lot of  
14 talking. And there's so much that was said that is in  
15 conflict with known evidence that I couldn't begin to  
16 cover it all, even if you gave me two hours.

17 But what I am the most concerned about is  
18 the statements that were made about the public, the  
19 members of the public and concerned people.

20 I realize that they were generalizations  
21 and they didn't specifically address them to me, who's  
22 been studying this for 45 years. But I just felt, well,  
23 some of it had to do with the laughter. I mean, like  
24 it was a game and that you could find the answer. You  
25 could find the answer to nuclear radiation, man-made

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1 nuclear radiation, that somehow or other there was a  
2 way to accept this and to find it was acceptable to expose  
3 people to that.

4 And I feel a terrible sadness to think that  
5 people who I'm sure feel that they are doing the right  
6 thing. And yet what is the outcome of this? What has  
7 been the outcome? What will continue to be the outcome?  
8 What is this going to do to our children and our  
9 grandchildren?

10 Because the basic thing comes back to  
11 there's no safe exposure to radiation, man-made  
12 radiation, any kind of radiation. I just am  
13 overwhelmed.

14 CHAIRMAN RYAN: Well, we appreciate you  
15 taking the time to call and let us know your thoughts.  
16 Thank you.

17 MR. LEWIS: This is Marvin Lewis.

18 CHAIRMAN RYAN: Yes, Marvin.

19 MR. LEWIS: All right. Well, here is my  
20 point. You want it cut off at 1,000 or 10,000. And  
21 my point is this.

22 Recently discovered is the science of  
23 epigenetics, E-P-I genetics. And EPI genetics skips  
24 generations. It may skip even more.

25 The problem there is will the load radiation

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1 be cumulative over generations until we wind up the  
2 entire human race up against the wall until our evolution  
3 stops.

4 Now that is backed up. It's already  
5 happened in reverse in the pre-Cambrian explosion of  
6 light where suddenly over the millennia. But then soon  
7 after that four more filers, soon after that a few  
8 hundred million years, you have human beings walking  
9 around on another error. But --

10 MS. CHALMERS: Well, this is Ruth Chalmers  
11 again.

12 CHAIRMAN RYAN: Ruth, excuse me, Ruth, I'm  
13 sorry. You're interrupting the other speaker. He's  
14 giving his comments now.

15 MR. LEWIS: I'm sorry, Ruth. There is a  
16 history in the geology, in the anthropology and  
17 whatever. Now we have a science called epigenetics.

18 I'll show you danger is allowing increased amounts of  
19 radiation into our biosphere over the ages. And we have  
20 in NRC litigation of this up by the various NGOs, and  
21 have --

22 CHAIRMAN RYAN: Thank you for your comment.

23 MR. LEWIS: -- administrative law judges  
24 of the NRC. But what I'm saying is what we should be  
25 looking at is epigenetics and asking the question as

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1 we add radiation eventually cause more, the end of the  
2 human race. Thank you.

3 CHAIRMAN RYAN: Well, thank you very much.

4 We appreciate the comments. And are there any  
5 additional speakers who would like to make a comment?

6 MS. CHALMERS: Well, it's Ruth. I was --

7 CHAIRMAN RYAN: Ruth, Ruth, I'm sorry,  
8 Ruth. We're going to ask for other speakers first.  
9 You had a turn. So I want to make sure there's --

10 MS. CHALMERS: Oh, okay.

11 CHAIRMAN RYAN: -- there's nobody else who  
12 wants to speak. Is there anybody else that would like  
13 to speak?

14 Ruth, we're 20 minutes over our allotted  
15 time here in the room. So we're going to take one short  
16 comment from you and then we'll close the line.

17 MS. CHALMERS: All right. I wanted people  
18 to be aware that there is a proposal to transport weapons  
19 grade uranium, enriched uranium, highly enriched  
20 uranium, on our highways.

21 And it's in a liquid form. And it's never  
22 been transported before. And it's going to go to the  
23 Savannah River plant. And the woman that gave the talk  
24 on the Savannah River plant didn't mention the fact that  
25 that's where it's headed.

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1 And what's interesting too is it's being  
2 kept secret. And even though it's on the newspapers,  
3 in the newspapers in Canada, it's not in the newspapers  
4 in this country. I think there've been maybe two  
5 articles.

6 CHAIRMAN RYAN: Well, again. We thank you  
7 for your comment. And with that, we're going to have  
8 to close the bridge line, because we are well over our  
9 allotted meeting time. So we appreciate you being with  
10 us. And thank you for your comments.

11 MS. CHALMERS: Thank you, bye.

12 CHAIRMAN RYAN: All right. Bye now. Why  
13 don't we close the bridge line please. Okay, with that,  
14 any other business or are we good?

15 I want to thank everybody. You really gave  
16 very thorough presentations and information to us.  
17 It's been very helpful to have your colleagues at a  
18 distance and yourselves here. And we really appreciate  
19 the time and effort you put in to have this great  
20 conversation with us. So thank you all very much. We  
21 appreciate it.

22 MS. GELLES: Thank you very much.

23 (Multiple thank yous)

24 CHAIRMAN RYAN: All right. With that,  
25 we're adjourned.

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1 (Whereupon, the meeting in the  
2 above-entitled matter was concluded at 5:20 p.m.)  
3  
4  
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U.S. DEPARTMENT OF  
**ENERGY**

OFFICE OF  
**ENVIRONMENTAL  
MANAGEMENT**

# DOE Regulatory Approach for Near-Surface Disposal of Radioactive Waste

Christine Gelles, DOE Office of Environmental Management

Roger Seitz, Savannah River National Laboratory

Andrew Wallo III, DOE Office of Health, Safety and Security



**Savannah River  
National Laboratory**™

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November 19, 2013





## **Christine Gelles**

Associate Deputy Assistant Secretary

Waste Management

DOE Office of Environmental Management

# Purpose

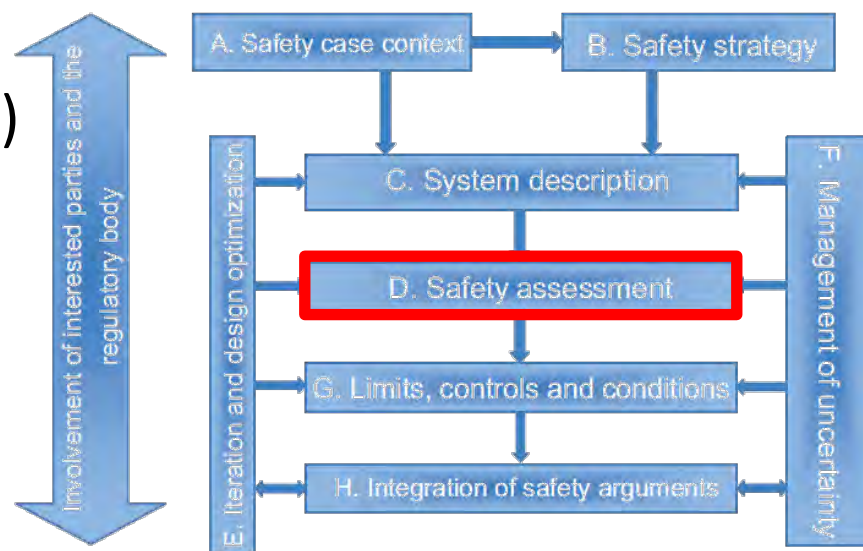
- Provide an overview of DOE's integrated protection systems approach to near-surface disposal
- Highlight the use of defense-in-depth and role of performance assessment (PA) as one of many inputs for risk informed decision-making
- Describe the emphasis on consistency with promulgated requirements
- Summarize considerations for a few key topics:
  - Use of 1,000 year time frame for quantitative compliance followed by a transition to a more risk-informed interpretation recognizing increasing speculation and uncertainties for later times
  - Inadvertent intruders considered in the context of optimization, not a performance objective
  - Radon considered separately from the all pathways objective

# Agenda

Introduction and Background	Christine Gelles DOE Office of Environmental Management
Regulatory Approach	Roger Seitz Savannah River National Laboratory
History and Implementation	Andrew Wallo III DOE Office of Health, Safety and Security
Site-Specific Implementation	Robert Boehlecke DOE Nevada Field Office Sherri Ross DOE Savannah River Operations Office

# DOE System of Regulations for Near-Surface Disposal

- Integrated approach to safety using defense-in-depth principles (similar to Safety Case)
- Performance Assessments (PAs) are one part of the integrated approach
- Consistency with other regulations for near-surface disposal and consideration of international recommendations
- Risk-Informed, Performance-Based for more than 25 yr



## IAEA Safety Case Concept

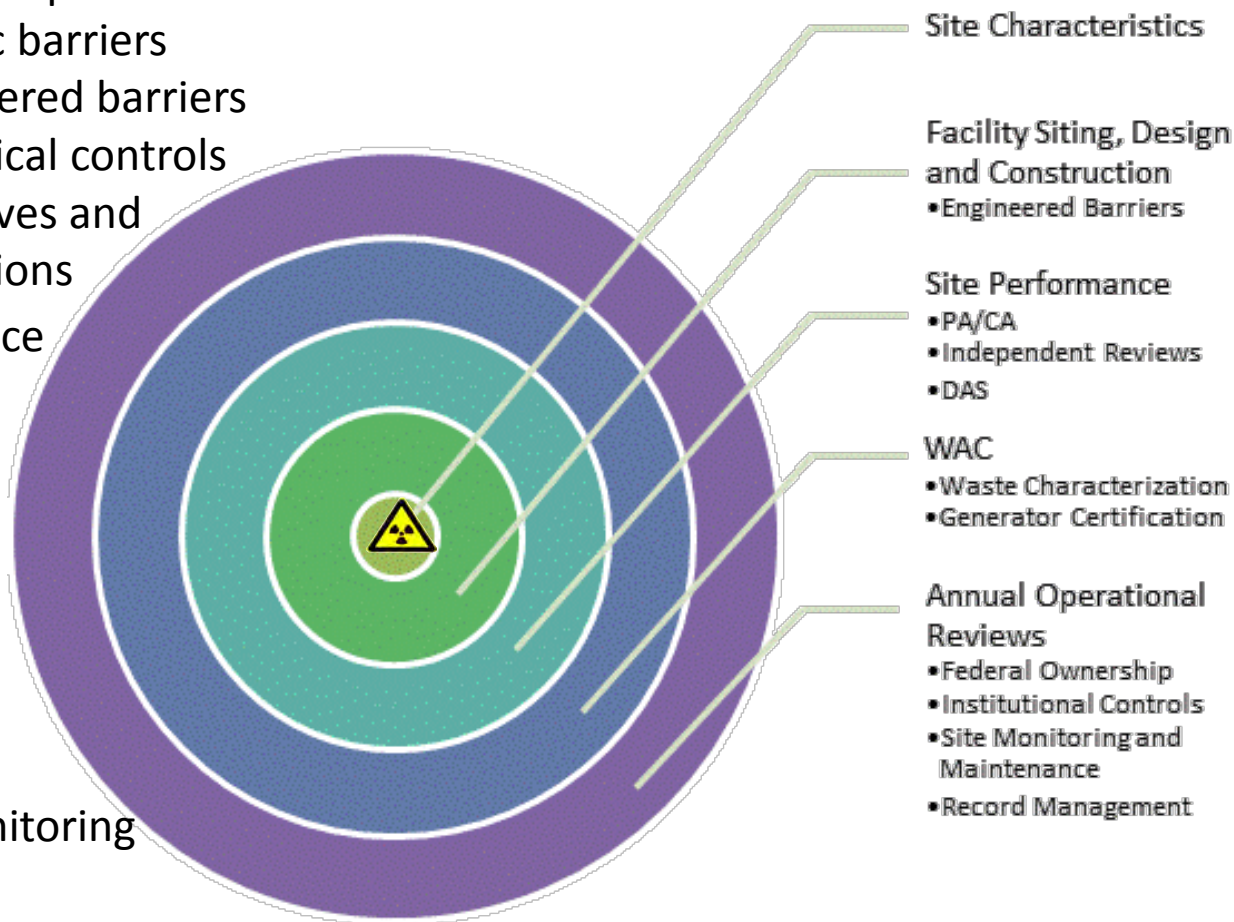
# DOE System of Regulations for Near-Surface Disposal (PA)

- PAs provide reasonable expectation that DOE disposal facilities will not exceed quantitative performance objectives and support decision-making for design, operations and closure
- A two-tiered approach to time frames is used with no specific cutoff
  - 1,000 years - calculated doses are compared to quantitative dose constraints for compliance
  - Longer-term calculations consider peak impacts to support risk-informed decision-making in the context of increasing uncertainties



# Defense-in-Depth

- Integrated, total systems approach to safety
  - Site characteristics which provide geologic and hydrologic barriers
  - Facility design – Engineered barriers
  - Administrative & technical controls
- Conservative bias in objectives and assumptions for PA calculations
- Site-specific waste acceptance criteria and rigorous waste generator certification
- Federal ownership and necessary buffer zones until site can be released
- Commitment to continuous improvement with PA maintenance, including monitoring
- Permanent maintenance of records



## **Roger Seitz**

Sr. Advisory Scientist

Environmental Management Directorate

Savannah River National Laboratory

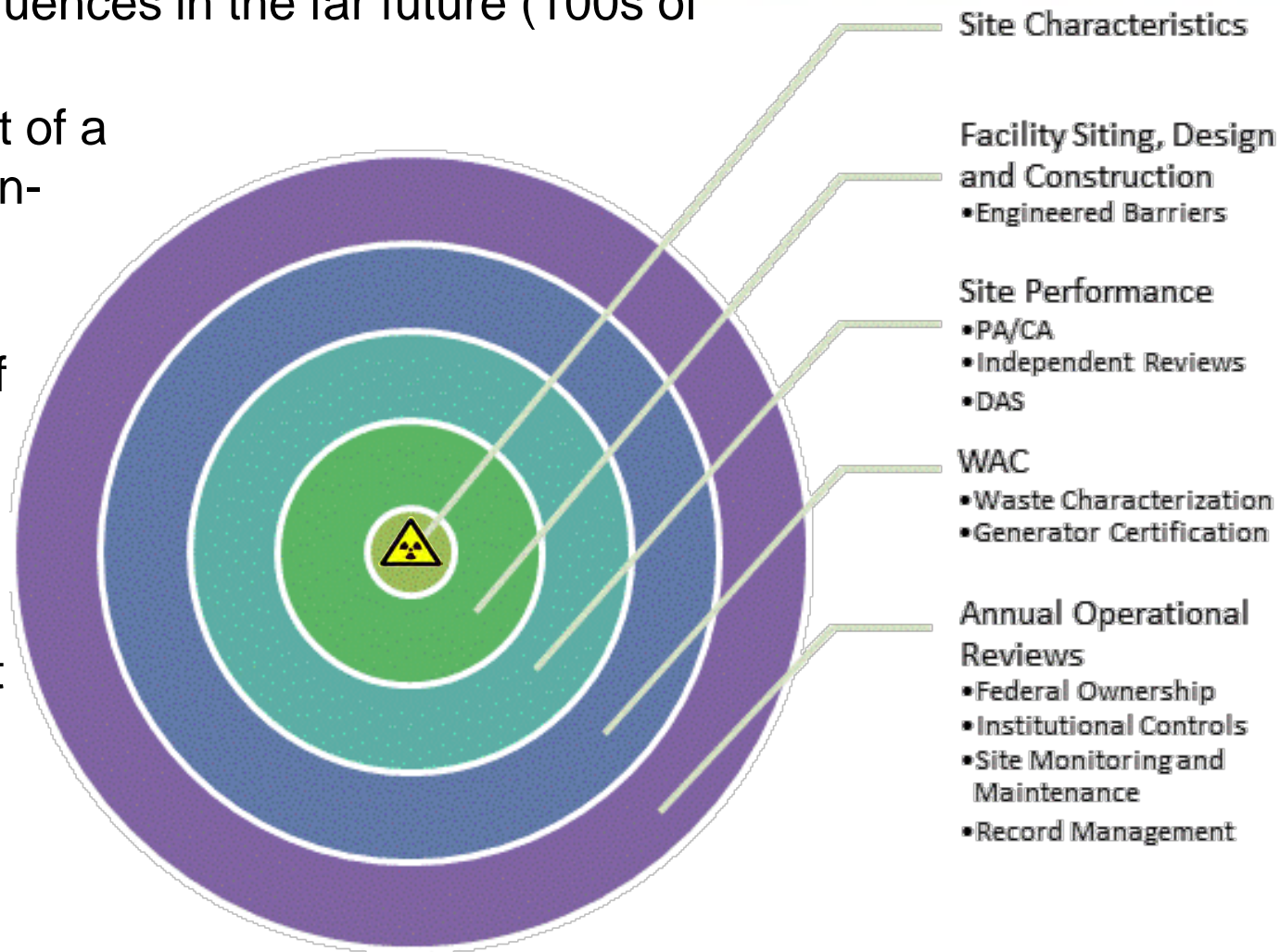
DOE has successfully implemented an integrated protection system for near surface disposal for more than 25 years:

- DOE Radioactive Waste Management Basis (RWMB) is similar to the IAEA Safety Case approach - PA is one of many contributors to risk-informed decision-making
- Defense-in-depth and total systems perspective
- Maintaining consistency with other promulgated Federal requirements for near-surface disposal
- Considering recommendations from International organizations



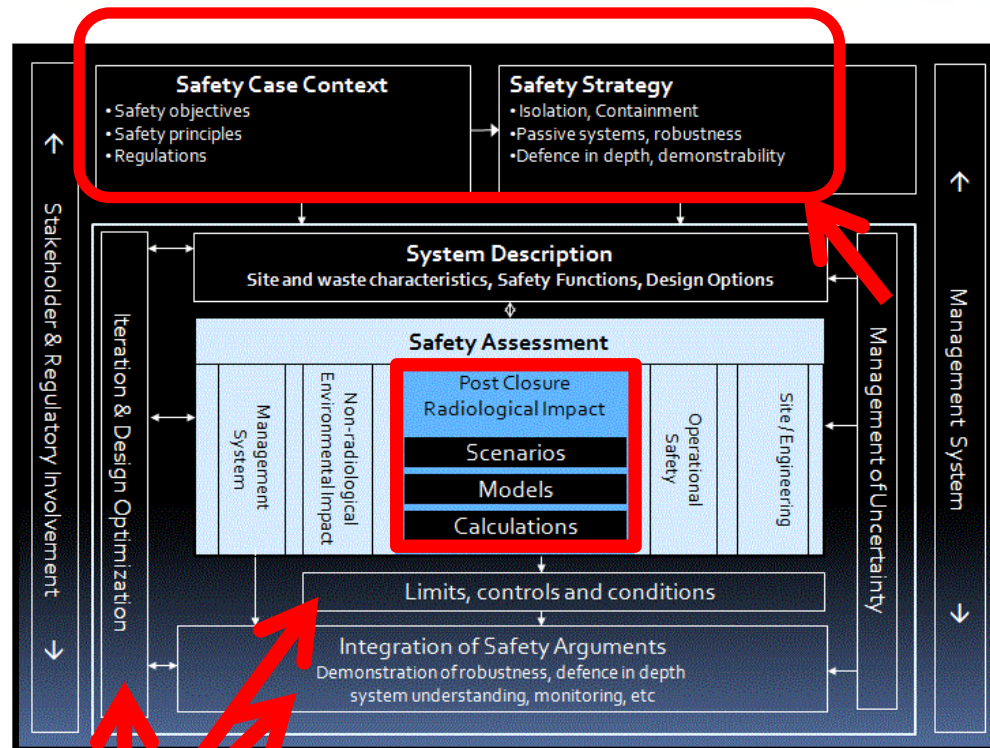
# Defense-in-Depth

- Approach goes to extraordinary lengths to consider potential consequences in the far future (100s of years or more)
- PAs are one part of a robust defense-in-depth approach for safety
- Multiple levels of safety factors (e.g., dose constraints, conservative bias, inadvertent intrusion)



# IAEA Safety Case

- Captures the integrated approach to safety
- Effective means to take credit for supporting activities used to build confidence
- Highlights links among modeling, design and waste acceptance criteria
- Addresses management of uncertainties throughout process (e.g., testing, R&D, monitoring – “Maintenance”)
- DOE RWMB is consistent with this approach



Courtesy: IAEA (DRAFT)

# DOE Performance Assessment

Site and facility-specific PAs have been formally required since 1988:

- Risk-informed, performance-based
- Emphasis on reasonable expectation of meeting objectives
- Graded and iterative process
- Implementation has been continuously refined

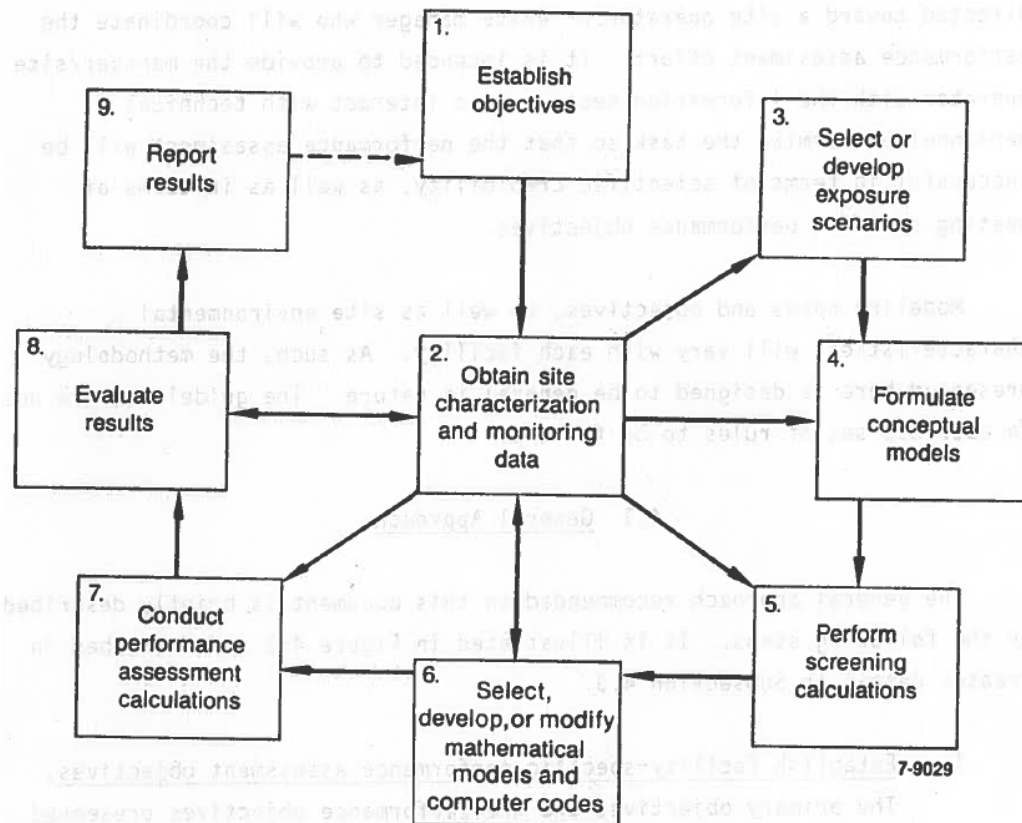


Figure 4-1. Performance assessment process.

Initial concept for graded and iterative approach (DOE LLW PA Guidance - Case and Otis, 1988)



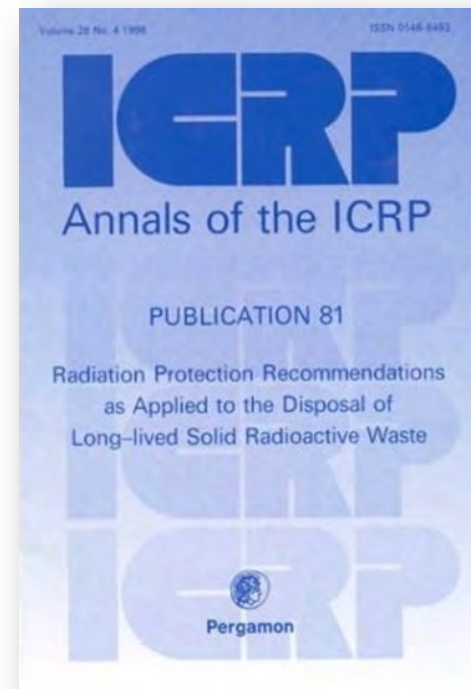
# Time of Compliance for Near-Surface Disposal

- 1,000 year time of compliance based on multiple factors:
  - Consistency with approaches used in DOE Order 458.1 and in existing promulgated NRC and EPA rules addressing near-surface disposal (e.g., 10 CFR Part 20.2002, 10 CFR Part 40 (40 CFR 192), RCRA Subtitle C),
  - Role of PA as only one contributor to the overall safety basis,
  - Decreasing relevance/usefulness of increasingly speculative/uncertain information in the far future when used for decision-making
  - Considerations related to intergenerational equity, and
  - Recommendations from the ICRP, IAEA
- Not a cutoff to calculations - must address potential peaks
  - 1,000 years marks a transition from quantitative compliance with performance objectives to use of results in a more risk-informing role for decision-making

# Perspectives on 1,000 yr Time of Compliance

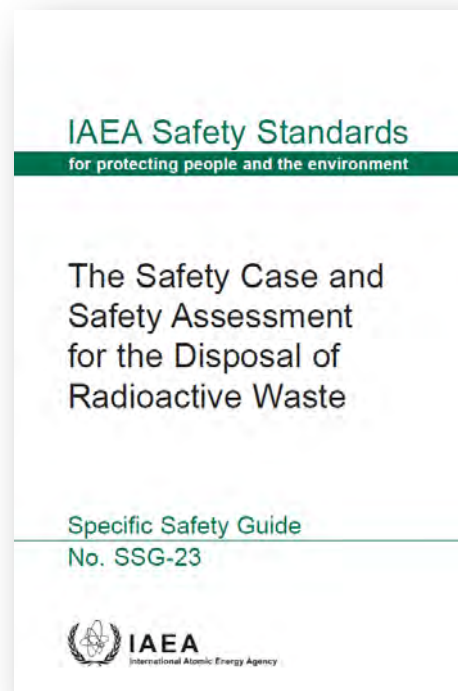
- ICRP position regarding the use of dose and risk as measures of health detriment (several hundreds of years)
- IAEA position on calculations for extended times for surface and near-surface disposal
- Consideration of deterministic and probabilistic (risk) views of consequences at longer times of compliance (e.g., event probabilities)

- ICRP Publication 81 (addresses near-surface and geologic disposal)
  - *“Doses and risks, as measures of health detriment, cannot be forecast with any certainty for periods beyond around several hundreds of years into the future”*
  - *“To evaluate the performance of waste disposal systems over long time scales, one approach is the consideration of quantitative estimates of dose or risk on the order of 1000 to 10,000 years.”*



## IAEA Safety Guide SSG-23

- *“For above surface disposal facilities (e.g. for waste from mining), the uncertainties in modelling results will already be substantial when considering periods of **several hundred years**, and quantitative estimates may become meaningless already beyond a period of a thousand years. For engineered near surface disposal facilities, which are subject to processes that may affect their integrity (e.g. erosion, human intrusion) to a lesser degree or with a smaller probability, modelling periods of **a few thousand years** may still be reasonable.”*



Note: IAEA's Safety Standards are not legally binding on Member States but may be adopted by them, at their discretion, for use in national regulations in respect of their own activities.



- Difficult to directly compare “compliance” times from other countries because of differing assumptions
- Low-Level Waste Repository in the United Kingdom
  - Constraint applies through closure, risk guidance level applied later
  - Probabilities can be applied for exposure scenarios for prospective calculations
  - Generally up to thousands of years considered - Reference case considered erosion of facility at 1000 years and 10,000 yr considered for a delayed erosion case





# PA Considerations

*An iterative process involving site-specific, prospective modeling evaluations with two primary objectives:*

- *to demonstrate whether **reasonable expectation of compliance** with quantitative performance objectives can be demonstrated; and,*
- *to identify critical data, facility design, and model development needs for defensible, cost-effective, and **risk-informed decisions** and to develop and maintain operating limits (e.g., waste acceptance criteria).*

*(after NCRP 2005, Performance Assessment of Near-Surface Facilities for Disposal of Radioactive Waste)*

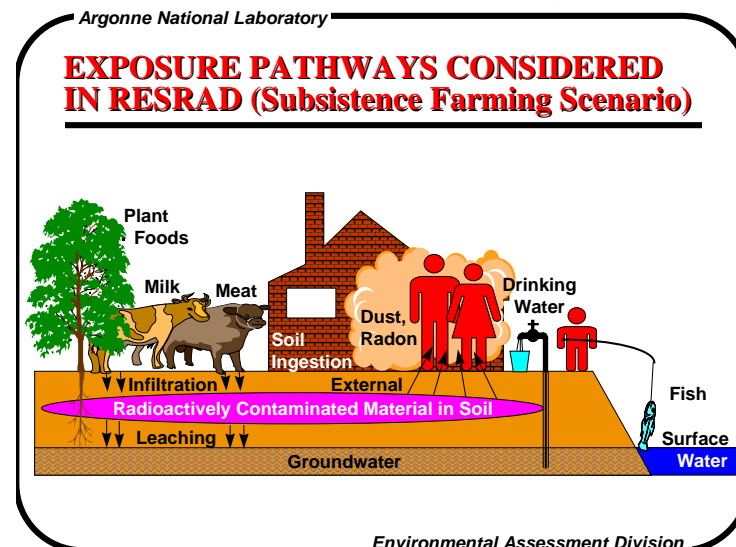
Compliance decisions are made in the context of multiple layers of safety factors, for example:

- 0.25 mSv/yr (25 mrem/yr) is 25 times less than the average annual dose received in the United States (6.3 mSv/yr, NCRP) and a factor of 4 less than the dose limit of 1 mSv/yr
- Assumed that all memory of the facility will be lost (DOE commitments, land use agreements, etc. will be ineffective at some time)
- Future residents will not test well water or be able to recognize that contamination is present underground
- General intent for conservative bias in PA approach (e.g., “highly exposed individuals”, barriers or processes are not credited in calculations in lieu of defending their performance)

# Exposure Scenarios in Context

Stylized constructs representing more highly exposed individuals (probability of 1) used as a basis for compliance

- Resident drills a well for water use at location and time of peak
- Resident farmer habits (e.g., beef/milk cows, garden for consumption)
- Other scenarios specific to a site
- Intruder digs basement and drills well, immediately following loss of institutional controls





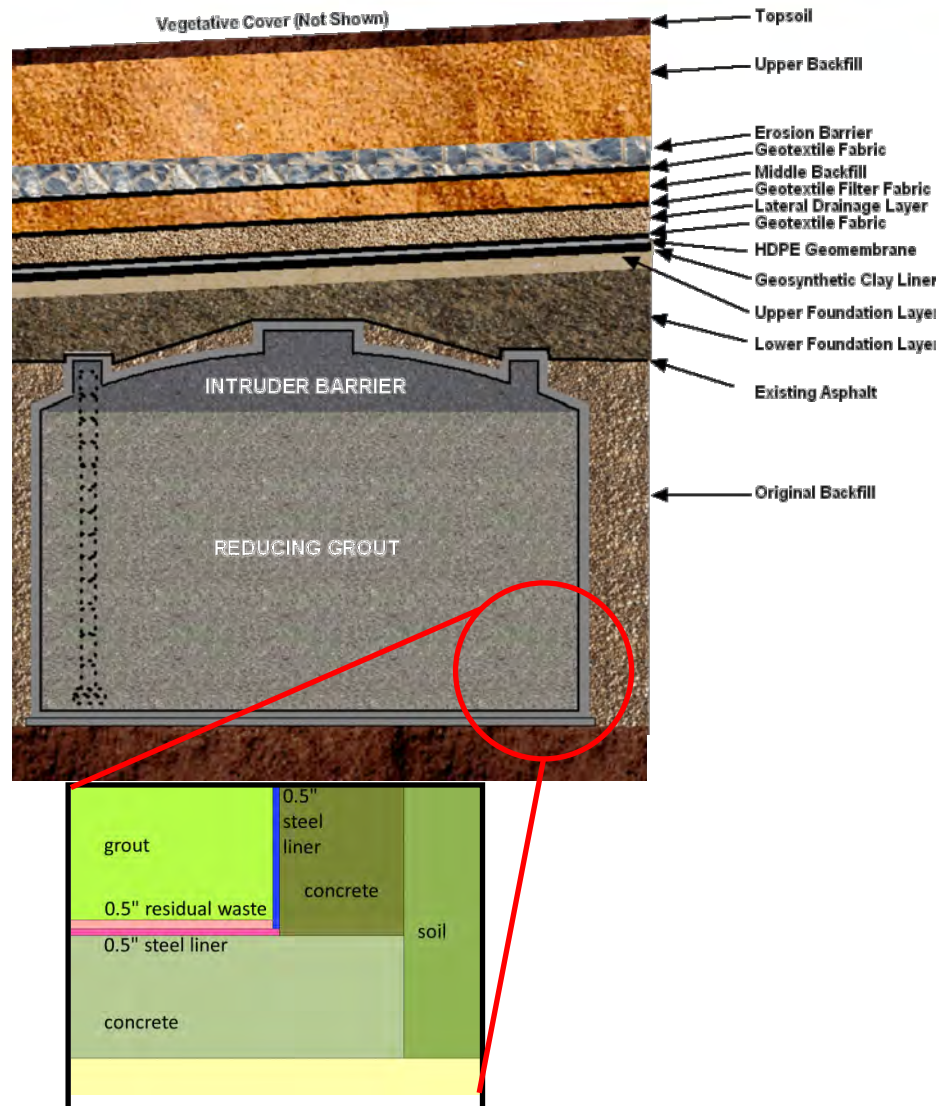
# Approach for development of scenarios

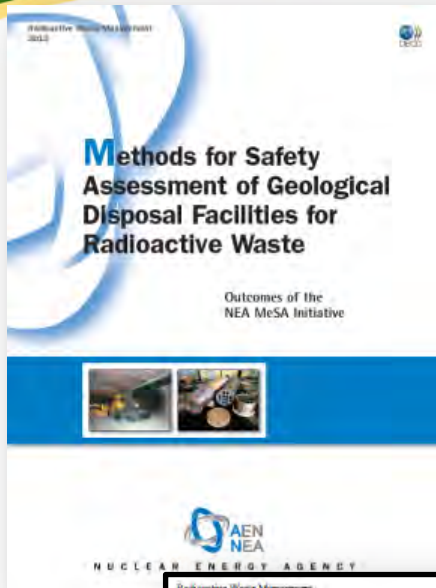
**Conceptual Model Focus** - Start with initial description of the system and its evolution and refine as needed in areas critical to the decision

**Systems Approach** - Consider behavior of individual features in the context of overall system performance rather than independently (refinement of details is made within context of importance for system performance)

## **Safety Function Perspective** –

Understanding of roles and functions of “barriers” within total system and addressing potential failure mechanisms for key barriers (FEPs lists can provide insights)

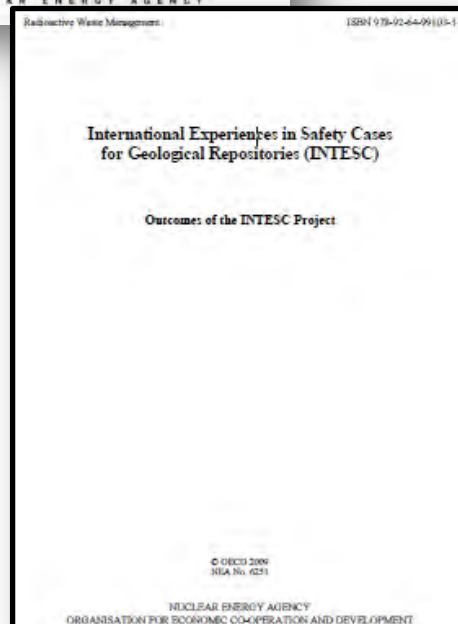




Practical implementation has emphasized “top-down, bottom-up” rather than a FEPs based development approach.

*“In all programmes, the starting point for the identification of safety-relevant phenomena and uncertainties is the development of a detailed description of the initial state of the system and its subsequent evolution. This description provides the basis for a main scenario, also termed normal evolution, base or reference scenario.”*

*“FEP lists or FEP databases ... have evolved (at least in more advanced programmes) to become mainly a tool for checking completeness in a system (and scenario) description that has been derived earlier or using other methods. “*



- Recognize that waste disposal decisions must be made under uncertainty
  - Increasing use of probabilistic modeling to quantify sensitivity and uncertainty
- Initially focused on addressing changes to waste, waste form, etc. and new information
- Approach evolved to a broader confidence building context:
  - Demonstrations & field studies
  - Monitoring
  - Unreviewed Disposal Question Evaluations (e.g., design, container, waste form or inventory changes)





- DOE-EM sponsored organization to share assessment experience
- Mission
  - Reduce regulatory and technical risks related to PA implementation
  - Foster continuous improvement in the quality, credibility, consistency, and efficiency of DOE's PA and risk-based decision-making
  - Maintain enduring performance and risk assessment capability and knowledge base
- Sponsored technical exchanges, workshops and technical support





## **Andrew Wallo III**

DOE Office of Health, Safety and Security

Deputy Director, Office of Environmental Protection,  
Sustainability Support and Corporate Safety Analysis

Establish by rule, regulation, or order, such standards and instructions to govern the possession and use of special nuclear material, source material, and byproduct material as the Commission\* may deem necessary or desirable to promote the common defense and security or to protect health or to minimize danger to life or property.

\* In this context “Commission” refers to the Atomic Energy Commission.

# DOE's Regulation of Radioactive Materials and Waste Disposal

- Self-regulation does not mean everyone gets to do whatever they want
- Responsibilities and authorities under the Atomic Energy Act implemented through Directives and Orders
- Requirement to protect members of the public from all sources of radiation, not to exceed 100 mrem/yr
- Seek consistency with existing promulgated Federal requirements
- Strive for internal consistency in Regulations and Directives (DOE O 458.1 and 10 CFR Part 835 establish protection requirements and DOE O 435.1 implements the requirements for waste management)

# DOE Order 458.1 – Radiation Protection

Purpose: To establish requirements to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under the control of the DOE pursuant to the Atomic Energy Act of 1954, as amended.

Establishes Public Dose Limit from all sources and pathways: 100 mrem/yr total effective dose, excepting dose from (25 mrem/yr dose constraint for DOE activities):

- Radon and decay products in air
- Medical exposures
- Background radiation
- Occupational exposure

Also, must meet applicable ALARA process requirements.

## DOE Order 458.1 (Cont.)

- Radon is controlled separately from the all pathways objective consistent with 40 CFR Part 61 and other requirements.
- Describes the approach for demonstrating compliance with the dose limit (representative person or MEI, use of DOE approved dose coefficients and a 25 mrem in a year dose constraint).
- Includes specific requirement that DOE property cannot be released from DOE control until the approved authorized limits are met (applies to waste disposal facilities).

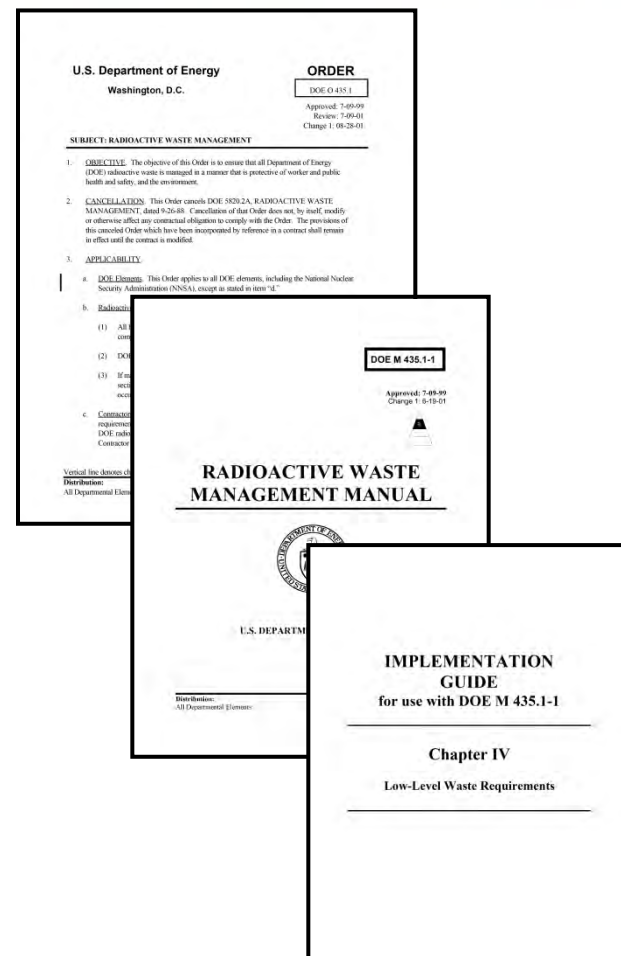
# History of DOE Regulation of Radioactive Waste Management

- DOE Order 5820.2A, *Radioactive Waste Management*, issued September 1988 (PA formally introduced)
- After a few years of implementation, the DNFSB provided Recommendation 94-2 that identified areas for improvement
- DNFSB 94-2 recommended DOE to conduct a complex-wide review
- The Complex-Wide Review identified 6 complex-wide vulnerabilities which echoed DNFSB findings (May 1996) and these were used as input to revision of the directive (DOE Order 435.1 development)



# Development of DOE Order 435.1 (Current)

- Began process in September 1996
- Four teams of Headquarters and Field staff
  - High Level Waste
  - Transuranic Waste
  - Low Level Waste/Mixed Low Level Waste
  - General Requirements
- Structured process of workshops and steps to incorporate input from the DOE Complex
- Package included Order, Manual, Guidance, Technical Basis, and training program



# DOE Order 435.1 – Radioactive Waste Management

Objective: Ensure that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety, and the environment. DOE Manual 435.1-1 includes the specific requirements.

- Effective implementation date July 2000
- Established DOE HQ/Site responsibilities including establishment of a Low-Level Waste Disposal Facility Federal Review Group (LFRG) to provide independent assessments of PAs and their maintenance complex wide
- Established Performance Objective and Requirements governing disposal actions
- Required Composite Analysis to assess cumulative impacts of the disposal system and other DOE activities (planning tool)



# Low-Level Waste Disposal Facility Federal Review Group

LFRG comprises representatives from each site office with a disposal site and specific HQ organizations

## Roles and Responsibilities

- Develop and conduct formal review processes
- Review compliance documentation submitted by sites in support of disposal authorization statements
- Track and report preparation of compliance documentation
- Provide LFRG recommendations to senior managers
- Prepare disposal authorization statements for disposal facilities
- Monitor maintenance activities
- Conduct other reviews and assessments as directed by senior management (e.g., waste determinations and transuranic waste disposal performance assessments)

# Current Performance Objectives

Low-level waste disposal facilities shall be sited, designed, operated, maintained, and closed so that a reasonable expectation exists that the following performance objectives:

## All Pathways

- Dose to representative members of the public shall not exceed 25 mrem (0.25 mSv) in a year total effective dose equivalent from all exposure pathways, excluding the dose from radon and its progeny in air.

Note: Separate treatment of radon is consistent with 40 CFR Part 190.10, 40 CFR Part 61 (subpart H), 40 CFR Part 61.192 (subpart Q), and 10 CFR Part 40 (Appendix A, criterion 6))

## Air

- Dose to representative members of the public via the air pathway shall not exceed 10 mrem (0.10 mSv) in a year total effective dose equivalent, excluding the dose from radon and its progeny. (Consistent with NESHAPS dose limits)

## Radon in Air

- Release of radon shall be less than an average flux of 20 pCi/m<sup>2</sup>/s (0.74 Bq/m<sup>2</sup>/s) at the surface of the disposal facility. Alternatively, a limit of 0.5 pCi/l (0.0185 Bq/l) of air may be applied at the boundary of the facility. (Consistent other promulgated rules, see previous slide)

ALARA – maintain releases as low as reasonably achievable

# Demonstrating Compliance with Performance Objectives

Performance Assessment will:

- Assess for compliance with dose limit for 1000 year period after closure and to risk inform decisions and evaluate model performance for periods >1000 years
- Average living habits for members of the critical group (more highly exposed individuals)
- Point of compliance is 100 meters from disposal facility boundary unless other point is justified
- Evaluate reasonably foreseeable natural processes that may disrupt disposal system
- Evaluate sensitivity and uncertainty
- Apply ALARA process to determine if releases are as low as reasonably achievable

# Time of Compliance

## Support Decision making process:

- Internal Consistency
  - Property control and release requirements
  - 435.1 working groups
- External Consistency
  - EPA, NRC requirements
  - OMB risk assessment recommendations (E.O.12866, Circular A-94 and A-4, and memo M-12-06)
  - NAS recommendations (NAS, 1990; NAS 1995)

**Not a science but science policy & public administration issue** (resource allocation and intergenerational equity and support good decisions):

- Contracted National Academy of Public Administration to review intergenerational issues



- NAS 1990: “[A] scientifically sound objective of geological modeling is learning over time, how to achieve the long-term isolation of radioactive waste. That is a profoundly different objective from predicting the detailed structure and behavior of a site...it is the latter use to which models have been put. The Board believes that this is scientifically unsound.”

## NAS 1995:

- “[W]e believe that there is no scientific basis for limiting the time period of the individual-risk standard to 10,000 years or any other value.”
- “[W]e note that although the selection of a time period of applicability has scientific elements, it also has policy aspects that we have not addressed.” “Another ... issue is intergenerational equity.”
- Recommended peak dose or a million years



## ***Deciding for the Future: Balancing Risks, Costs, and Benefits Fairly Across Generations, June 1997***

- Exhaustive literature survey
- Stakeholder workshop
- Expert panel

# NAPA Study Recommendations

- **Trustee Principle** - Every generation has obligations as trustee to protect the interests of future generations.
- **Sustainability Principle** - No generation should deprive future generations of the opportunity for a quality of life comparable to its own.
- **Chain of Obligation Principle** - Each generation's primary obligation is to provide for the needs of the living and succeeding generations. Near-term concrete hazards have priority over long-term hypothetical hazards. (rolling present)
- **Precautionary Principle** - Actions that pose a realistic threat of irreversible harm or catastrophic consequences should not be pursued unless there is some compelling countervailing need to benefit either current or future generations.

- Near term considered to be 2 or 4 generations. Distant future – 500 or 1,000 years.
- “Future impacts should be weighted differently from impacts on the present generation.”
- “[I]t is inappropriate to use traditional economic discounting formulas over long time periods ...”
- “Consideration of the needs of the future does not entitle anyone to impose an injustice on the present generation. In general, the literature related to intergenerational equity clearly opposes making trade-offs favoring the future that fail to meet crucial obligations to present generations, or that impose an injustice on the present.”

- Time of compliance is not simply a matter of science but a public administration issue that needs to be selected to support good decisions
- It is question of intergenerational equity and resource allocation
- The goal should be to expend current resources to maximize benefit to current and future generations

## Limitations and Considerations

- Dose limits based on current assessment of risk and needs
- Activities that generate waste are beneficial to both the current and future generations
- Future state of society and technology will change significantly over the next 100, let alone thousands of years
- Uncertainty in calculations is very large beyond a few hundred years

# Times Change

## Time Period

## Event/Activity

Approx 10,000 years ago

Glacial period ending. Hunting Mammoths

1862

Internal Combustion Engine

1903

Wright brothers

1969

Man on moon

## Top 3 Causes of Death

1900

Pneumonia, Tuberculosis, Diarrhea  
(Cancer # 8)

2001

Heart disease, Cancer, Cerebrovascular  
(Pneumonia #9, TB .02% of all, Diarrhea not listed)

# Costs of Excessive Time of Compliance

- Not just added PA computer run time
- Additional site characterization and research to defend increasingly speculative assumptions for longer times
- Schedule delays
- Extended licensing hearings
- Litigation
- Cancellation of projects
- Cost of elaborate barriers

***Invest in risk  
assessment or  
risk reduction ?***



# Additional Requirements (not Performance Objectives)

## Water Resources

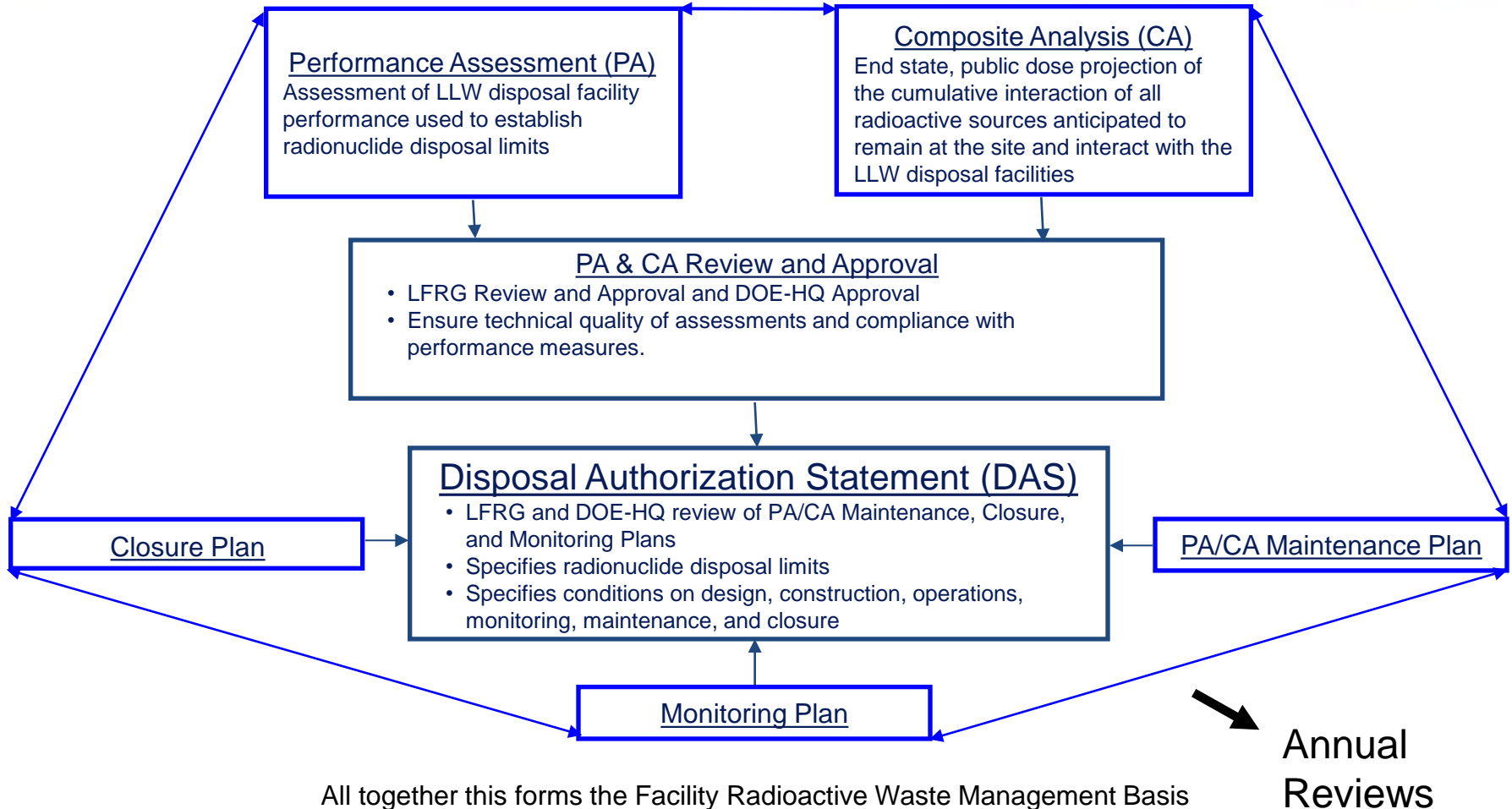
- For purposes of establishing limits on radionuclides that may be disposed of near-surface, the performance assessment shall include an assessment of impacts to water resources.

## Inadvertent Intruders

- For purposes of establishing limits on the concentration of radionuclides that may be disposed of near-surface, the performance assessment shall include an assessment of impacts calculated for a hypothetical person assumed to inadvertently intrude for a temporary period into the low-level waste disposal facility (discussed in more detail later).

# Documentation Required for a LLW Disposal Facility

## An Integrated & Iterative Regulatory Framework





Annual summaries routinely document activities that are relevant for the disposal facility, for example:

- Disposal volumes and inventories relative to projections
- Status of PA/CA maintenance activities
- UDQEs and any unforeseen circumstances
- Summary of demonstrations and field/laboratory studies
- Monitoring results with comparisons to model results
- General conclusions about the continued adequacy of the assumptions for the PA and CA

# Update to DOE Order 435.1

# Future Developments - Update to DOE Order 435.1

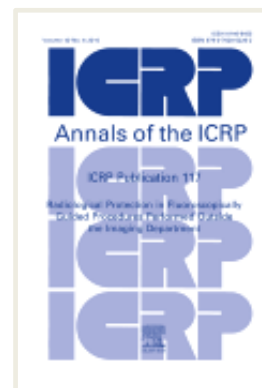
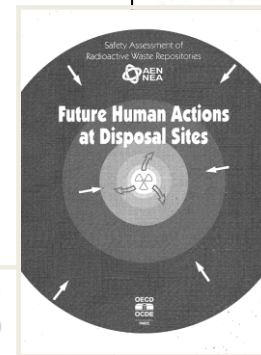
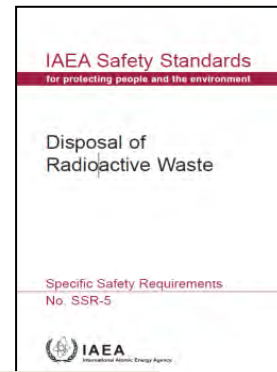
- Complex-Wide Review initiated late 2008
  - More than 10 years since first Complex-Wide Review (1996)
  - 10 years experience implementing DOE Order 435.1
  - First step to evaluate needs for DOE Order 435.1 update
- Final Complex-Wide Review Report was published
- DOE Order 435.1 Update is nearly complete in draft form
  - Order, Technical Standard and Guide are being prepared
  - Will include a public review and comment period

- Technical Standard being developed to replace format and content guides and other informal guidance, for example
  - Disposal Authorizations,
  - Contents for PA report, CA report, monitoring report, closure plan,
  - LFRG review process,
  - Unreviewed disposal question process.
- Specific requirements to provide the ability to use probabilistic results to compare with objectives
- Specific provisions to address Waste Incidental to Reprocessing and Tank Closure

# Inadvertent Intrusion

## IAEA, ICRP and OECD/NEA

- Consider inadvertent intruder, not advertent intruder
- Striving to reduce potential for and/or consequences of intrusion
- Intrusion considered in the context of intervention and optimization, not as a dose constraint or objective
- Limited stylized scenarios, current habits
- Optimize waste acceptance, design, etc.

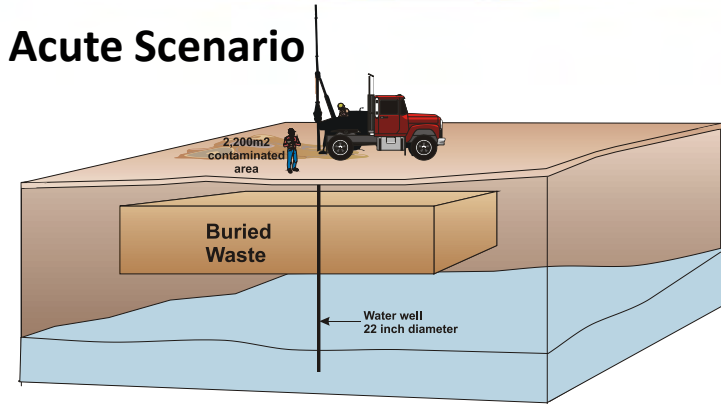




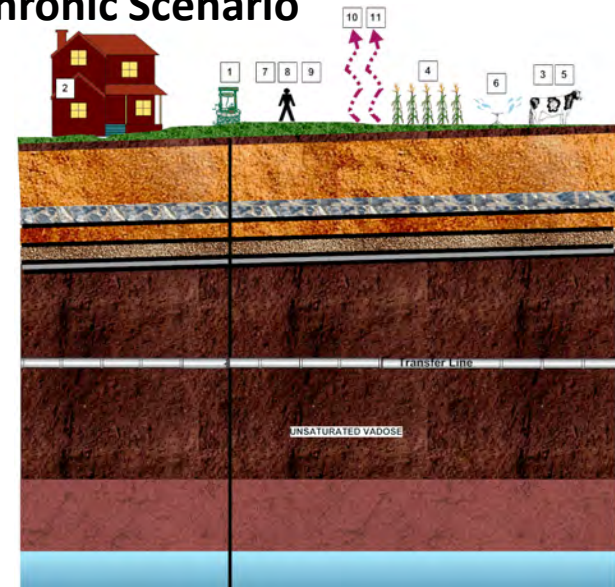
# Inadvertent Intrusion (DOE)

- Assess the potential consequences in the case of a temporary loss of institutional controls (hypothetical)
- Typically assumed to occur immediately following loss of institutional controls (e.g., complete loss of memory of site, land use/deed restrictions not effective)
- Active institutional control assumed to only last for 100 years, in spite of DOE requirements to maintain controls
- Stylized scenarios similar to basis for Part 61 typically used

## Acute Scenario



## Chronic Scenario



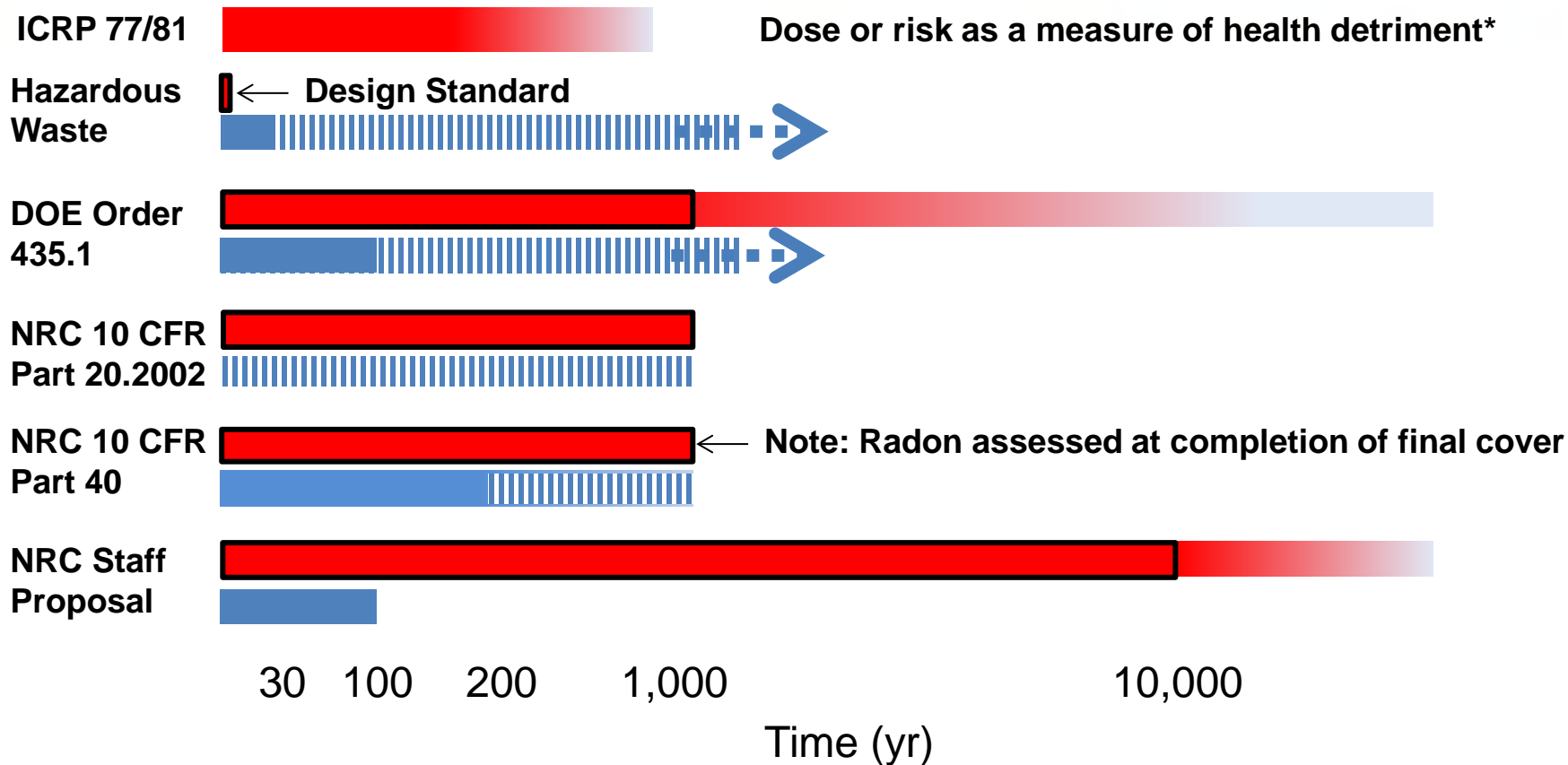
- Results are addressed in the context of establishing waste acceptance criteria and improving facility design, but not considered a performance objective - consistent with
  - EPA feedback on 10 CFR Part 61 rulemaking that intrusion should not be a performance objective
  - International recommendations that intrusion is considered from the perspective of optimization rather than as a performance objective

Two criteria are considered

- Acute (e.g., basement excavation, well drilling) exposures are compared with 500 mrem consistent with basis for Part 61
- Chronic (e.g., residential) exposures are compared with 100 mrem/yr which is more restrictive than basis for Part 61, but does not include doses from groundwater use



# Regulatory Time Frames for Near-Surface Disposal



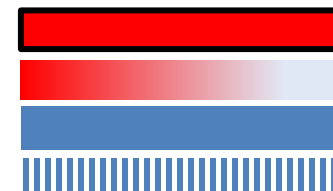
\*\*\*Several hundreds of years\*\*

Assessment of Compliance

Decision-making

Active institutional controls

Commitment to control as needed



# Conclusions

- DOE has more than 25 years implementing an integrated protection systems approach to near-surface disposal
- Defense-in-depth approach is applied with a number of safety factors inherently built into the process
- PAs are viewed as one of many inputs to the RWMB and for risk informed decision-making
- Regulatory approach is to seek consistency with existing promulgated requirements
- There is no specific cutoff applied to PA calculations – 1,000 years deemed appropriate for quantitative compliance followed by a transition to a more risk-informed interpretation recognizing increasing uncertainties
- Inadvertent intruders considered in the context of optimization, not a performance objective
- Radon considered separately from the all pathways objective

# Backup Slides

## 10 CFR Part 40, Appendix A, Criterion 6 (Tailings)

*"A calculation of the potential peak annual TEDE within 1000 years to the average member of the critical group that would result from applying the radium standard (**not including radon**) on the site must be submitted for approval."*

*(Note: compliance with Radon flux standards are a design requirement assessed at time of emplacement of final cover)*

## 40 CFR 61, Subpart H (NESHAPS)

Definitions (Effective Dose Equivalent) - "For the purposes of this subpart, doses caused by radon-222 and its respective decay products for after the radon is released from the facility are not included."

## 40 CFR 190.10 (a) – Environmental Standards for the Uranium Fuel Cycle

" The annual dose equivalent does not exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public as the result of exposures to planned discharges of radioactive materials, **radon and its daughters excepted**, to the general environment from uranium fuel cycle operations and to radiation from these operations."

## 10 CFR Part 20.1101(d)

"... a constraint on air emissions of radioactive material to the environment, **excluding Radon-222 and its daughters**, shall be established..., such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10 mrem (0.1 mSv) per year from these emissions."

## **10 CFR Part 40, Appendix A, Criterion 6 (Tailings)**

*"A calculation of the **potential peak annual TEDE within 1000 years** to the average member of the critical group that would result from applying the radium standard (not including radon) on the site must be submitted for approval."*

*(Note: compliance with Radon flux standards are a design requirement assessed at time of emplacement of final cover)*

## **10 CFR Part 20.1401(d)**

*"When calculating TEDE to the average member of the critical group the licensee shall determine the **peak annual TEDE dose expected within the first 1000 years** after decommissioning."*



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# DOE Order 435.1 Implementation at the Savannah River Site

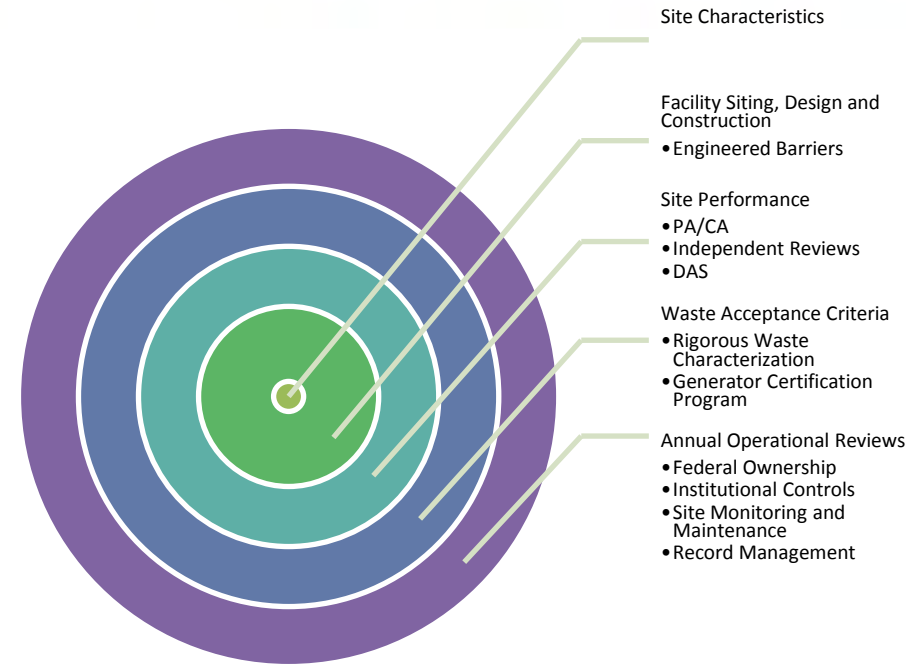
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Sherri Ross  
U.S. Department of Energy  
Savannah River Field Office  
November 19, 2013



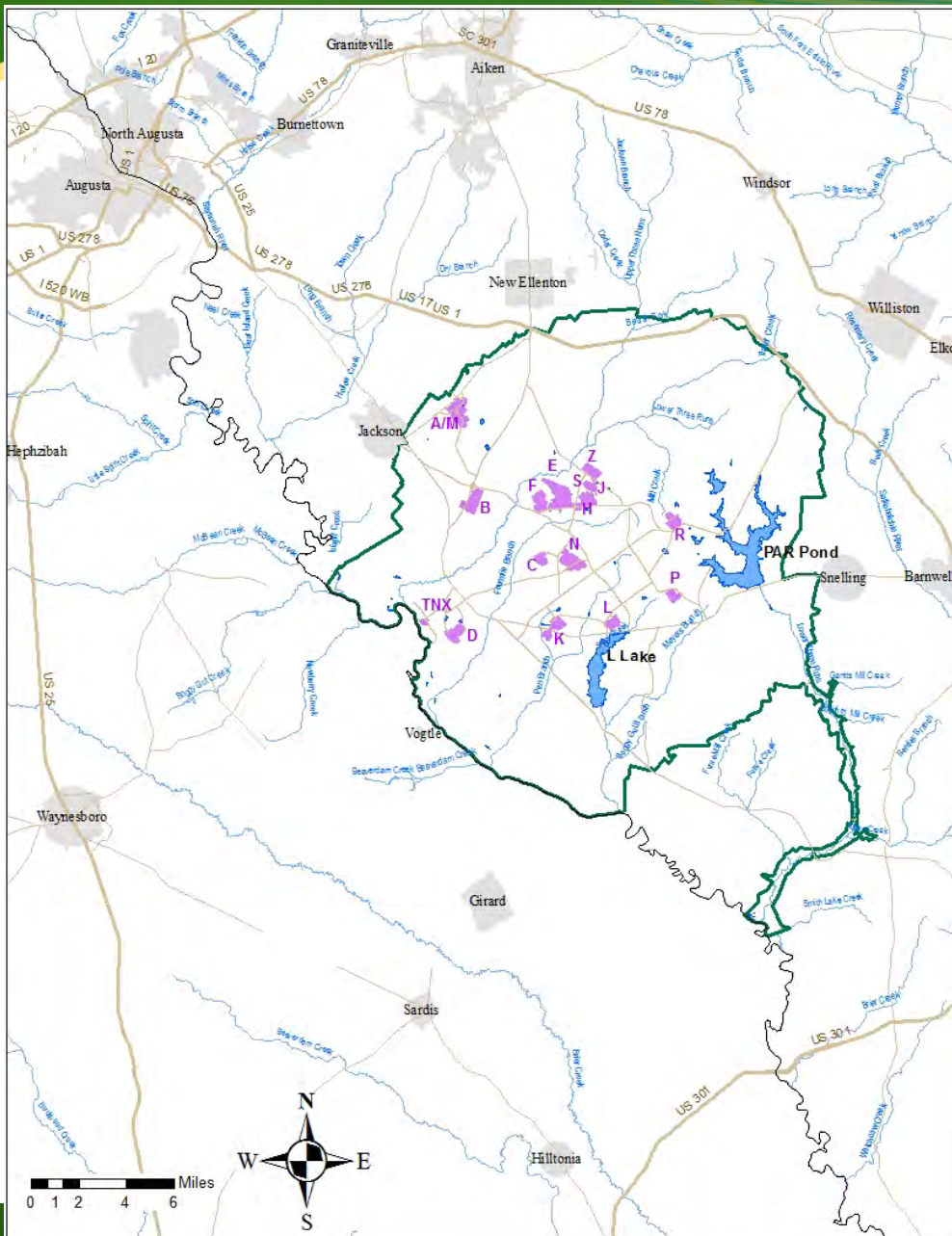
# Key Points

- Both natural and engineered barriers are considered to demonstrate compliance
- All disposal and closure facilities comply with performance objectives
- Performance Assessment (PA) Maintenance program supports continuous improvement and continued compliance
- Strong external stakeholder involvement (e.g., state, EPA, NRC, public)



# Overview of Savannah River Site

- 310 square miles of federally owned and controlled land
- Communities are ~6 miles from closure and disposal facilities in center of site
- Site waterways flow to the Savannah River which forms western boundary of the site



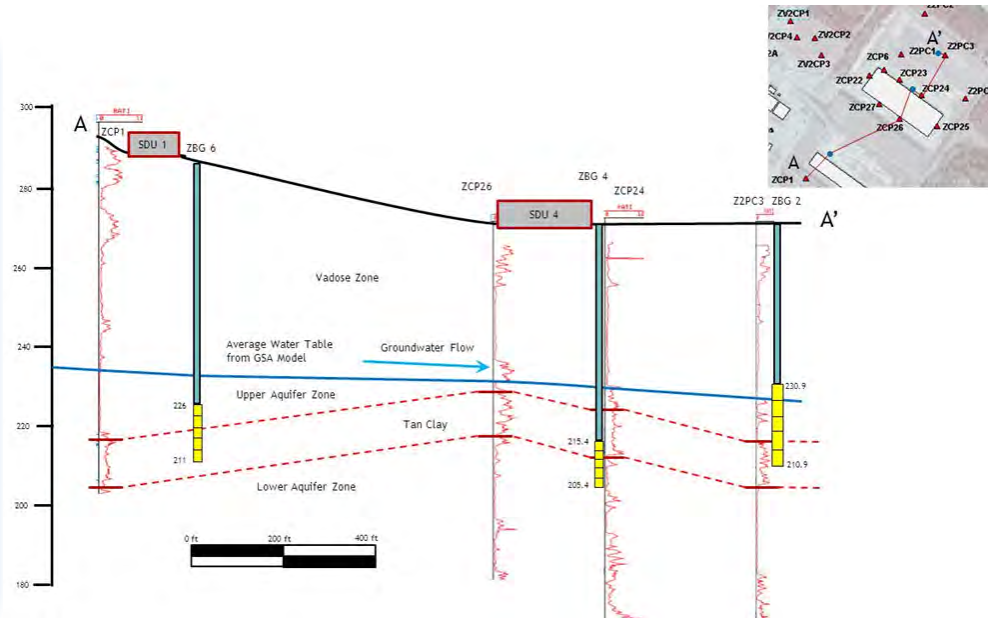
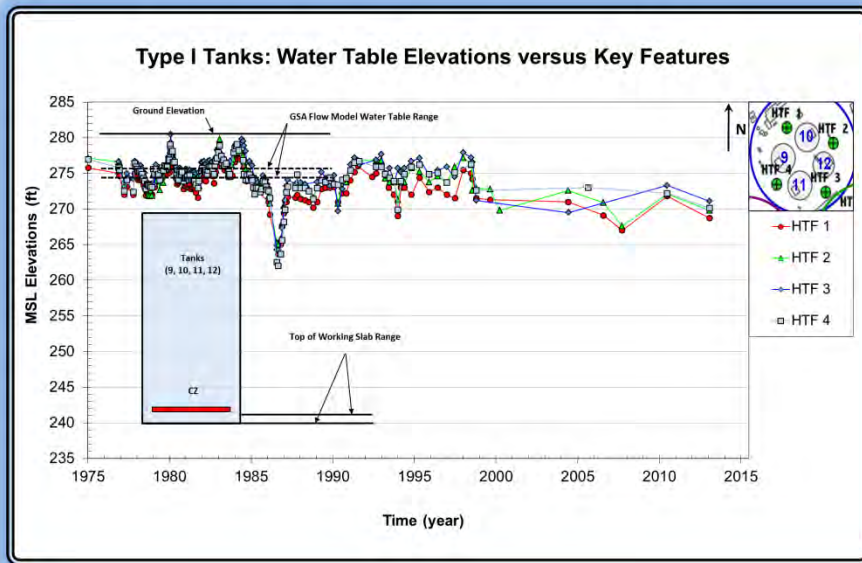


- Liquid waste facilities are either disposal facilities (i.e., Saltstone) or closure facilities (i.e., F and H Tank Farms)
- All facilities have Performance Assessments
  - Saltstone (1992, 2009)
  - F Tank Farm (2008, 2010)
  - H Tank Farm (2011, 2012)
- SRS has a Composite Analysis that covers all radioactive residues at the site (2010)

- Annual Performance Assessment  
Maintenance Plan and Disposal Facility  
Summary report
- Saltstone Disposal Facility includes Disposal  
Authorization Document, Waste Acceptance  
Criteria, Radioactive Waste Management  
Basis, Closure Plan, Monitoring Plan
- Tank farms utilize Tier 1 and 2 Closure Plans
- Continuously ensure conditions remain as  
evaluated in documents

# Natural Site Conditions

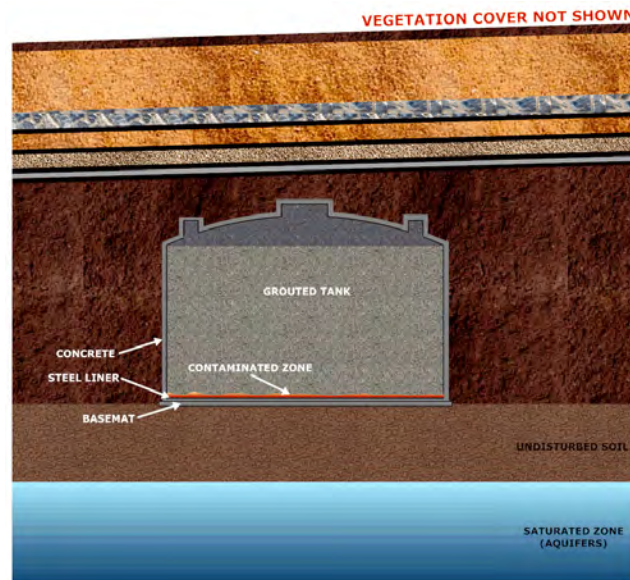
- Closure facilities range from within the groundwater to <20 feet above water table
- Disposal facilities are <50 feet above water table



- Humid environment with ~49 inches average annual rainfall, ~16 inches/year average infiltration
- Multiple potential exposure pathways from residual material over time
- Natural soil characteristics (e.g., clay content) a barrier to movement of certain contaminants
- Low seismic and volcanic activity



- Disposal and closure facilities incorporate multiple engineered barriers as part of the total system performance
  - Closure cap
  - Disposal cells / tank structures
  - Engineered waste form or tank fill material

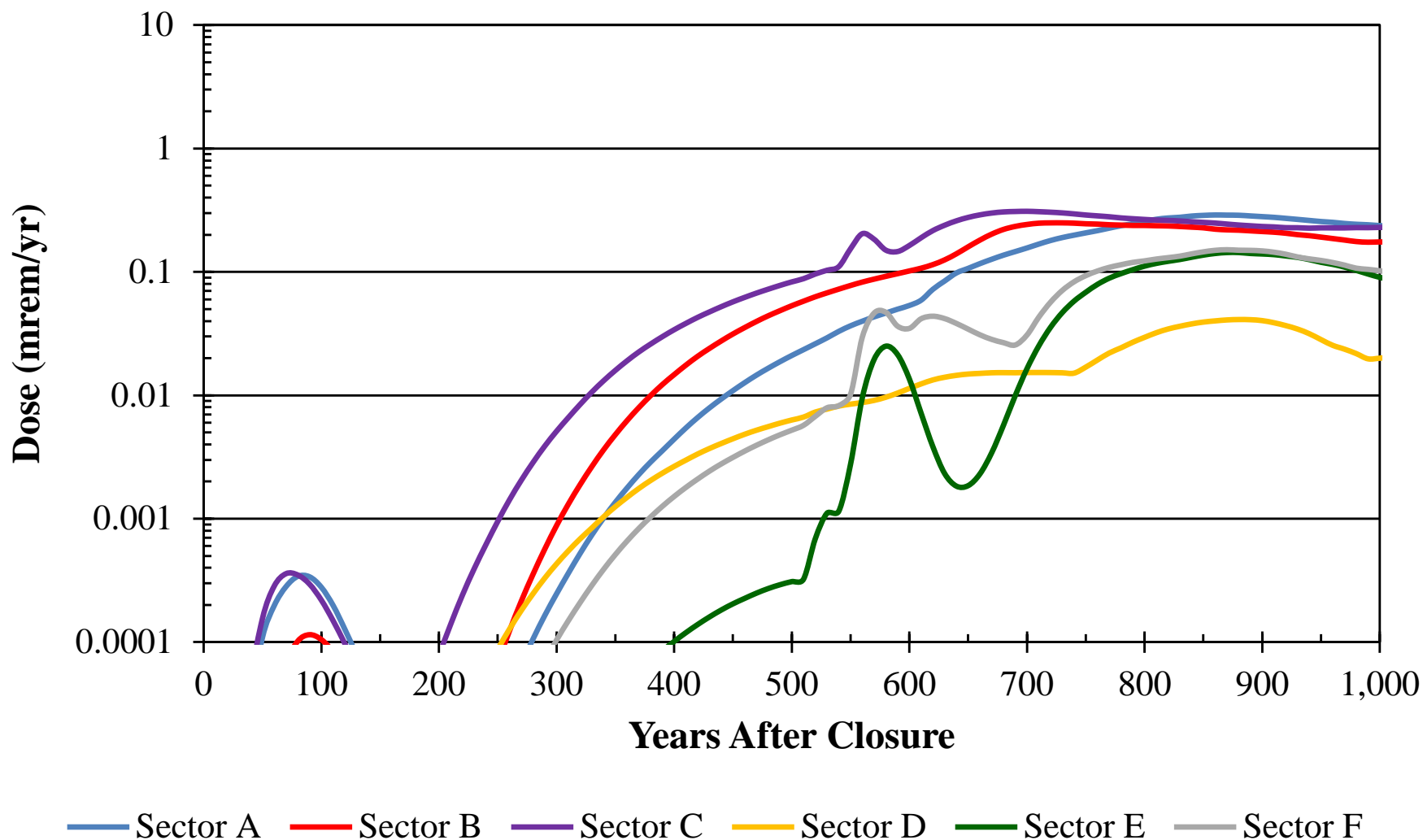


## Conservative Bias (Examples)

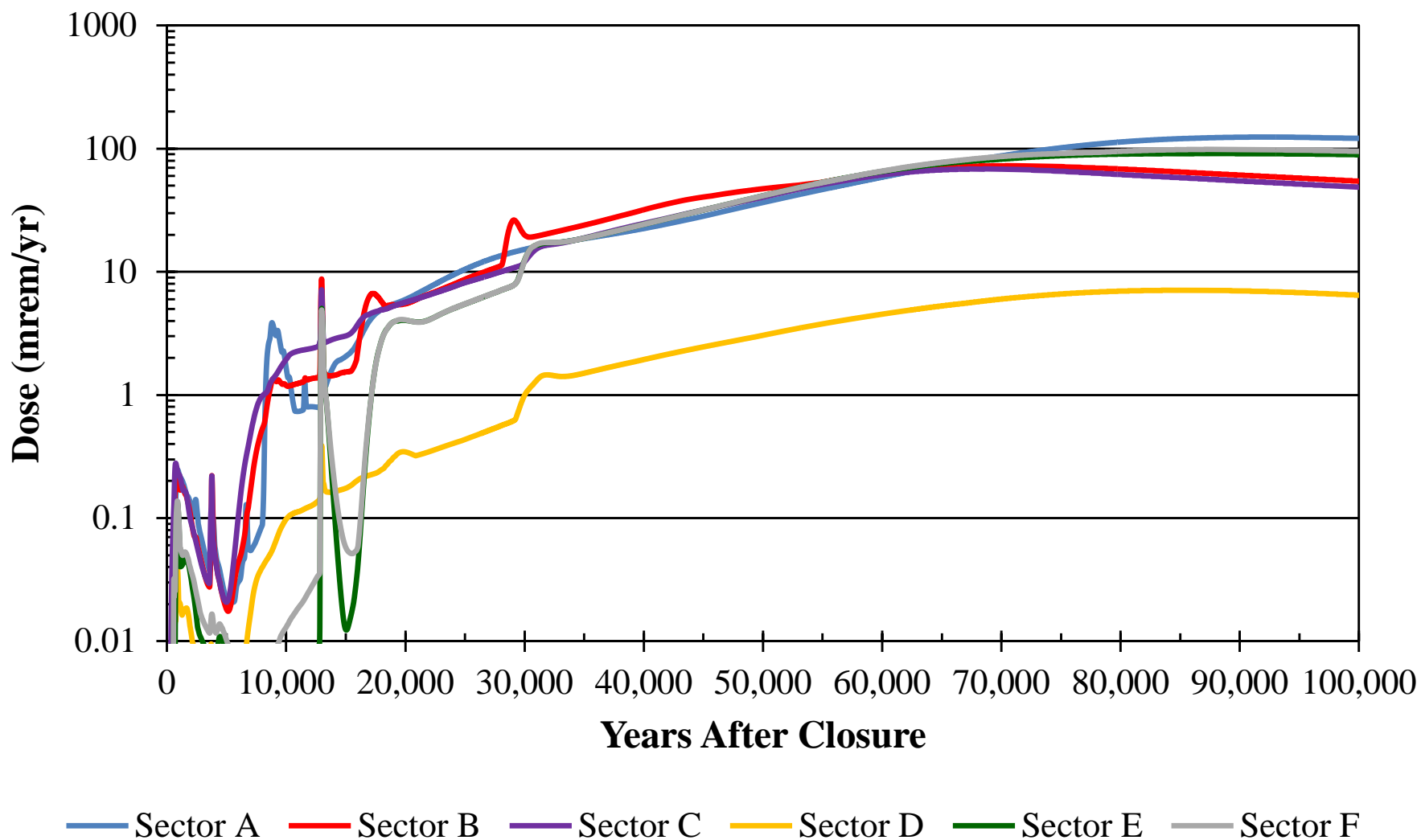
- Evaluate compliance doses at 100 meters although plans as negotiated with stakeholders assume government control of entire site in perpetuity
- No credit for passive controls after 100 year active institutional control period
- Use peak aquifer concentration although wells not typically drilled to shallow aquifers
- Assumed intruder resides directly on facility
- Assume all similar engineered barriers fail at the same time

- Modeling includes anticipated conditions and robust sensitivity and uncertainty analyses
- Detailed characterization of residual material during disposal or closure operations
- Disposal facility - Waste Acceptance Criteria used to evaluate proposed disposal streams
- Closure facility - final residual material characterization against anticipated inventories in modeling

# DOE Order 435.1 Compliance

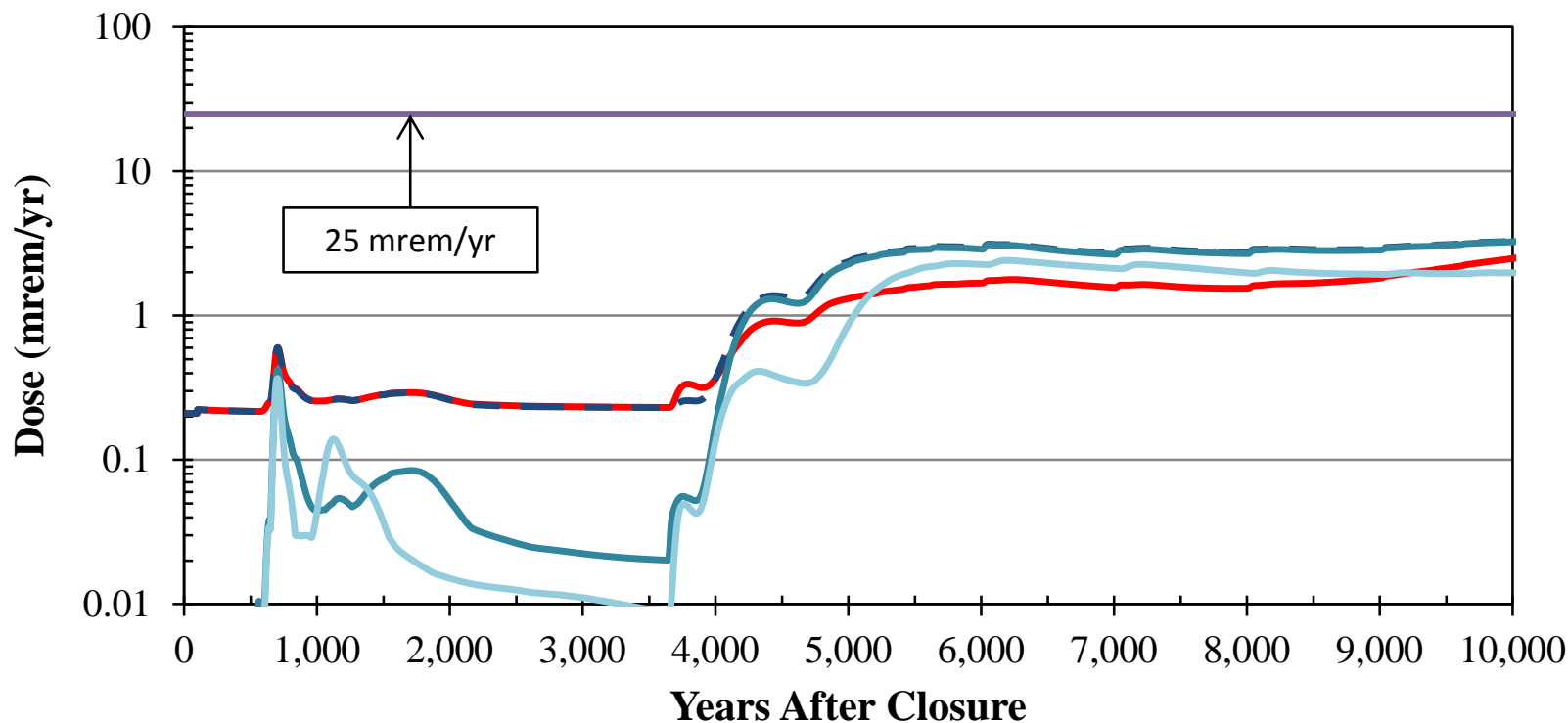






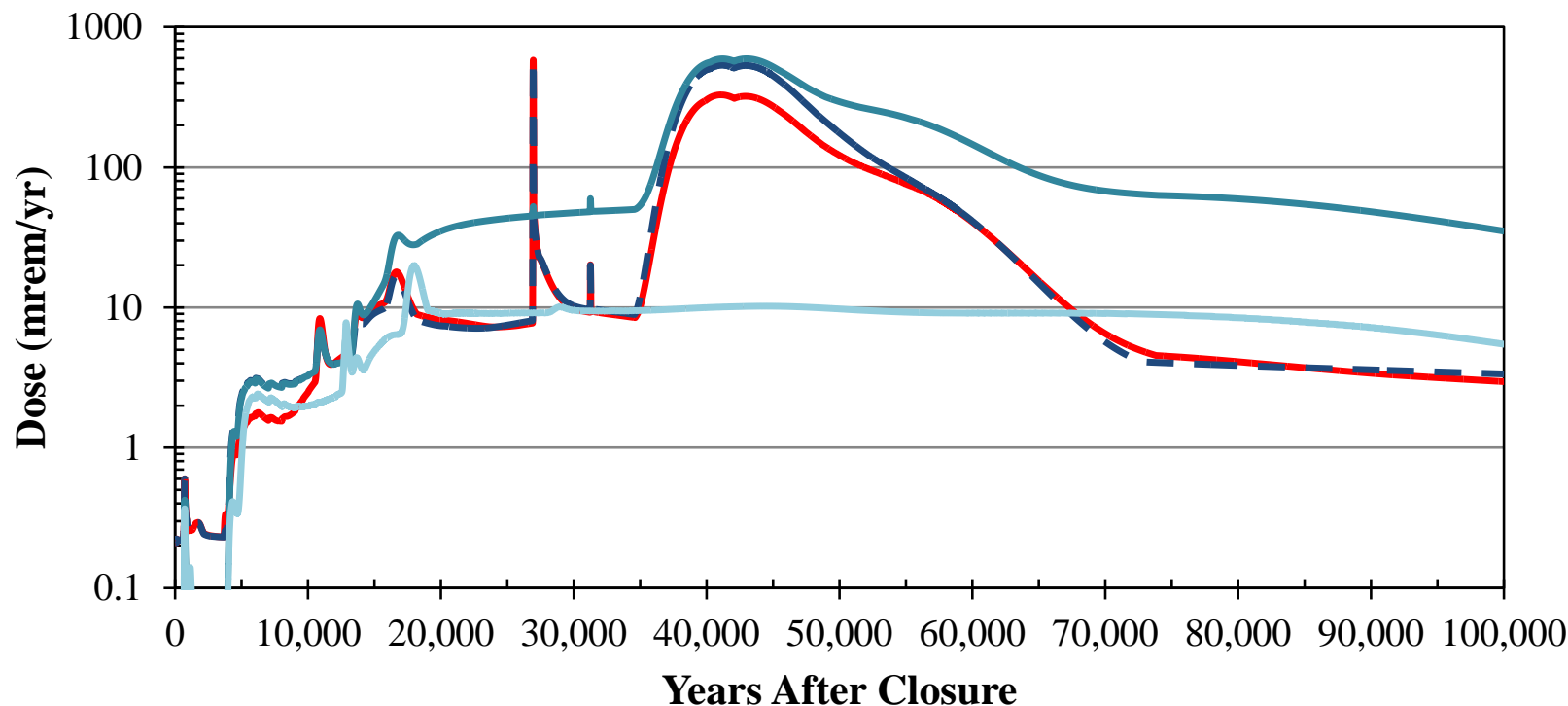
- Operating facilities have rigorous Unreviewed Waste Management Question (UWMQ) process to evaluate new information or proposed activities against expected conditions
- Can result in no action, UWMQ Evaluation or Special Analysis depending on nature/complexity of new information

# Special Analysis Example



- FTF PA, Rev. 1, All-Pathways Dose (Base Case)<sup>a</sup>
- Tank 18 and Tank 19 SA, All-Pathways Dose (Base Case)<sup>b</sup>
- Tank 5 and Tank 6 SA, All-Pathway Dose (Base Case)<sup>c</sup>
- Tank 5 and Tank 6 SA, All-Pathway Dose (Composite Sensitivity Study)<sup>d</sup>

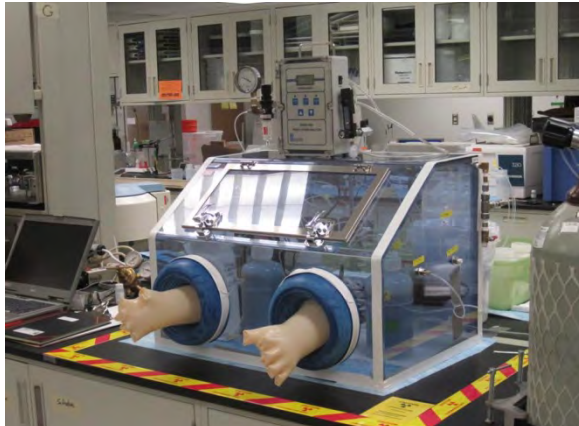
# Special Analysis Example



- FTF PA, Rev. 1, All-Pathways Dose (Base Case) <sup>a</sup>
- - Tank 18 and Tank 19 SA, All-Pathways Dose (Base Case) <sup>a</sup>
- Tank 5 and Tank 6 SA, All-Pathway Dose (Base Case) <sup>b</sup>
- Tank 5 and Tank 6 SA, All-Pathway Dose (Composite Sensitivity Study) <sup>c</sup>



- Ongoing science work informed by the risk significance of PA/SA sensitivity and uncertainty analyses



- PA Maintenance Program plan evaluated and updated on an annual basis
- Annual summaries conducted on disposal facility to document operations and science work in relation to establish bases
- Annual monitoring includes facility and environmental media conditions

- Special Analyses performed as key science work obtained or new information available for a closure facility (e.g., final tank inventory determined)
- Performance Assessments revised on a periodic basis with timing driven by magnitude and significance of changes to modeled system





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# DOE Order 435.1 Implementation at the Nevada National Security Site

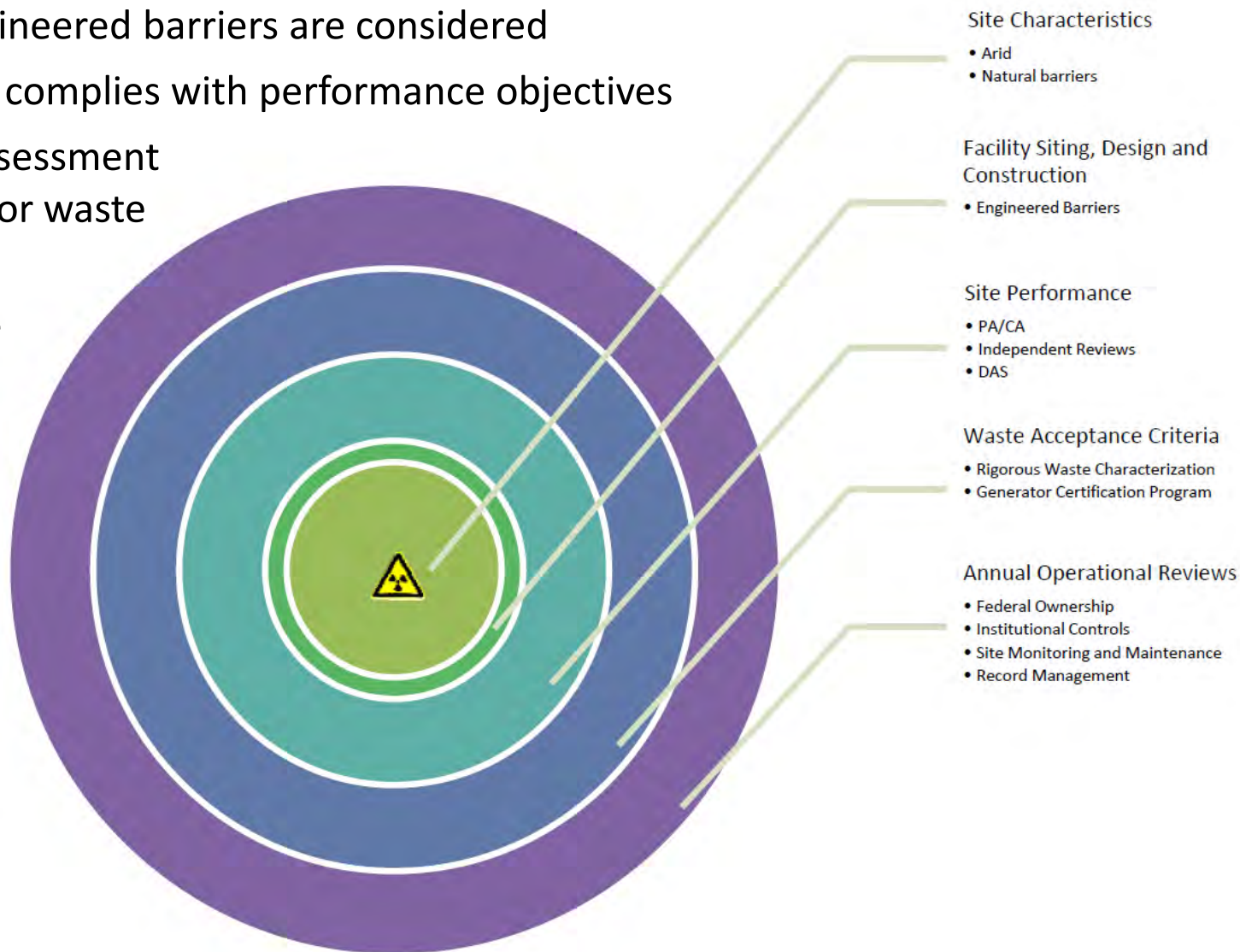
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Robert Boehlecke  
U.S. Department of Energy,  
Nevada Field Office  
November 19, 2013

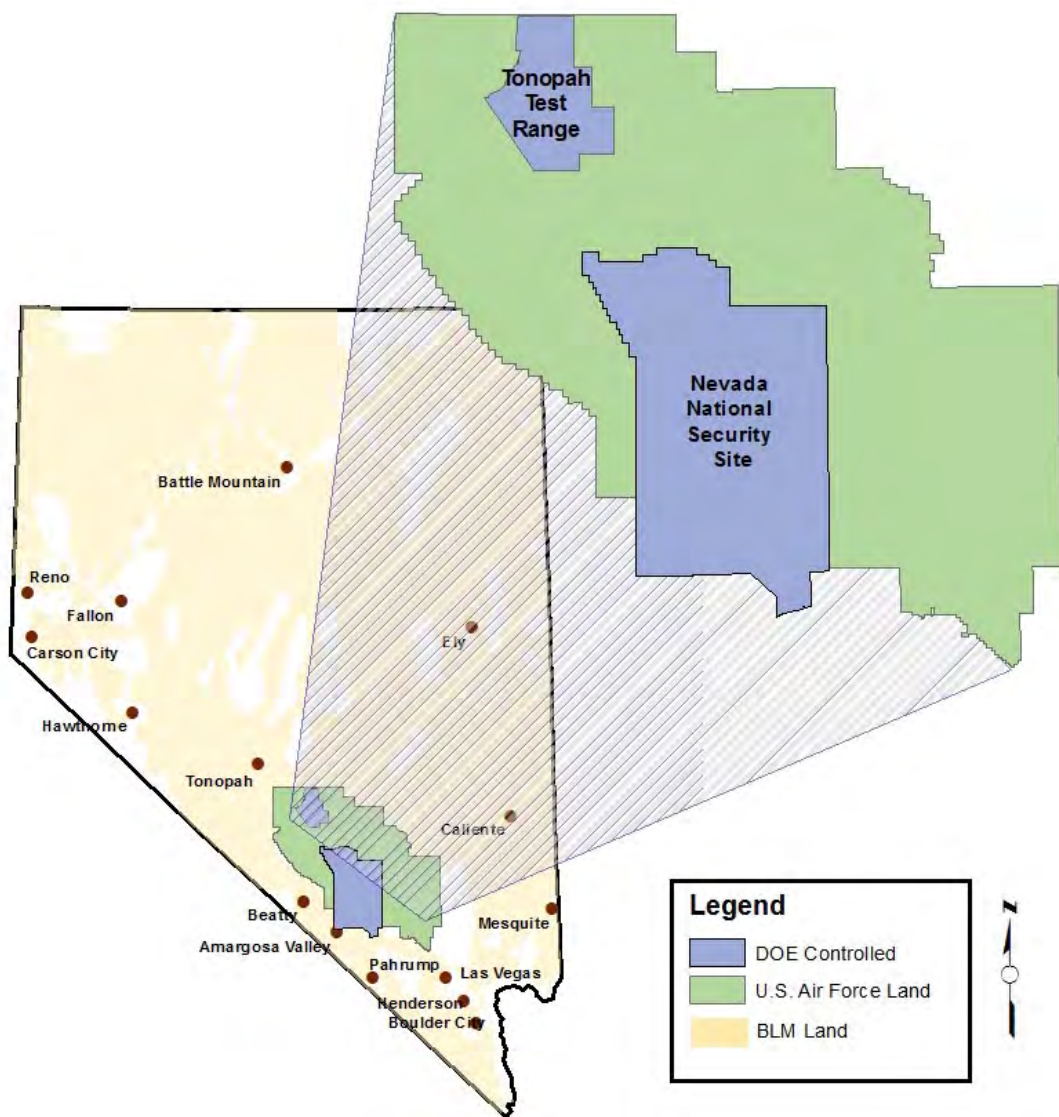


# Key Points

- Natural and engineered barriers are considered
- Disposal Facility complies with performance objectives
- Performance Assessment (PA) used daily for waste profile review
- PA Maintenance program allows for continuous improvement
- Strong external stakeholder involvement (e.g., state, advisory board)



# Overview of Nevada National Security Site (NNSS)



- 1,360 sq. miles of federally owned and controlled land
- Surrounded by 4,500 sq. miles of federally owned and controlled Nevada Test and Training Range (NTTR)

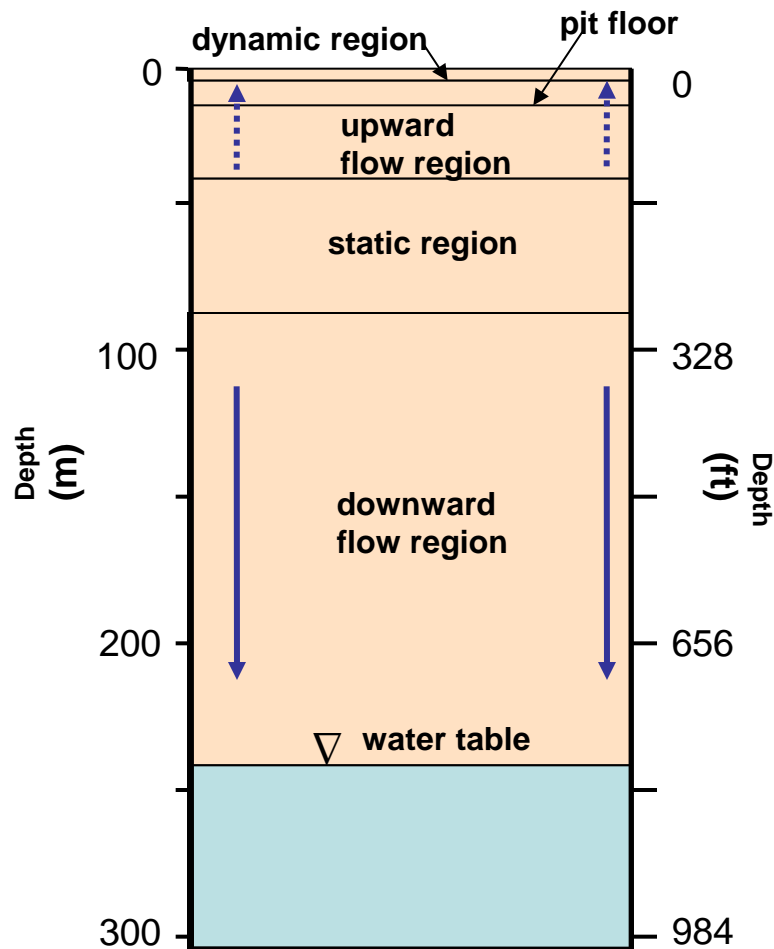
## Area 5 Radioactive Waste Management Site (RWMS)

- Disposal Authorization Statement (DAS) issued in 2000, 2002, and 2007
- Radioactive Waste Management Basis (RWMB)
- PA (DOE/NV/11718-176)
  - Two addenda (DOE/NV/11718—176-ADD1;-ADD2)
- Composite Analysis (CA) (DOE/NV—594)
  - One addenda (DOE/NV—591-ADD1)

- Maintenance Plan (DOE/NV/25946—091)
- Closure Plan (DOE/NV/25946--553)
  - Includes monitoring plan
- NNSS Waste Acceptance Criteria (NNSSWAC)  
(DOE/NV—325-Rev.10)
- 2012 annual summary report (DOE/NV/25946—1717)

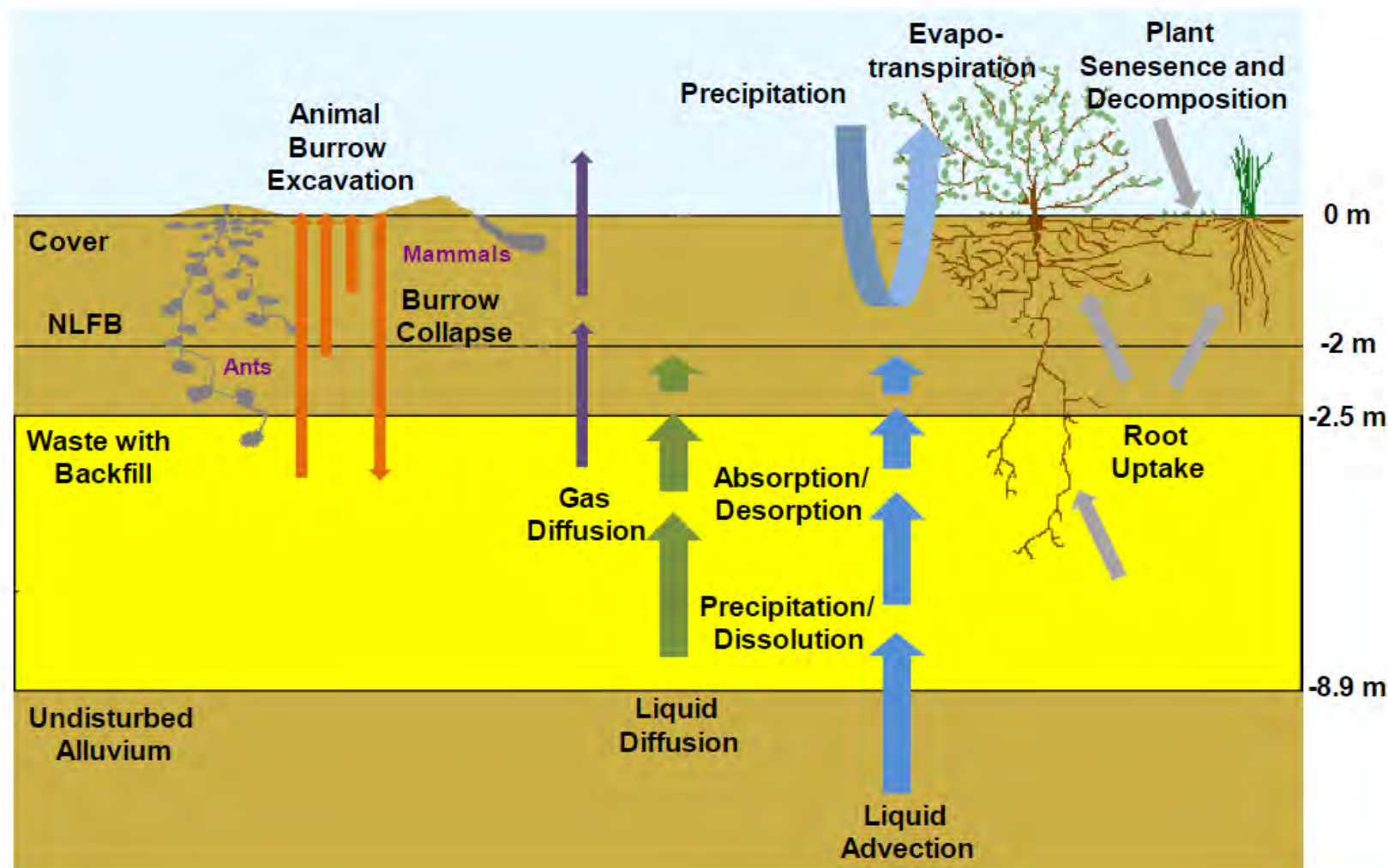


# Natural Site Conditions

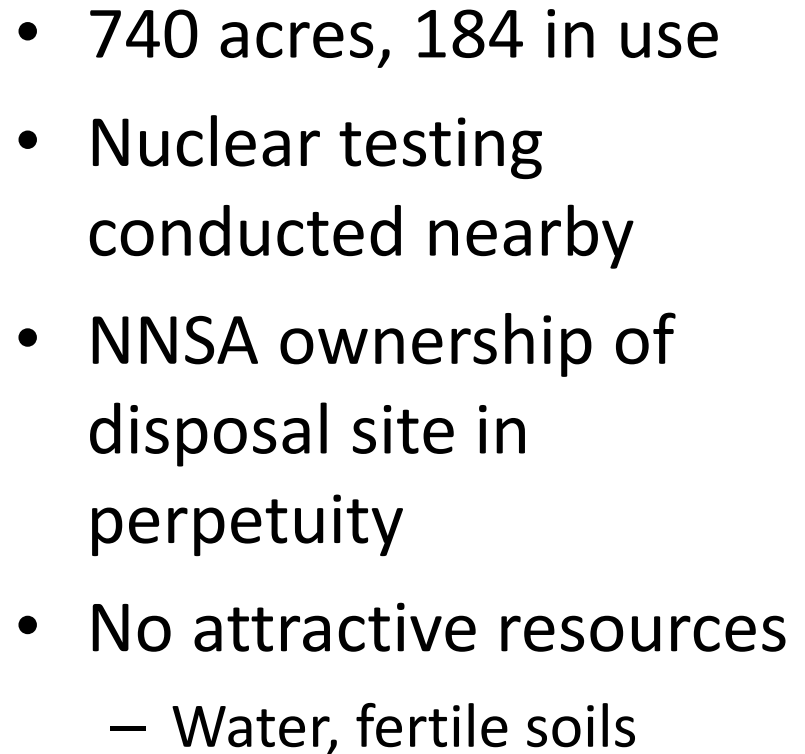


- Located >700 feet above groundwater
- ~5 inches average annual rainfall
- High potential evaporation rates (x12 rainfall)
- No groundwater pathway
- Drying unsaturated zone with upward water and vapor flow
  - 35 m
- Limited pathways from buried waste to surface
- Low seismic and volcanic activity

# Natural Site Conditions (continued)

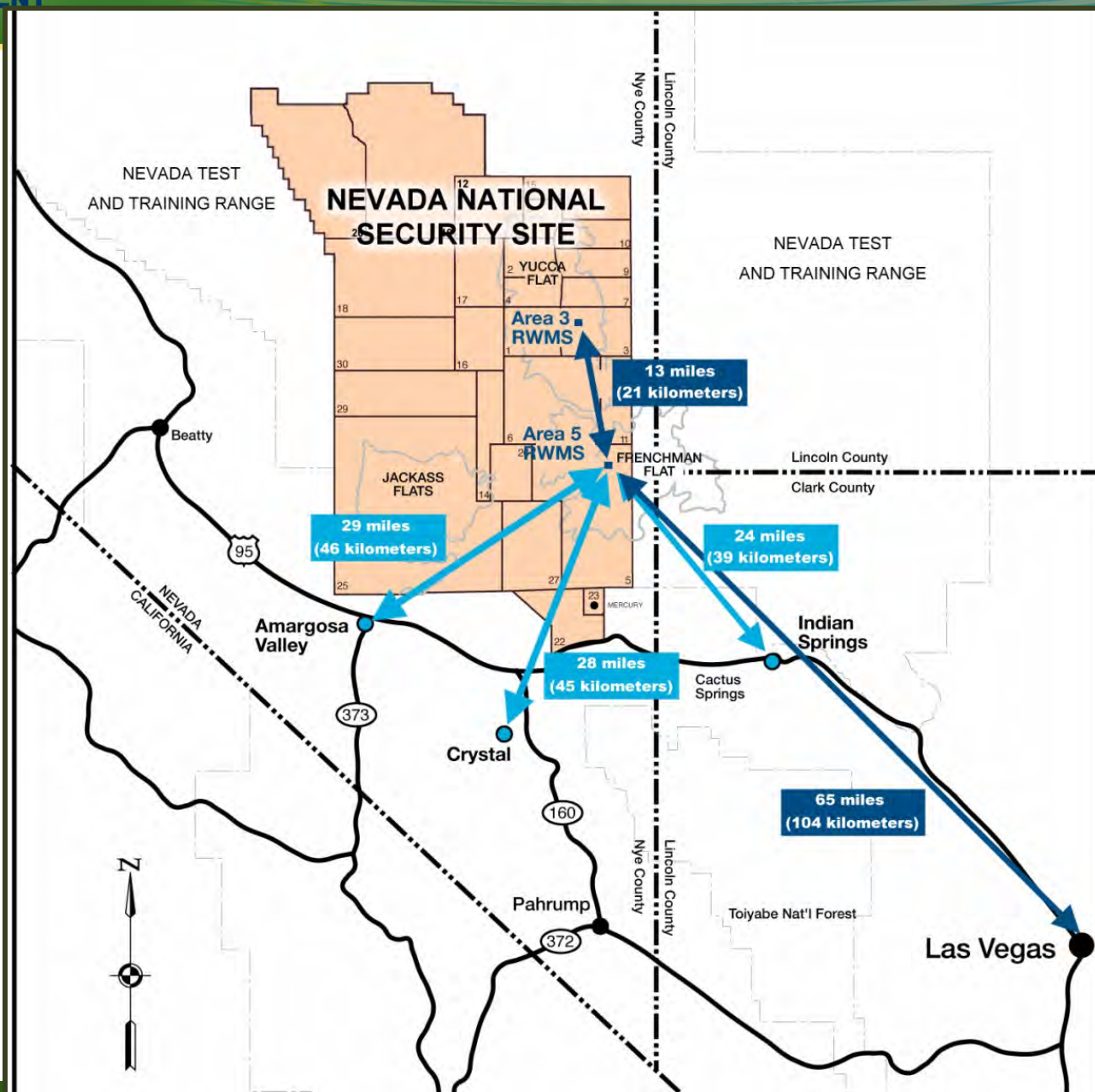


No groundwater pathway





# Distance to Communities





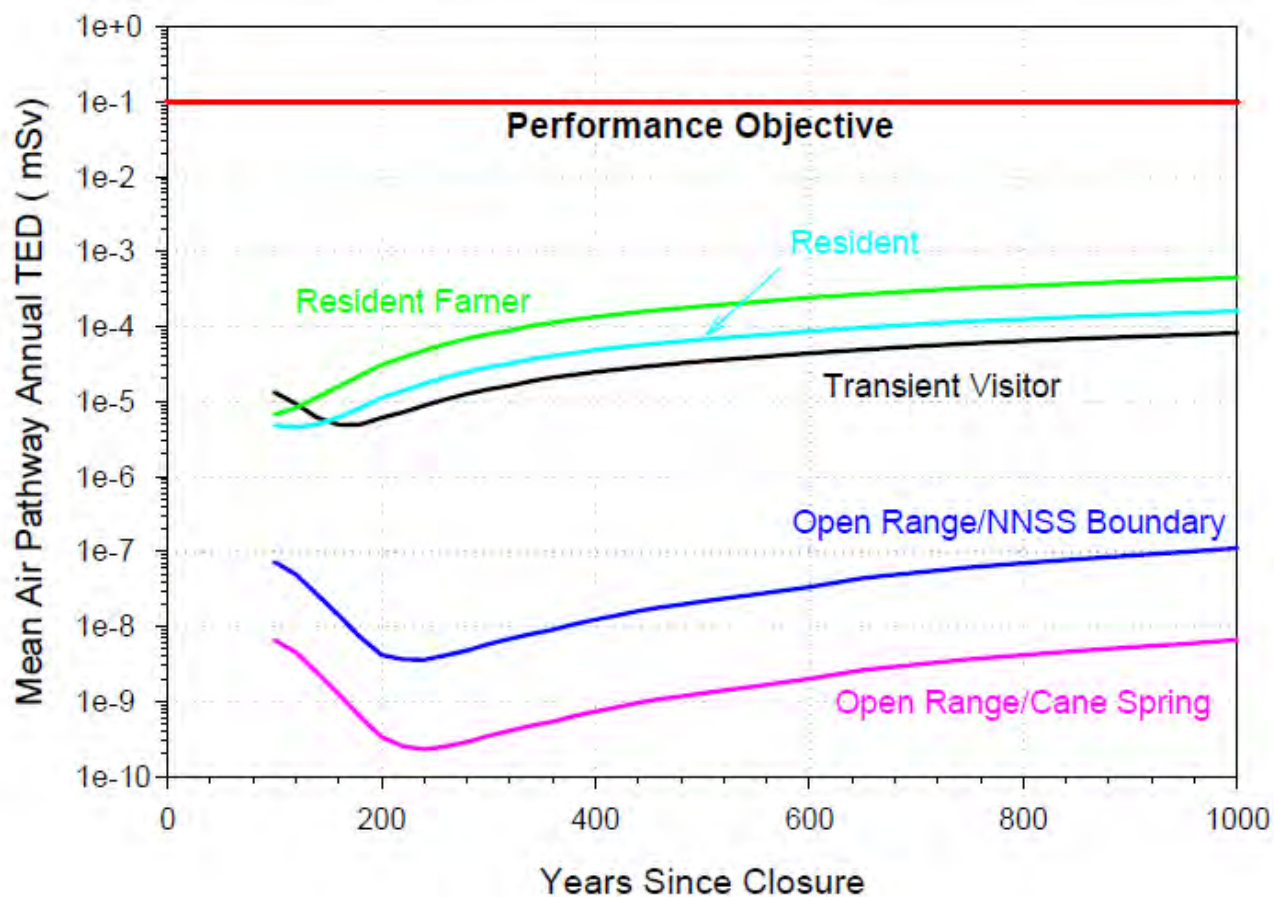
## Conservative Bias/Assumptions

- Radionuclides available for immediate release and transport
  - Waste forms and containers do not delay source term release
- Inadvertent intruders do not recognize waste at any time
- Resident continuously present 100 m from the RWMS boundary
  - No evidence of any permanent or long-term presence of humans in Frenchman Flat
- Member of public 100 m from the RWMS boundary exposed to soil concentrations estimated for the disposal unit covers
  - No dilution during transport from the disposal site cover to the residence

## Conservative Bias/Assumptions

- Conservative bias is used for the compliance
- Probabilistic model used to quantify uncertainty and reduce conservatism for cost effective management of facility lifecycle
  - 2007 NNSSWAC concentration action levels based on probabilistic model results
  - Resident farmer highly conservative for NNSS, moved to resident with no agriculture for compliance

# Compliance



Member of Public Air Pathway results

TED – Total Effective Dose

# Uncertainty/Maintenance

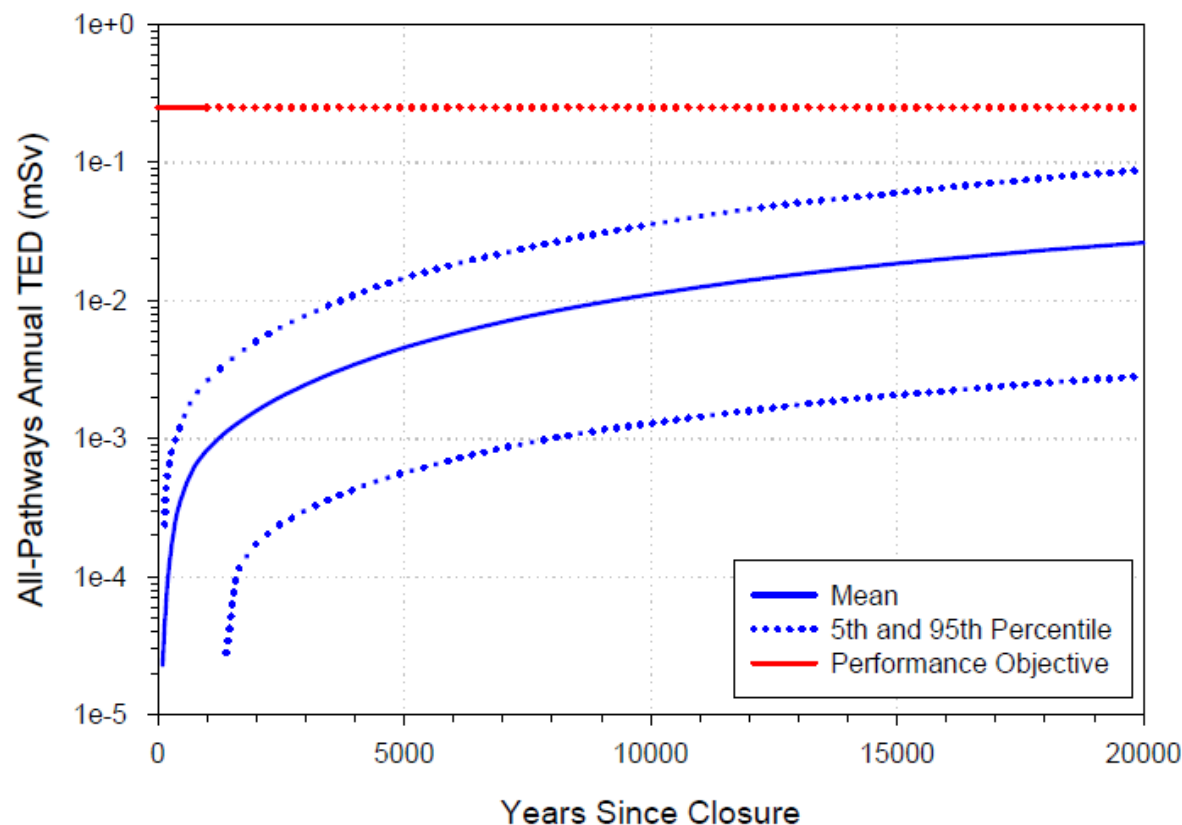


Figure 1. Area 5 RWMS all-pathways annual TED to a resident estimated by the A5 RWMS v4.114 GoldSim model.

- Uncertainty analyses include
  - Chronic intruder scenarios
  - No cover vs. various cover thickness
  - Additional member of public (MOP) scenarios
  - Out year model runs (20,000, 60,000 years)

# Qualitative Peak Information

Performance Objective	Scenario	Time of Maximum (years)
Air Pathway	Resident	3.1E6
All-Pathways	Resident	3.3E6
<sup>222</sup> Rn Flux Density	NA	2.0E6
Acute Intruder	Acute Drilling	2.4E6
Acute Intruder	Acute Construction	1.8E6



# Inadvertent Intruder Analyses

- Construction scenario estimates the dose to construction workers building a home with a basement on a disposal unit
- Acute drilling scenario estimates dose to a drill crew drilling a water well through a disposal unit
  - Exposure to contaminated drill cuttings occurs while auguring a surface casing for the well
- Used to set radionuclide action levels in NNSSWAC

- Waste Acceptance Review Panel reviews every waste profile (WP) submitted for disposal
- Members: DOE/State of Nevada/site operations/RWAP/performance assessment/nuclear safety/criticality
- Generator facility audits and mixed waste stream verification
- 24 approved off-site generators



## Nevada National Security Site Waste Acceptance Criteria

Prepared by  
U.S. Department of Energy  
National Nuclear Security Administration  
Nevada Site Office  
Waste Management Project



# PA Review of Waste Profiles

- Review for potential change to PA and DAS
  - Changes radionuclide inventory
  - Requires a change in facility design or closure plans; or the imposition of operational constraints or conditions
  - Alters the likelihood of a feature, event, or process; or significantly change a parameter value
  - Requires a change in waste acceptance criteria, the performance assessment or disposal authorization statement
- If yes to any, enter unreviewed disposal question (UDQ)

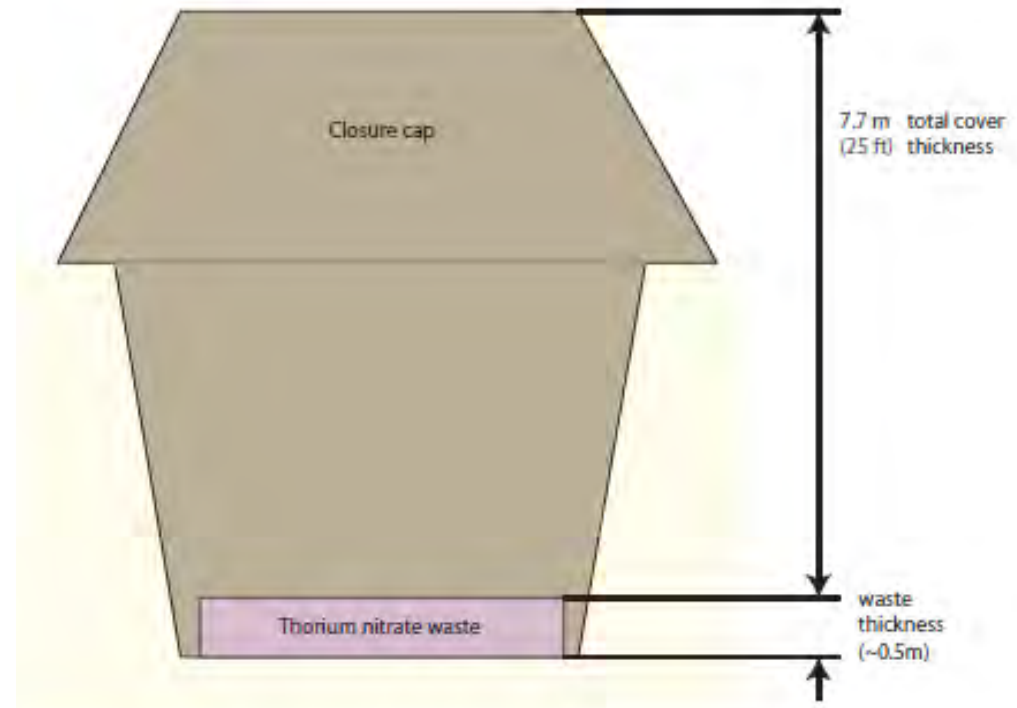


# Unreviewed Disposal Question Process

- Inventory changes
  - Screening using sum of fractions based on WAC action levels
    - If pass no further action, if fail then special analysis
- Special Analysis
  - PA and process modeling (e.g. radon producing radionuclides, heat-producing potential)
  - Impose operational conditions (depth, spacing)
  - Radionuclides not analyzed in PA

# Special Analysis Example

- Thorium Nitrate in Cell 13
- 11,600 cubic meters (m<sup>3</sup>)
- Ra-226, Th-230, Th-232 exceed WAC action levels
- Buried in deeper trench (25 feet) in a single layer
- No other waste placed above



- Ongoing field study and environmental monitoring based on PA/CA sensitivity and uncertainty analyses
  - Field Investigations determined proper distribution for burrowing animals and plant root depths
  - Vegetative cover based on long-term lysimeter
- Annual summaries document review of modeling and inventory updates, monitoring, and operations
- Monitoring includes facility and environmental media conditions

- Research and Development
  - ALARA cover optimization
- PA revision driven by magnitude and significance of changes

- Area 5 RWMS incorporates
  - Natural and engineered barriers based on sparsely populated arid disposal site
  - WAC compliance
  - Site assessments (PA/CA)
  - Maintenance program to ensure the facility is protective of the worker and public health and safety, and the environment