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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
(ACRS)
+ + + + +
SUBCOMMITTEE ON RADIATION PROTECTION
AND NUCLEAR MATERIALS
+ + + + +
WEDNESDAY,
APRIL 21, 2010
+ + + + +
ROCKVILLE, MARYLAND
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The Subcommittee met at the Nuclear
Regulatory Commission, Two White Flint North,
Room T2B3, 11545 Rockville Pike, at 8:30 a.m.,
Dr. Michael T. Ryan, Chairman, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

MICHAEL T. RYAN, Chairman

J. SAM ARMIJO, Member

DANA A. POWERS, Member

JOHN D. SIEBER, Member

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1 NRC STAFF PRESENT:

2 CHRISTOPHER BROWN, Cognizant Staff Engineer

3 and Designated Federal Official

4 RAY LORSON

5 ELIZABETH THOMPSON

6 RON PARKHILL

7 ROBERT EINZIGER

8 JORGE SOLIS

9 LUIS CRUZ

10 DENNIS DAMON

11 MICHEL CALL

12 JIM PEARSON

13 DAVID TANG

14 ZHIAN LI

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Adjourn

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

(8:28 a.m.)

CHAIRMAN RYAN: All right. It is the appointed hour, so we will come to order, please.

This is the meeting of the Advisory Committee on Reactor Safeguards, Subcommittee on Radiation Protection and Nuclear Materials.

I am Dr. Michael Ryan, Chairman of the Subcommittee. Subcommittee members in attendance are Dr. Sam Armijo, Dr. Dana Powers, Mr. Jack Sieber, and perhaps Harold Ray, but he is not here yet, so we will see him when he gets here.

The purpose of this meeting is to receive a follow-up briefing from the staff in the Division of Spent Fuel Storage and Transportation on the SRP for spent fuel dry storage at a general licensed facility, NUREG document 1536.

The Subcommittee was briefed on February 17, 2010, in which the staff discussed cask operations and vendor designs, and highlighted some of the pertinent changes made to the standard review plan. Today we will hear more details about the SRP revisions, in particular concerns raised about the risk prioritization approach in radiation protection.

Also, fuel cladding integrity and ISG-25 will be

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1 discussed.

2 The Subcommittee will gather information,
3 analyze relevant issues and facts, and formulate
4 proposed positions and actions as appropriate for
5 deliberation by the full Committee.

6 Christopher Brown is the Designated
7 Federal Official for this meeting.

8 The rules for participation in today's
9 meeting have been announced as part of the notice of
10 this meeting published in the Federal Register on
11 April 2, 2010.

12 A transcript of the meeting is being kept
13 and will be made available, as stated in the Federal
14 Register notice. It is requested that speakers first
15 identify themselves, and speak with sufficient clarity
16 and volume, so they can be readily heard.

17 We ask at this time that you silence your
18 cell phone or Blackberry.

19 We have not received any requests from
20 members of the public to make oral statements or
21 written comments.

22 The full Committee is scheduled for SFST
23 on May 6th at 8:30 a.m. in this room.

24 We will now proceed with the meeting, and
25 I will call upon Mr. Ray Lorson, Deputy Director in

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1 NMSS's Division of Spent Fuel Storage and
2 Transportation, to begin.

3 MR. LORSON: Okay.

4 CHAIRMAN RYAN: Good morning, sir.

5 MR. LORSON: Good morning. Good morning,
6 Dr. Ryan, and members of the Subcommittee. I just
7 want to thank you for this follow-up meeting to our
8 informational briefing that we had on February 17th.

9 At that meeting, there was a lot of good
10 discussion in our view, and we heard a lot of messages
11 and questions that we went back, looked at, reflected
12 upon, and I think that we were able to take that input
13 to make the document better. And the purpose of
14 today's meeting in our view is to basically kind of
15 take up where we left off from the last meeting, go
16 through and provide back to you the responses from
17 some of the issues and questions that were raised in
18 preparation for the next briefing of the full ACRS
19 meeting.

20 There were a couple of other things I want
21 to point out. You had mentioned ISG-25. That was an
22 ISG that we had had under development for a period of
23 time, and we are going to discuss that briefly here
24 today. That is something that is a natural fit into
25 our standard review plan, and so that works out well

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1 from the perspective of efficiency in terms of
2 handling multiple documents in this format.

3 The other thing you had mentioned was the
4 issue with the fuel cladding integrity question, and I
5 think that was something that was specifically
6 requested at the last meeting. It wasn't necessarily
7 an integral part of our SRP, but it was something
8 that, you know, we are prepared to discuss with you
9 today --

10 CHAIRMAN RYAN: Great.

11 MR. LORSON: -- based on your request. So
12 we will cover that.

13 CHAIRMAN RYAN: Thank you.

14 MR. LORSON: Also, if you notice the
15 gentleman to my left, Meraj Rahimi, is different than
16 the fellow that was here on February 17th. That was
17 Mike Waters. I don't know if anybody picked up on
18 that difference.

19 (Laughter.)

20 Mike has been off tasked with a separate
21 task. We received direction from the Commission in
22 the form of a Staff Requirements Memorandum to relook
23 at all of our regulations associated with spent fuel
24 storage and transportation, to include a number of
25 activities including our inspection process, oversight

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1 process, licensing process, and so this is actually
2 kind of an early step in that direction we received
3 from the Commission.

4 But Mike has been assigned full-time to
5 kind of develop our plan for how we are going to
6 respond to the Commission. So as a result, Mike is
7 gone and now Meraj here is backfilling behind Mike as
8 the Chief of the Thermal Containment Branch. So he
9 stepped in at an opportune time to lead us through the
10 discussion here today.

11 So with that, I will turn it over to
12 Meraj.

13 MR. RAHIMI: Thank you. Thank you, Ray.
14 My name is Meraj Rahimi. I am the Acting Branch Chief
15 for Thermal Containment.

16 Go to the next slide.

17 CHAIRMAN RYAN: Could you not wrestle your
18 microphone there? That is the recorder.

19 MR. RAHIMI: Ron control --

20 MR. BROWN: I thought Ron was going to be
21 put there to operate that.

22 MR. RAHIMI: Yes, he just stepped out.

23 MR. BROWN: Okay. So you're going to have
24 to --

25 MR. RAHIMI: Okay. Okay. I guess we

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1 went through this slide.

2 As Dr. Ryan mentioned, we met last time
3 February 17th. And what we did during that meeting,
4 we presented the revision to the SRP, an overview of
5 the revision to the SRP NUREG-1536, which is the SRP
6 for spent fuel dry storage system. And this SRP has
7 been in use by the staff for more than a decade, about
8 13 years, so I just wanted to mention that.

9 And what we did in this round of updating,
10 including all of the ISGs and also risk -- or what I
11 would say, you know, work prioritization, that -- we
12 will go over that.

13 And last time at the meeting we gave some
14 background on the dry cask storage system. We showed
15 a typical operation from, you know, receiving,
16 loading, transferring, placing a dry cask storage
17 system on the pad, and we provided the regulatory
18 basis and design basis.

19 In the Standard Review Plan update
20 project, we also gave the overall project approach,
21 and we also went over the -- sort of a risk-informed
22 approach and -- but with your, you know, insightful
23 comments. We went back and we call it now, you know,
24 prioritization methods.

25 And we had the technical staff to present

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1 a, you know, key revision to each chapter, technical
2 chapters. We went over that last time. And also, the
3 key stakeholder comments, you know, per chapter, which
4 was mainly from the industry.

5 And since the last meeting what we did, we
6 went back and we revised the SRP based on the
7 Committee comments. And some of them -- for example,
8 we replaced the risk-informed terminology with the
9 prioritization. That is one of the changes that we
10 did throughout the document. And also, the Committee,
11 you know, identified polymeric neutron shielding
12 materials as important to safety, and, you know, we
13 changed that. We included that as that item being
14 important to safety.

15 So today -- the purpose of today's meeting
16 is to continue the briefing on the update to the SRP.

17 And we are going to discuss the carryover items from
18 the last meeting, as Dr. Ryan mentioned, you know, a
19 couple of them, ISG-25, cladding integrity, and there
20 are a number of other items which in the next slide I
21 will cover it.

22 And also, we are going to talk about some
23 of the significant public comments and staff response
24 to those comments. We want to talk about those today.

25 And so you are more than welcome to

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1 identify any more areas of interest that the Committee
2 would like to hear, especially for the next meeting,
3 which is May 6th for the full Committee meeting.

4 CHAIRMAN RYAN: Great.

5 MR. RAHIMI: So today's presentation, that
6 is the order. And, first, I think Ron -- since Dennis
7 Damon is not here right now, so we are going to cover
8 the item I guess as the second item. So we are going
9 to go, first talk about the radiation protection. Ms.
10 Thompson will lead that, and --

11 CHAIRMAN RYAN: Somebody is rubbing a
12 microphone. Ron, is that you?

13 MR. PARKHILL: No, I don't --

14 CHAIRMAN RYAN: Yes, that black thing.

15 MR. PARKHILL: Oh.

16 CHAIRMAN RYAN: Don't rub that.

17 (Laughter.)

18 MR. PARKHILL: Sorry.

19 MR. RAHIMI: Bob Einziger is going to be
20 here later on. Yes, Bob Einziger, he is going to
21 cover, you know, two subject areas, spent fuel
22 oxidation and damaged fuel. And Luis Cruz, he is
23 going to briefly go over the ISG-25. That has been
24 incorporated in the SRP. I think we already forwarded
25 to the Committee the -- even the public comment and

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1 response to the public comment on that ISG.

2 And then, Ron will cover any other issues.

3 And at the end we will go over the -- some of the
4 public comments. And what we have done, we have
5 picked the significant comments in each discipline
6 areas, and we will go over those public comments and
7 the staff responses to those comments.

8 CHAIRMAN RYAN: Okay.

9 MR. RAHIMI: So with that, I guess I will
10 turn it over to Liz to go over the radiation
11 protection.

12 CHAIRMAN RYAN: Liz, why don't you come up
13 to the front, if you don't mind.

14 MS. THOMPSON: I kind of liked it back
15 here, Mike.

16 CHAIRMAN RYAN: Well --

17 (Laughter.)

18 -- we know you did.

19 MEMBER POWERS: We're trying to get you
20 out of your comfort zone here.

21 MS. THOMPSON: Okay. As many of you have
22 guessed, I am Elizabeth Thompson. I'm a Certified
23 Health Physicist and a Senior Health Physicist in
24 SFST. I am going to talk to you about radiation
25 protection and dry storage system licensing and

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1 operations.

2 I would like to start out by mentioning
3 that the NRC regulations for spent fuel storage are
4 structured to put the emphasis for radiation
5 protection into operation, so this standard review
6 plan reflects that emphasis. And this aspect of the
7 standard review plan has not changed in this revision.

8 I would also like to note that Part 72
9 does not specify how specific operations are
10 completed. It just ensures that the safety analysis
11 report that is submitted to NRC has an overview of the
12 operations that will be used with a system.

13 Another general thing to note is that for
14 NRC licensees 10 CFR Part 20 governs radiological
15 operations. All of these casks are used at facilities
16 with Part 50 licenses. So all of these licensees have
17 active and inspected 10 CFR Part 20 radiation
18 protection programs.

19 Also, there were several questions about
20 radiation limits last time, and it is not only the
21 limits in the regulations that come into play, but
22 also licensees have typically administrative limits
23 that are lower than the regulatory limits that help in
24 controlling the radiological activities at a site.

25 CHAIRMAN RYAN: Is there any typical value

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1 where they're set? Is it 80 percent, 75 percent, of
2 the regulatory limits, or --

3 MS. THOMPSON: I don't know that there is
4 a typical value. I would guess that there probably
5 is, but I'm not familiar with what it is.

6 CHAIRMAN RYAN: Okay.

7 MR. LORSON: I think INPO establishes
8 guidelines in the -- you know, where they distribute
9 information to the industry. And then the industry
10 tries to, you know, achieve a certain quartile status,
11 and so they all want to try to, you know, do what they
12 can to minimize dose compared to their industry peers.

13 CHAIRMAN RYAN: Okay.

14 MS. THOMPSON: All right. I am going to
15 -- I am going to talk to you about the storage system
16 and the radiation protection issues kind of together.

17 So questions on either one I will -- if you have
18 those, I will try to field them.

19 The key radiation protection of the -- the
20 key radiation protection aspects of the design are
21 reviewed during the review of an application for a dry
22 storage system. We look at the shielding features, we
23 look at the source terms of what is going to be placed
24 in the design, or what is allowed to be placed in the
25 design.

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1 We look at the generic procedures that the
2 applicant proposes. We look at the dose assessments
3 that the applicant provides, and we look at the
4 accident evaluations. Those are all reviewed during
5 the licensing process.

6 Next one, Ron, please.

7 Oh. I should have mentioned on the
8 previous slide the picture was of a welded canister
9 system. In this slide it just shows some different
10 systems on the right, and it's a system that has a
11 bolted-closure canister. Both this and the previous
12 system are generally -- are systems that are stored
13 upright when they are taken to the ISFSI pad.

14 The upper left picture is of a horizontal
15 storage system, and the lower left picture is actually
16 a photo of a horizontal system located at a site.

17 The licensing review ensures that
18 appropriate system characteristics and parameters are
19 placed in the Certificate of Compliance and the
20 technical specifications to control the design and
21 ensure that we can develop effective inspection
22 criteria for our inspectors to look at when they go
23 out to inspect the systems.

24 Next, Ron, please.

25 Now, in the way of procedures, in the

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1 safety analysis report, there are just high-level
2 generic procedures. We look at these to see that they
3 are consistent with ALARA principles, and these are
4 reviewed by the staff in SFST during the licensing
5 process.

6 Specific operating procedures are
7 developed at each site. These have to be consistent
8 with the procedures in the SAR, consistent with the
9 Certificate of Compliance and the technical
10 specifications, and also with 10 CFR 20 and the site's
11 radiological protection program. And these are
12 inspected by NRC's regional inspectors.

13 CHAIRMAN RYAN: Are the inspection staff
14 from NRC the same staff that does the reactor work, or
15 is it a separate --

16 MS. THOMPSON: There are separate
17 inspectors that do the ISFSI operation inspections.

18 MR. LORSON: Actually, to give you a more
19 complete answer, it is actually some combination of
20 both. It depends on -- it varies slightly from region
21 to region, because the regional makeups are slightly
22 different. For example, Region 2 does not have a
23 materials inspection program, whereas Regions 1, 3,
24 and 4 do have a materials inspection program.

25 In Regions 1, 3, and 4, the inspections

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1 are conducted separately out of their materials
2 inspection group. However, they do get assistance
3 from some of the folks that inspect the reactors
4 programs.

5 Some areas, like, for example, heavy loads
6 controls, is -- we rely upon the Part 50 heavy loads
7 program for handling of these materials during the
8 loading campaigns. And so the inspection is likely a
9 hybrid of both a materials inspector who is very
10 familiar with this, plus supplemented with some
11 Part 50 inspectors if there is specific expertise that
12 is required.

13 And from the headquarters office, we also
14 support a number of the inspections around the
15 country, mainly in the form of providing additional
16 resources where the regions may not have folks
17 available.

18 CHAIRMAN RYAN: Got you. Thank you.

19 MEMBER SIEBER: I have a quick question.
20 You talked about heavy loads. When you actually --
21 this shows a picture here, this slide, of loading a
22 cask and taking it out of the pool. The concrete and
23 all of that is always with the liner, is that correct?

24 MR. LORSON: No. The concrete storage
25 overpack --

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1 MEMBER SIEBER: Right.

2 MR. LORSON: -- what you see here is you
3 see the loading of -- this is a Holtec system design,
4 and the outer white portion of the can that you are
5 looking at, that is called a -- basically a transfer
6 overpack. It is called the Hi-Trac.

7 MEMBER SIEBER: Okay.

8 MR. LORSON: And what happens is the
9 actual mesh that you see on the picture, you know, the
10 actual --

11 MEMBER SIEBER: Right.

12 MR. LORSON: See there? That is the
13 actual multipurpose canister that the fuel is loaded
14 into. And so what happens is the fuel is loaded into
15 a honeycombed assembly --

16 MEMBER SIEBER: Right.

17 MR. LORSON: -- inside the multipurpose
18 canister. That is processed and welded shut. Okay?
19 And what happens is that overpack -- and we will see
20 it here in a minute. If you go two slides down --
21 there we go. What you see on the left here is a
22 picture of that overpack. That has been removed from
23 the -- excuse me, not the overpack, that is the
24 transfer, the high-track transfer.

25 MEMBER SIEBER: Okay. Is it the one on

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1 the left or the right?

2 MR. LORSON: It is on the left.

3 MEMBER SIEBER: Okay. Got you.

4 MR. LORSON: Okay. The multipurpose
5 canister sits in there, and that overtrack -- or,
6 excuse me, that overpack there provides shielding
7 while the cask is being processed. And then, what
8 happens is later it is placed into a stack-up
9 condition where it is actually landed on top of the
10 concrete storage overpack that you see in this
11 particular picture. Okay?

12 And then, what happens is the actual
13 multipurpose canister is removed from the transfer
14 overpack and then lowered into the concrete overpack,
15 and then a separate crawler will take that concrete
16 overpack to the pad.

17 MEMBER SIEBER: My question --

18 MR. LORSON: Oh, okay.

19 MEMBER SIEBER: -- involves when the --
20 when the liner and the fuel is at its least shielded
21 conditions, what kind of exposure rates are available
22 to personnel at that point, you know? Because you are
23 moving a lot of things around, and the overpack is
24 sitting over here, and the transfer cask is here. But
25 there are times when all you have is spent fuel in the

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1 liner, right?

2 MS. THOMPSON: No, not --

3 MR. LORSON: Well, you have spent fuel in
4 the liner. It is always enclosed by this transfer
5 overpack here.

6 MEMBER SIEBER: So that goes into the
7 pool.

8 MR. LORSON: Correct.

9 MEMBER SIEBER: Okay.

10 MR. LORSON: So it is always shielded by
11 that.

12 MEMBER SIEBER: So what are the radiation
13 doses when that -- at a point where personnel could be
14 exposed?

15 MS. THOMPSON: For a typical system, it
16 ranges from about half a rem per hour up to four or
17 five rem per hour, combined gamma and neutron, at the
18 surface.

19 MEMBER SIEBER: It's pretty substantial.

20 MS. THOMPSON: We have --

21 MEMBER SIEBER: And I take it there is an
22 exclusion area?

23 MS. THOMPSON: We have one system that is
24 in the process of being certified that could
25 potentially have a higher dose rate around it. But we

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1 are looking at -- the applicant has decided to
2 decrease the heat load of the fuel in the source term
3 that is placed in that, to limit the dose rate on the
4 outside of that to 10 rem per hour.

5 MR. LORSON: But to answer your question,
6 the -- you know, your question regarding the
7 radiological exclusion area, this operation is very
8 carefully controlled by the site radiation protection
9 staff. And they have established, you know, stand-off
10 areas and things, and they are continuously checking
11 for dose rates, to provide the appropriate -- you
12 know, the appropriate radiation protection controls,
13 so that nobody receives a -- you know, an excessive
14 dose.

15 MEMBER SIEBER: Okay.

16 MR. LORSON: So there is a very controlled
17 evolution.

18 MEMBER SIEBER: Do you have any idea of
19 what the highest rad worker would receive in a cask
20 loading operation, roughly?

21 MS. THOMPSON: Unfortunately, I have that
22 information but didn't have time to review it before
23 the meeting this morning.

24 MEMBER SIEBER: Is it in --

25 MS. THOMPSON: I know the -- for loading a

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1 cask, for the whole operation, from starting the
2 process to putting it out on the pad, you get on the
3 order of a man-rem or less for the whole operation,
4 for the whole crew.

5 MEMBER SIEBER: For the whole crew, yes.

6 MS. THOMPSON: Okay? So --

7 CHAIRMAN RYAN: Typical crew size is?

8 MR. LORSON: You are probably looking at a
9 total of about 15 to 20 people when you count the
10 entire operation. You know, when you are talking
11 radiation protection folks --

12 CHAIRMAN RYAN: So it is 75 millirem per
13 person average.

14 MR. LORSON: Approximately. Some of them
15 get a little more, some get a little less. The key
16 point to keep in mind is that typically -- in a
17 typical loading campaign, if you look at the total
18 dose for the job, the first canister that is loaded is
19 typically the highest dose that is received
20 cumulatively, and it is typically less than one man-
21 rem, okay?

22 As folks load additional casks, you see a
23 pretty steep learning curve as folks gain familiarity
24 with the tasks, such that typically, you know, on the
25 order of about half your dose that you get from the

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1 entire campaign might be on that first cask, and then
2 the next four casks you get much less dose.

3 MEMBER SIEBER: It has been my experience
4 that during this operation the person most exposed
5 would be the crane operator. He is sort of trapped
6 there, and particularly if something goes wrong there
7 is no way for -- no way for that person to sort of get
8 away.

9 MR. LORSON: It depends where the crane
10 operator is located. I think if --

11 MEMBER SIEBER: If he's on the crane, yes.

12 MR. LORSON: Right, on the crane.
13 Sometimes you -- the cranes now today are mostly being
14 operated remotely.

15 MEMBER SIEBER: Yes.

16 MR. LORSON: Okay? From somebody who
17 might be in the fuel pool building, but not actually
18 sitting in the cab of the crane. Okay?

19 But I think if you actually look at all of
20 the data -- and I haven't looked at it this morning
21 either, but what I seem to recall was that the folks
22 that do the welding and processing of the canister and
23 set up the welding machine, they tend to get a lot of
24 the dose, because they will be closest to the --

25 MEMBER SIEBER: Right on it, yes.

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1 MR. LORSON: -- fuel.

2 MEMBER SIEBER: Yes.

3 MR. LORSON: Yes.

4 MS. THOMPSON: I think that --

5 CHAIRMAN RYAN: Maybe we could make a mark
6 to add that to the agenda for the May meeting, just to
7 have a summary of that radiation protection.

8 MEMBER SIEBER: Yes. I think through the
9 years that operation has changed as people have
10 learned about it. On the other hand, it is one of the
11 most critical pieces of potential exposure to workers
12 throughout the lifetime of the canister and the fuel.

13 MS. THOMPSON: Right.

14 MR. LORSON: Potentially, very significant
15 doses.

16 MEMBER SIEBER: And things can go wrong.
17 So I personally think it's important.

18 MEMBER ARMIJO: Roughly how long does it
19 take to -- for this whole operation? Load the
20 canister, weld it shut, put it in this transfer thing,
21 bring it to the final overpack and out on -- is this a
22 week process, one week, one day?

23 MR. LORSON: It depends on --

24 MEMBER SIEBER: Shifts.

25 MR. LORSON: It is typically, I would say,

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1 one to three days without complications. But if you
2 have complications, then it could be up to a week.
3 Some of the complications you can encounter, you could
4 have a problem with the crane or some handling device
5 perhaps, maybe you have some problems in your weld
6 passing the initial quality to requires rework, okay?

7 There is another component of this
8 operation, which is drying the fuel, because before we
9 put the fuel into storage we require that it basically
10 be dried. Okay? Sometimes that can take longer than
11 what you might expect. Okay? Depending on how much
12 moisture the fuel has absorbed over sitting in the
13 fuel pool for a period of time.

14 MEMBER SIEBER: I have some questions
15 about that, but I will ask them later. Thank you.

16 MR. LORSON: Thank you. Okay. Liz?

17 MS. THOMPSON: Okay. Ron, why don't you
18 go back to 16, please.

19 All right. This is Liz Thompson again.

20 I just wanted to note that the picture
21 here is in preparation of a cask for loading. It is a
22 canister inside a transfer cask, as Ray mentioned.
23 And they are -- the workers at the side are hosing
24 down the parts that have not yet been submerged, and
25 filling up the cask with water to decrease the rise in

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1 level of the pool.

2 Next, please?

3 This image is of actually loading a fuel
4 assembly into the canister. I would like to reiterate
5 that all of these operations are conducted under the
6 site's radiation protection program. And before a
7 site loads its first canister, there is a dry run
8 where no spent fuel is used, and our regional
9 inspectors go out and go through the operation with
10 the licensee to ensure that they are actually ready to
11 do the operations with spent fuel.

12 Next, please.

13 MEMBER SIEBER: And this is underwater
14 there.

15 MS. THOMPSON: Yes.

16 If we could go back just a moment.

17 Questions have been asked about how things
18 are shielded at various points. When you are loading
19 the spent fuel into the canister, all sites to this
20 point use an underwater process, where you put the
21 canister into the spent fuel pool, you move the fuel
22 into the canister, and all of that is done with still
23 a significant level of water between the top of the
24 spent fuel and the surface of the water.

25 MEMBER SIEBER: I'm going to -- you can

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1 give me a short answer, but I did this at one time in
2 my life, and it turned out that my -- the greatest
3 part of my radiation dose was neutron exposure from
4 the casks. How significant is -- and neutrons have a
5 quality factor of 10. So how significant is the
6 neutron dose? Do people wear neutron dosimetry? What
7 kind of surveys occur?

8 MS. THOMPSON: Any good radiation
9 protection program, the workers are monitored for the
10 type of radiation they are expected to encounter. In
11 a situation like this, I would expect to see workers
12 monitored for both neutron and gamma. I would expect
13 to see both neutron and gamma detectors used for
14 surveys.

15 With the systems that we have licensed
16 now, the majority of the dose rate is due to gamma as
17 opposed to neutron, probably a factor of roughly 10 to
18 1, give or take a little bit.

19 MEMBER SIEBER: Okay. So that makes it
20 equal from the --

21 MS. THOMPSON: No, I'm talking about dose,
22 not --

23 CHAIRMAN RYAN: That is dose-equivalent.
24 That is after you multiple.

25 MS. THOMPSON: That has got that factored

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1 in. So that is just --

2 MEMBER SIEBER: Is that written into tech
3 specs or -- that is not in the rules any place. That
4 is the expected practice for health physicists, right?

5 MS. THOMPSON: Well, I believe in Part 20.

6 MEMBER SIEBER: Yes, it says you should --

7 MS. THOMPSON: I would have to look at it.

8 MEMBER SIEBER: -- you should monitor the
9 radiation type that you expect to occur.

10 MS. THOMPSON: And they would be --

11 MEMBER SIEBER: That is a general
12 statement, though.

13 CHAIRMAN RYAN: Well, Jack, I think there
14 are specific sections that require you to monitor for
15 specific radiations that you generate. And there is
16 an obligation to identify what you generate --

17 MEMBER SIEBER: Right.

18 CHAIRMAN RYAN: -- how it is going to be
19 monitored, both in terms of, you know, the levels and
20 sensitivities and equipment and radiation type, and
21 all of that. It gets into -- and I think many of the
22 reg guides cover this. It's in pretty specific
23 detail. It would be -- you would be hard-pressed to
24 have a program that would miss something if you did it
25 right.

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1 MEMBER SIEBER: Yes, it has happened in
2 the past, however.

3 CHAIRMAN RYAN: Yes. My guess is that
4 some of the updates have --

5 MEMBER SIEBER: Okay.

6 CHAIRMAN RYAN: -- plugged some of those
7 holes.

8 MR. LORSON: But I think it is fair to say
9 that the 10 CFR rules apply to dry storage operations,
10 like they apply to any other radiological work that
11 you do in the power block.

12 In my experience of observing several of
13 these activities, I have always seen them monitor for
14 neutron doses at the point where the cask is going to
15 actually exit the spent fuel pool. And at that point,
16 everybody is required to be in the neutron dosimetry
17 and appropriately monitored for the situation.

18 CHAIRMAN RYAN: Maybe one question that
19 addresses Jack's point, and it is I think a helpful
20 one to answer, is: how is the Part 50 license -- how
21 does it tie in the radiation protection program for
22 the station, and elements of the reactor's licensed
23 activities to make it all, you know, kind of work
24 under one banner so to speak?

25 MEMBER SIEBER: Right.

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1 CHAIRMAN RYAN: How does that work?

2 MS. THOMPSON: Would you like to take
3 those?

4 (Laughter.)

5 MR. LORSON: Sure. You know, when you
6 have a Part 50 operating license, right, you know, you
7 have a license with a number of conditions on it. You
8 are required to implement, you know, a number of
9 aspects of the regulation. As part of that license,
10 somewhere in there it is going to tie in to Part 20
11 for conduct of any -- control of any radiological work
12 that you are doing on the site.

13 So this is something that is being done
14 under the site's radiological program under Part 20
15 that ties back into the Part 50 license. Okay?

16 In terms of, how do we assure that anybody
17 that is going to handle spent fuel has a Part 50
18 license, we have two licensing processes. We have a
19 general licensing process, and we have a site-specific
20 licensing process. As a matter of practicality, we
21 haven't issued any of these licenses for dry storage
22 systems to anybody that does not have a Part 50
23 license. Okay?

24 But in the general licensing process, the
25 first requirement is that you have a Part 50 license.

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1 So that covers the folks that are in the general
2 license population.

3 For folks that are site-specific licenses,
4 okay, that would be something that, you know, we would
5 be giving a site-specific license to, and it has
6 always been something that would be in the line of
7 somebody that has a current Part 50 license, is
8 applying for a site-specific license. We would have
9 to consider that as part of the licensing process.

10 MEMBER SIEBER: So it is not -- it doesn't
11 necessarily have to be that way. You could have an
12 independent operator of a spent fuel storage --

13 MR. LORSON: Correct. I mean, and the one
14 case that comes to mind is this -- I'm trying to
15 think. We have licensed one private interim storage
16 facility --

17 MEMBER SIEBER: Right.

18 MR. LORSON: -- where they don't -- you
19 know, they didn't have a pre-existing Part 50 license.

20 MEMBER SIEBER: Right.

21 MR. LORSON: And I think I would have to
22 go back to find out exactly how we tied that knot.

23 MEMBER SIEBER: You don't have to for me.

24 MR. LORSON: Okay.

25 MEMBER SIEBER: But there is one.

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1 MS. THOMPSON: If they would have
2 radioactive material, they would be required to have a
3 Part 20 radiation protection program. So they would
4 need to meet similar operating -- they would have
5 similar operating expectations as what we have of a
6 Part 50 licensee's radiation protection program.

7 MR. LORSON: And just as kind of a heads
8 up, when it comes to site-specific licenses, we have
9 updated our standard review plan now for the general
10 licenses. We plan in the near future to update our
11 standard review plan for site-specific licenses, and,
12 you know, we will be bringing that through separately.

13 MEMBER SIEBER: Okay. Thank you.

14 MR. LORSON: Thank you.

15 MS. THOMPSON: Okay. And this picture is
16 just showing raising the loaded cask out of the pool
17 to move it to the decontamination area, so that it can
18 be decontaminated.

19 MEMBER ARMIJO: It is still full of water,
20 right, at this point?

21 MS. THOMPSON: Right. Still full of
22 water.

23 CHAIRMAN RYAN: Okay. I was going to ask
24 that question.

25 MS. THOMPSON: Still full of water.

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1 Depending on the system, there may or may not be a lid
2 on it at this point.

3 CHAIRMAN RYAN: Yes, okay.

4 MS. THOMPSON: But it is full of water.

5 Okay. Then, the operations that follow
6 moving it out of the pool are that it is
7 decontaminated. The main closure lid is placed on the
8 canister, if it is not already there, and it is either
9 welded or bolted closed, depending on the design.

10 It is drained and dried and --

11 MEMBER ARMIJO: You have to do some
12 draining before you can do that welding procedure.

13 MS. THOMPSON: Yes. I believe you --

14 MR. LORSON: Typically, you drain a
15 nominal amount of water out of the cask before you
16 weld. I have seen values typically in the
17 neighborhood of about 50 gallons of water. Just to
18 give yourself a pocket there, you can establish a
19 purge gas before you do the welding.

20 MEMBER ARMIJO: Okay.

21 MR. PARKHILL: And typically it's
22 backfilled with helium. There is no air in --

23 MEMBER ARMIJO: Right, covered gas.

24 MR. PARKHILL: Right.

25 MEMBER ARMIJO: And it's helium. Would

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1 you do the same thing with the bolted covers? So it
2 is basically the same process -- drain it a little
3 bit, either weld or bolt these covers on?

4 MR. PARKHILL: Well, for bolted, you don't
5 have to weld anything. So --

6 MEMBER ARMIJO: Yes, I understand, but --

7 MR. PARKHILL: -- I don't think you have
8 to lower the water level. Just thinking off the --
9 I've never seen a bolted one loaded, but I'm, you
10 know, just --

11 MEMBER ARMIJO: All right.

12 MR. LORSON: I mean, it would make sense
13 you'd have to take a little bit of the water out, so
14 you don't have like -- you would be able to ensure
15 that you have a clean seal -- sealing surface before
16 you actually apply -- you know, before you bolt it up.

17 MEMBER SIEBER: Is there a high-point vent
18 on the lid?

19 MR. LORSON: The lids have a vent line and
20 a drain line.

21 MEMBER SIEBER: Okay.

22 MR. PARKHILL: You are typically draining
23 and pressurizing it at the same time, so you are
24 lowering the water level. You are not pushing --

25 MEMBER SIEBER: Yes. Okay.

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1 MS. THOMPSON: Okay. Then, after it has
2 fully dried, you seal the vent and drain port. And
3 this is pictures of one of the welding machines
4 welding a canister lid.

5 Next, please, Ron.

6 MEMBER ARMIJO: Are these vent and drain
7 ports always on the top of the canister, or are they
8 -- where they are?

9 MR. PARKHILL: As it is loaded, yes.

10 MEMBER ARMIJO: Okay.

11 MR. PARKHILL: Yes. And they have a
12 quick-disconnect valve that is the first avenue of
13 making the seal. But we don't rely on that, so we
14 have typically two disks that go over top of that that
15 are each seal-welded to provide the redundant sealing.

16 MEMBER ARMIJO: Okay.

17 MR. LORSON: I think the idea is you want
18 to keep that vent drain hardware within the footprint
19 of the multipurpose canister, so when you place it
20 into the storage overpack you don't have any potential
21 for --

22 MEMBER SIEBER: Breaking it off.

23 MR. LORSON: Right.

24 MS. THOMPSON: This slide, as Ray
25 mentioned earlier, shows the -- on the left side the

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1 preparation of the Hi-Trac, and on the right side the
2 Hi-Trac stacked on top of the Hi-Storm, which is the
3 storage overpack. So that the fuel canister can be
4 transferred from the transfer cask to the storage
5 overpack.

6 Now, this slide shows the transfer of the
7 overpack to the ISFSI pad. Again, it is just a large
8 piece of equipment moving a heavy object.

9 This is a picture of a storage cask array
10 on an ISFSI pad. This picture brought up a lot of
11 questions last time, so I want to just take a moment
12 to clarify a couple of points.

13 The fence in the picture here is -- let me
14 start. There are several areas at any reactor ISFSI
15 site that go by various names. An ISFSI might have a
16 fence around it, just to delineate the bounds of the
17 ISFSI. Okay? It might have a fence around it to
18 designate a protected area, which is a security term
19 and has certain security aspects that are associated
20 with that boundary.

21 And an ISFSI may be in its own protected
22 area, or it may be inside the reactor's protected
23 area. But it will be inside a protected area.

24 The controlled area is another area that
25 we talk about with ISFSIs. The controlled area is in

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1 some ways more conceptual in that there is no
2 regulatory requirement for a physical boundary to mark
3 the controlled area. But the controlled area has to
4 be a minimum distance -- the controlled area boundary
5 has to be a minimum distance of 100 meters from the
6 ISFSI, and the licensee has to be able to control
7 access to that area. It may have a roadway or
8 waterway going through it, as long as the applicant
9 can --

10 MEMBER SIEBER: Protect it.

11 MS. THOMPSON: -- can control that access
12 if they need to.

13 In this picture --

14 MEMBER ARMIJO: Well, maybe you are going
15 to cover it. You have cabling on the outside of that
16 overpack. Now, that is for some instrumentation.
17 Could you just tell us what that is for?

18 MR. LORSON: Right. That appears to be
19 resistance temperature detectors on the outlet of the
20 gas vents. You will notice that there is -- you know,
21 you have the concrete and then you have an area here
22 that looks a little darker, and you have a little area
23 here that looks --

24 MEMBER ARMIJO: Right.

25 MR. LORSON: -- a little darker.

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1 Basically, what you have, you have air inlet vents.
2 Air can travel in and passively cool the external --
3 the multipurpose canister and then exit through the
4 top, and what you have is basically a remote
5 temperature detector on the top of the outlet vent
6 that allows you to monitor a differential temperature
7 and just gives you the added confidence that you are
8 getting air flow through the system.

9 MEMBER ARMIJO: And that is for all of the
10 -- all types of systems? They all monitor the -- for
11 that temperature?

12 MR. LORSON: Most of them do. There are
13 tech spec requirements to verify the vents are clear.

14 That is typically the requirement, to verify your
15 vents are clear on some periodic basis. A temperature
16 system may be put in by some facilities where they may
17 have periodic problems with weather, for example,
18 where it may not be convenient to send an individual
19 out to, you know, somewhere remotely to check vents
20 for clearance, in which case there might be alternate
21 monitoring methods available to verify temperature.

22 So this seems to be a system that -- they
23 have installed that system. But the tech spec
24 requirement is typically to verify your vents are
25 clear.

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1 MS. THOMPSON: Okay. The next couple of
2 slides just show more pictures of the horizontal
3 system. In the first one it shows lining up the
4 transfer cask with the door of the horizontal storage
5 module, so that the fuel canister can be placed into
6 the horizontal storage module. They make those up.

7 And then, the next one --

8 CHAIRMAN RYAN: Just before you leave
9 that, what is the typical workforce makeup for these
10 sorts of operations? Is this a vendor-supplied
11 service, or do the plant people typically handle these
12 units? Or how is that done?

13 MR. LORSON: It is typically kind of a mix
14 of both. It depends on the operation. For example,
15 the radiation protection programs are typically
16 controlled by a site radiological person. Folks that
17 are doing like the heavy loads lifting, handling the
18 cranes, and what not, are typically site personnel.

19 Folks that are involved with the
20 processing of the multipurpose canister, the actual
21 welding, typically those are contractors. Folks that
22 are involved with the operation of the drying of the
23 cask may be supplied by the vendor or could be site
24 utility folks.

25 Somebody like this who is doing the

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1 detailed fit-up and alignment, that is probably a
2 vendor representative who does these at multiple
3 locations and is experienced and very familiar with
4 the equipment. So it is kind of a mixed bag, if you
5 will.

6 CHAIRMAN RYAN: It sounds like a good-
7 sense mix of those that are good at it, come and do
8 it, and those that can do in-house cheaper and better
9 and faster and are our own program, that sounds like
10 the cut.

11 MR. LORSON: Right. And I think that is a
12 licensee-specific decision based upon availability of
13 personnel, experience level of personnel, a whole host
14 of things that go into that.

15 CHAIRMAN RYAN: Thank you.

16 MEMBER SIEBER: I think in most places it
17 is combinations.

18 MR. LORSON: I would think so.

19 MS. THOMPSON: If there are no other
20 questions, that concludes my part of --

21 MEMBER ARMIJO: This particular system
22 doesn't have one of those transfer overpacks like the
23 vertical. So it looks like the canister is -- people
24 are standing around the canister and it never happens
25 with the vertical system.

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1 MS. THOMPSON: No. People are standing
2 around the transfer cask.

3 MEMBER ARMIJO: Okay. There is a canister
4 inside that --

5 MS. THOMPSON: There is a canister inside
6 that cask that you see on the transporter.

7 MEMBER ARMIJO: Okay.

8 MS. THOMPSON: Okay. This is moved in a
9 horizontal alignment, but what you are looking at is
10 actually the transfer cask. For this system it is a
11 steel-lead-steel construction, and the canister is
12 inside of that.

13 MEMBER ARMIJO: So the whole thing is put
14 inside, and then the transfer cask is removed or --

15 MS. THOMPSON: No. Actually, there is a
16 ram that you can't really see. It is fitting on the
17 end.

18 MR. RAHIMI: Actually, this is the --

19 MEMBER ARMIJO: Okay. That just pushes it
20 in.

21 MR. RAHIMI: The ram pushes the canister
22 inside the -- into the hole.

23 MEMBER ARMIJO: Got it. All right. Thank
24 you.

25 MS. THOMPSON: It's just a thick stainless

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1 steel.

2 (Laughter.)

3 MEMBER ARMIJO: I imagine it is.

4 MR. PARKHILL: Okay. Thank you, Liz.

5 CHAIRMAN RYAN: Thanks, Liz.

6 MS. THOMPSON: You're welcome.

7 MR. PARKHILL: Robert Einziger is going to
8 make presentations that were requested by the
9 Subcommittee on fuel oxidation and damaged fuel. He
10 has a few slides to talk about, and then we will
11 probably regress and get into the prioritization
12 methodology.

13 Do you want to load something in there,
14 Bob?

15 MR. BROWN: Bob, we've got some -- we
16 can't do that.

17 MR. EINZIGER: Okay. I will wing it,
18 then. I was going to show some pictures, but I won't,
19 then.

20 The pictures came from some presentations
21 that I had made before, just so that you have a place
22 that you can go to get more information on this
23 subject. It was a presentation made at the high-level
24 waste meeting that was held in Las Vegas in 2005,
25 international high-level waste meeting that Chris and

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1 myself gave on this same topic.

2 I want to start out with a few facts about
3 oxidation, just so you have a background. Oxidation
4 of UO_2 can occur at any temperature, and it does occur
5 at any temperature. The only thing that changes as
6 you go up the temperature is the rate that it occurs.

7 MEMBER SIEBER: Right.

8 MR. EINZIGER: So there is some -- even
9 some studies that have been at room temperature for 15
10 years that have shown oxidation of the fuel. But you
11 have to be very careful about these tests, because
12 they may not be applicable to -- the conclusions of
13 the tests may not be applicable to the systems that we
14 are working with.

15 When fuel oxidizes, it goes through a
16 series of different phases. The phases for spent fuel
17 are not the same as the phases for just unirradiated
18 UO_2 , and that is sort of surprising because basically
19 spent fuel is UO_2 .

20 UO_2 will go oxidize to U-307, and then on
21 to U-308. Spent fuel will go to U-409, not pass the
22 -- through the U-307 state, and then on to U-308.

23 When it goes from UO_2 to U-409, you have
24 about a four percent contraction of the lattice that
25 opens the grain boundaries that allows oxygen to get

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1 into the fuel. As it proceeds to oxidize further from
2 U-409 to U-308, you have about a 30 percent expansion
3 of the lattice, which basically tears the fuel rod
4 apart. So you want to prevent that second step from
5 happening.

6 MEMBER SIEBER: Now, that can occur at
7 high temperatures in a matter of hours.

8 MR. EINZIGER: Well, that was the picture
9 I was going to show you.

10 MEMBER SIEBER: Okay.

11 CHAIRMAN RYAN: Bob, just for the full
12 Committee briefing, if you could work with Chris and
13 get those pictures integrated into your presentation,
14 that would probably be a good idea.

15 MR. EINZIGER: That's fine.

16 CHAIRMAN RYAN: Yes, thanks.

17 MR. EINZIGER: This was one of the things
18 that came to me at my usual getting up at 2:00 in the
19 morning thinking --

20 CHAIRMAN RYAN: I understand, yes.

21 MR. EINZIGER: -- about the --

22 CHAIRMAN RYAN: And we appreciate you
23 bringing them, but we'll see them in May.

24 MEMBER SIEBER: The numbers that I
25 remember is like four or five hours to where you get

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1 clad rupture, and U-308 is actually particles. It's
2 powder at that point, right?

3 MR. EINZIGER: That's right. Well, you
4 know, it -- at 150 C, you might have a number of years
5 before you get anything. At 350 C, you split the
6 cladding apart in about 30 to 40 hours. You get up
7 near 400 degrees C, you are going to split it in a
8 matter of an hour or so.

9 MEMBER SIEBER: Right.

10 MR. EINZIGER: And basically what happens
11 is that the fuel oxidizes, and then it sits -- it goes
12 up to U-409 fairly rapidly, it sits at a plateau for a
13 while. Then, it continues to oxidize more to U-308.
14 Depending upon the particular cladding, you can have
15 anywhere from two to six percent strain on the
16 cladding before you will start splitting it.

17 And then the split will either run down
18 the cladding as a split, or it will spiral around the
19 cladding, or will go partially down the cladding and
20 then take a right turn and just wrap right around it
21 and open the whole thing. So it is unpredictable what
22 is going to happen.

23 The other interesting thing about the
24 oxidation is that you take a pellet or fragments of a
25 pellet that are fairly good size, and now you reduce

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1 it to a grain size powder.

2 MEMBER SIEBER: Powder.

3 MR. EINZIGER: And that is fairly easy to
4 just fall out of the cladding. That has implications
5 as a source term. It is particularly a concern in
6 high burn-up fuel where you've got an outer rim
7 structure that has got very fine grain particles in
8 the sub-micron size. As the health physicists will
9 know, that is already in the respirable range, and so
10 now you are breaking it up and having a much higher
11 distribution of respirable particles.

12 On the positive side, all indications we
13 have is that high burn-up fuel oxidizes much slower
14 than low burn-up fuel, primarily because of the
15 presence of the actinides.

16 CHAIRMAN RYAN: Just so we get a marker
17 down, what are you calling high and low burn-up in
18 your example?

19 MR. EINZIGER: We have done studies up
20 into the 48 gigawatt-day per metric ton range, and we
21 started to see at that range that the oxidation rate
22 was slowing down considerably.

23 The normal cutoff we use in spent fuel is
24 45 gigawatt-days between high and low burn-up, nothing
25 -- not that it is a magic number, that at 46 you're

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1 high and at 44 you're low. But there seems to be a
2 knee in many properties, and that is about where the
3 knee occurs, at about 45.

4 At high burn-up you have competing
5 effects. On one hand, the oxidation rate is
6 decreasing. On the other hand, because it is a grain
7 boundary-driven effect, and because in the rim region
8 you've got so much more grain boundary, things can be
9 happening faster. So to date there is really no good
10 way of knowing which of those effects are going to
11 dominate.

12 Now, about three years ago, I guess it was
13 about three years ago, and during one of the dry runs
14 for one of the utilities, they found out that they
15 were draining about 75 percent of the cask empty
16 before they were welding. And, in fact, they were
17 letting it air-backfill it.

18 MEMBER SIEBER: Right.

19 MR. EINZIGER: And the question came up,
20 is this okay? Well, remember you are up in the
21 neighborhood of above 350 degrees C. We allow damaged
22 fuel to have pinholes and tight cracks in them, so
23 there is a way for air to get into the cladding and
24 interact with the fuel. And so we put together an
25 ISG-22, and basically it says, "We don't want you to

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1 allow the fuel to oxidize during the loading -- during
2 any of the parts of the procedure."

3 There is a number of ways to prevent this.

4 One is to assure that there are no breaches in the
5 fuel column that are above the level where the water
6 drains. Another one is to immediately backfill with
7 helium or some other inert gas. A third way is to
8 show that you have a temperature profile.

9 It is going to be such that during the
10 time it is uncovered and in an air atmosphere that you
11 won't have the oxidation occur. You won't get up to
12 this plateau step. And there was a number of
13 recommendations for places they could get data to go
14 ahead and make these calculations.

15 There has recently been some more work
16 done in that in France to try to put a model together
17 to take some of the data and extrapolate it. I'm not
18 particularly happy with that particular information.
19 They are using uranium carbide fuel and extrapolating
20 to UO_2 , and there are some other things happening.

21 But the bottom line was, while I disagree
22 with their methodology, they basically came out with
23 the same conclusion in terms of a time-temperature
24 relationship that we came up with 15 years ago.

25 That is basically what I had to say about

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1 oxidation.

2 MEMBER SIEBER: Yes. Let me ask a quick
3 question. From the time that the fuel is discharged
4 or the reactor is shutdown, discharged into the spent
5 fuel, until you get into this operation is typically
6 at least five years. Decay heat levels are -- have
7 come down to fairly low levels.

8 Is there a time where you could keep the
9 fuel in the spent fuel pool long enough so that it
10 could not get up to the rapid oxidation point? I
11 presume it is more than five years.

12 And a corollary to that question would be,
13 if you kept it at five years, which is typically the
14 storage time, and then exposed it to oxidation, how
15 rapidly would you get up to the temperature which is
16 the knee in the curve where this damage would occur?
17 Is that at like three hours, four hours?

18 MR. EINZIGER: Well, the second
19 question --

20 MEMBER SIEBER: The first number is --

21 MR. EINZIGER: The second question I am
22 going to defer to some of our thermal experts in the
23 group. What we have to remember is that the cask
24 vendors want to load the casks so that they can get
25 the maximum thermal load in there and still stay below

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1 the temperature that we say that they -- the maximum
2 temperatures that they can have on the pad, which is
3 about 400 degrees.

4 MEMBER SIEBER: Okay.

5 MR. EINZIGER: And so if you have put the
6 fuel in a cask that is going to go near 400 degrees on
7 the pad, now you start draining it, it is even going
8 to be higher. So the question of: how long can you
9 lead it out there until you get to that low
10 temperature -- in the pool, it is fairly cool.

11 MEMBER SIEBER: Yes, it is.

12 MR. EINZIGER: And it is down into the --
13 anywhere between 60 and 85 C.

14 MEMBER SIEBER: C, right.

15 MR. EINZIGER: And -- but as soon as you
16 put it into the cask, and you start draining it, the
17 temperature starts going up. So I really don't have a
18 good answer for your question, other than it is going
19 to be significantly longer than five years. And that
20 also is going to be dependent on the burn-up of the
21 fuel. The higher the burn-up is, the longer it is
22 going to have to wait.

23 MEMBER SIEBER: Okay. On the other hand,
24 it is not unreasonable to assume that five-year old
25 fuel, if you drain it, expose it to oxygen, the

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1 temperature will get up there in a matter of hours to
2 where the damage would occur.

3 MR. EINZIGER: I can't say one way or
4 another on that. That would have to be a question
5 that is answered by our thermal expert.

6 MR. LORSON: Well, I mean, I think the
7 heat uprates can be a function of what is decay heat
8 load, right? And then, what is the external
9 environment that you are in? What was your initial
10 starting temperature, for example?

11 But, you know, I think the real issue is
12 that we sidestep it operationally -- that concern --
13 by limiting events and trying to provide appropriate
14 controls, so you don't get into a situation where you
15 expose the fuel during the drying --

16 MEMBER SIEBER: Yes. But I am just
17 thinking of what kind of accident can you have when
18 somebody makes a mistake?

19 MR. LORSON: Right.

20 MR. PARKHILL: Well, there is also a
21 practicality issue with the -- what we are limited
22 with is the, you know, capacity of the spent fuel pool
23 that drives, you know, when we load the fuel. So if
24 they had -- you know, if we had our druthers, yes, we
25 would build a lot of spent fuel pools, but nobody

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1 wants to do that. So they are trying to unload these
2 pools.

3 And it is my understanding that some of
4 the fuel is being loaded sooner than five years, too.

5 Yes, three years.

6 MEMBER SIEBER: Wow.

7 MR. LORSON: Yes, we have had applications
8 for three years. But what we could do is we could
9 take a question back. I don't know if Jorge would be
10 able to -- if there is anything you could pull off a
11 model that would give us an idea of heat uprates.

12 MEMBER SIEBER: From a regulatory
13 standpoint, if you can do the calculation, I guess it
14 is not important. It is more for me just to fill in
15 the background of what I expect would happen. So I
16 would not want to require you to do a lot of extra
17 work to answer that question.

18 MR. LORSON: Okay.

19 MEMBER SIEBER: You can decide for
20 yourself.

21 MR. LORSON: Okay. Well, Jorge Solis is a
22 thermal expert. Do you have anything you care to add
23 regarding that?

24 MR. SOLIS: Jorge Solis. Typically, the
25 heating rate would depend on the initial total heat

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1 load in the canister. And that is controlled through
2 calculations for time to boil. Typically, the vendors
3 perform those calculations, and they have those time
4 limits in the technical specifications. For a
5 typical, let's say, 30 kilowatts, with water inside,
6 you are talking about 15 to 20 hours to reach the time
7 to boil.

8 MEMBER SIEBER: Okay. Thank you.

9 MR. EINZIGER: And I just want to add a
10 note on oxidation. We are saying this was the
11 phenomena that drove the Yucca Mountain project to
12 have an above-ground facility where all the
13 repackaging was going to have to be done under water.

14 MR. PARKHILL: Just one footnote, because
15 I might have misheard this. But undamaged fuel can
16 have pinhole leaks and hairline cracks in it, so --

17 MEMBER ARMIJO: By your definition.

18 MR. PARKHILL: By our definition. So it
19 could be loaded and classified as undamaged, and have
20 hairline cracks and pinhole leaks, which leads right
21 into Bob's --

22 MEMBER ARMIJO: But the utilities know
23 when they have got leakers.

24 MR. EINZIGER: They should.

25 MEMBER ARMIJO: It is pretty easy to tell

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1 when you've got leakers. It is a rare case that you
2 have a pinhole that somehow is plugged and it is not
3 leaking. I have seen --

4 MR. EINZIGER: Right.

5 MEMBER ARMIJO: -- one example in my
6 career. But it is really rare, so -- my question was,
7 since this issue is really only relevant to breached
8 fuel, fuel that -- where the air could get in there --

9 MR. EINZIGER: That's right.

10 MEMBER ARMIJO: -- do you have any
11 requirements where you kind of segregate beyond
12 damage, where you know you've got a leaker, you've
13 definitely got leaking assemblies, that you say,
14 "Okay. For these particular assemblies, your
15 procedure for loading is going to be more
16 conservative, or we are going to assure that it is" --
17 or do you just say, "Hey, if it fits in that cask, and
18 you use these procedures, you will be safe, whether or
19 not it has got a pinhole"?

20 MR. PARKHILL: Well, our initial guidance
21 when we first started, the initial revision to the
22 standard review plan, you know, 13 years ago --

23 MEMBER ARMIJO: Yes.

24 MR. PARKHILL: -- there were studies by
25 PNNL that made recommendations that the fuel be kept

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1 in an inert environment. And that was always our
2 presumption. And then, we'd come along and find out,
3 well, there is a deviation from it in the operations.

4 So the ISG was written to make -- you know, to fix
5 that problem.

6 MEMBER ARMIJO: I agree with you. If you
7 do the inerting properly, and you keep your
8 temperature below 400 --

9 MR. EINZIGER: There is three classes
10 of --

11 MEMBER ARMIJO: -- it doesn't really
12 matter.

13 MR. EINZIGER: There is three classes of
14 elements, Sam. There is the rods and the assemblies
15 that have no breaches in them. They are good to go.
16 This isn't an issue with those.

17 MEMBER ARMIJO: Right.

18 MR. EINZIGER: Then, there is the class of
19 assemblies where they have large breaches in the
20 cladding, which we call gross breaches. And if it's a
21 gross breach, the fuel is damaged, and then it has to
22 be treated in damaged fuel cans, which are not
23 necessarily sealed.

24 And then, you have an intermediate group,
25 which is considered undamaged fuel but has -- could

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1 have pinholes and tight cracks in it. Both of the
2 latter two groups, where there is penetration of the
3 cladding that allows the oxygen in the air to contact
4 with the fuel, has to be treated -- considered under
5 these conditions where either the temperature is kept
6 low enough, the gas is inerted, or they show that
7 those breaches are not above the water level or --
8 right, not above the water level.

9 MEMBER ARMIJO: Yes. Which is hard to do
10 if there are just tiny pinholes.

11 MR. EINZIGER: That's right.

12 MEMBER ARMIJO: So, but there is a
13 category of fuel that is so badly damaged, broke, it
14 splits, that requires canning?

15 MR. EINZIGER: I will get to that in a
16 minute.

17 MEMBER ARMIJO: Okay.

18 MEMBER POWERS: Bob, you have not
19 discussed the issue of metallic nodules in the fuel.

20 MR. EINZIGER: Excuse me?

21 MEMBER POWERS: You have not discussed the
22 issue of metallic nodules in the fuel and the problem
23 of ruthenium tetroxide formation.

24 MR. EINZIGER: If you do get ruthenium
25 tetroxide formation, you've got a very volatile

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1 substance that is readily dislodgeable and can escape
2 the fuel. We have never monitored for that when we
3 have done the oxidation experiments. But it is a
4 concern as a release constituent and a source term
5 constituent.

6 MEMBER POWERS: When I look at the dose
7 consequences for ruthenium release, I see a
8 radionuclide that is equivalent to iodine for short-
9 term doses and equivalent to cesium for long-term
10 doses.

11 MR. EINZIGER: We know the rate that spent
12 fuel oxidizes. So we know the volume of the fuel that
13 is oxidizing. If you -- when you get to the U-308,
14 and you are opening up the lattice, then you can
15 release the ruthenium. And the amount of ruthenium
16 that you can -- is available there is proportional to
17 the amount of fuel that has been oxidized, which is
18 proportional to the time at whatever particular
19 temperature. So it can be calculated, knowing the
20 inventory of the ruthenium.

21 MEMBER POWERS: I suspect, without
22 actually knowing, that what you observe when you see
23 the change in fuel oxidation as a function of burn-up
24 is that you are seeing a transition from oxidizing
25 fuel to oxidizing the molybdenum and ruthenium

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1 nodules.

2 MR. EINZIGER: Yes. You are getting
3 oxidation of the other -- the actinides, oxidation of
4 the other products in there.

5 MEMBER POWERS: I suspect --

6 MR. EINZIGER: That is what is slowing it
7 down.

8 MEMBER POWERS: I suspect it is not so
9 much the actinides as it is the metallic inclusions.

10 MR. EINZIGER: It may well be. It is not
11 a very well-studied phenomena. The only thing that
12 was really studied was the fact that it -- the rate
13 was slowing down. Unfortunately, most of the work on
14 the oxidation of fuel was done by the Yucca Mountain
15 project, and at the time that they were starting to
16 get into high burn-up fuel the oxidation program was
17 already starting to ramp down.

18 MEMBER POWERS: We usually see that
19 oxidation of -- the nodules or alloys of molybdenum,
20 ruthenium, rhenium, palladium, technetium,
21 zirconium --

22 MR. EINZIGER: Five metal particles.

23 MEMBER POWERS: -- and they would usually
24 see that actually buffers out the hyperstoichiometry
25 of the fuel during operation. And so there is going

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1 to be a point where air oxidation starts oxidizing
2 those in preference to the lattice material. So you
3 are going to see less fuel oxidation.

4 But, unfortunately, that is not a good
5 thing, because now you are forming both molybdenum
6 trioxide, which is not an indifferent radionuclide,
7 but you will also see the ruthenium tetroxide, which
8 at these temperatures is gas, and has correspondingly
9 high transport characteristics.

10 MR. EINZIGER: The most recent and
11 probably the best work on high burn-up fuel oxidation
12 is work that was put out by Brady Hanson at PNNL. I
13 guess it was in 1998. If there was any mention of the
14 ruthenium -- and I would have to go back and look at
15 that again -- it would be in that report.

16 Damaged fuel -- this is an issue that is
17 addressed in ISG-1, Rev 3. Up until a number of years
18 ago, there was a very stringent rule for damaged fuel,
19 and that was basically if it had any defects in the
20 cladding that were bigger than pinholes, or tight
21 cracks, it was damaged. If it couldn't be handled by
22 normal means, it was damaged, and you have put it in
23 the damaged fuel can. That was pretty much what it
24 said.

25 About 19 -- excuse me, about 2005, we

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1 started thinking about this subject, and why was this
2 considered damaged? Is it the only way fuel could be
3 damaged? And we basically took a different approach
4 to it.

5 It said it is only damaged if it can't do
6 what it is supposed to do. If it can meet all of the
7 requirements of the system, it is not damaged. Damage
8 could have different meanings under different
9 circumstances.

10 When I gave a presentation at the IAEA
11 meeting in 2006, the example I gave was my old beat-up
12 Datsun. If I wanted to use that car to go woo a
13 mistress, you probably wouldn't do very well it was so
14 beat up, and it would be -- could be considered
15 damaged. But for getting me back and forth to work it
16 did just a great job, and for that purpose it was not
17 damaged. So damage depends -- whether it's damaged
18 depends on what you want to use it for.

19 And so there could be different
20 definitions for damage in the reactor, damage in the
21 spent fuel pool, damage in the storage, damage in
22 transportation, depending upon what the requirements
23 are on the fuel.

24 We also looked -- said, "Okay. What are
25 the requirements on the fuel?" And, actually, there

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1 are very few requirements in either Part 71 or Part 72
2 on the fuel itself. Basically, it can't interact with
3 anything.

4 But there is a number of other
5 requirements that could be put on the fuel by the
6 applicant in order to meet other requirements. There
7 could be a requirement on the fuel to stay in its
8 configuration, so it is retrievable. You don't want
9 it to break all apart.

10 It could be that you want to maintain a
11 configuration so that you could do your criticality
12 calculations. So there are certain functional
13 requirements. There is regulatory requirements, which
14 is basically don't interact, and there is functional
15 requirements, and these are ones that are basically
16 put on the system by the applicant.

17 And so we sort of changed the definition
18 of "damaged fuel" and the way it's handled. Damaged
19 fuel is anything that can't meet its functional and
20 regulatory requirements. Or, conversely, if it can
21 meet the functional and regulatory requirements, it is
22 not damaged. And there is a number of ways to
23 approach this.

24 One way is, if it's damaged, fix it. We
25 see that in the case where there is corrosion of the

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1 top-end nozzles, and they are putting bracing in there
2 to hold the system together. If it is damaged because
3 there is a rod in there that has got a large breach,
4 take the rod out and put a replacement rod in or put a
5 dummy rod in. If you don't want to do any of this,
6 and it is still damaged, put it in a can.

7 Or you can show that with a particular
8 amount of defects in the fuel, elements in fuel
9 assemblies, that you can still meet all of the
10 functional requirements, assume that these defects are
11 in there and show that it's still structurally sound,
12 still subcritical, still maintains its shielding
13 aspects, etcetera.

14 And so we changed the definition of
15 damaged fuel. A lot of the work on this definition
16 and the way to handle it was done in an IAEA
17 consultancy, which resulted in an IAEA document that
18 is listed in this viewgraph that has an extensive
19 discussion of the issue of damaged fuel.

20 But basically what we require now that is
21 -- is that when an applicant comes in, if he wants to
22 load damaged fuel, he'd define it. We gave him a
23 default definition, which was basically the old
24 definition, no pinholes, it can be handled. But if
25 they want to have assemblies go into the cask that has

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1 more defects in it, and they can show under this
2 definition that it can still meet all of the
3 requirements of criticality, retrievability, if that's
4 a case, shielding, containment, etcetera, we don't
5 consider it damage, then.

6 MEMBER ARMIJO: Well, there could be some
7 practical problems in drying out. Let's say you've
8 got something with a one-inch axial crack, and it --
9 the rod has gotten full of water. And so when you go
10 through your drying process you might have a -- take a
11 long time to get that done or --

12 MR. EINZIGER: That's correct.

13 MEMBER ARMIJO: So there could be
14 practical issues. But I was just more concerned about
15 fuel that is really in bad shape. I mean, it is
16 literally broken, big splits.

17 Now, maybe I -- I usually call -- people
18 call that degraded.

19 MR. EINZIGER: We call that damaged.

20 MEMBER ARMIJO: You call that damaged, but
21 you have a big spectrum of what damage would be. But
22 there is no requirements that fuel that is in that bad
23 a shape, there is no regulatory requirement that that
24 be canned separately and treated separately than --

25 MR. EINZIGER: We are not like most of the

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1 foreign countries who require that any damaged fuel be
2 put in a can, a quiver, or whatever they want to call
3 it. But we do require that it be placed in a
4 condition where it can meet all of the requirements.

5 And usually fuel that is badly degraded,
6 can't meet a retrievability requirement, if it's in
7 storage, or it can't meet a criticality calculation if
8 it's free to move this stuff all over the cask --

9 MEMBER ARMIJO: Well, I'll give you, Bob
10 -- there is examples, you know. People have had --
11 have been -- utilities have been afraid to remove the
12 fuel rod, because it might break up. And so they
13 leave it in the assembly, and so it is pretty badly
14 damaged.

15 Now, fortunately, that is pretty rare, but
16 it does happen. I'm just wondering, let's say you
17 have an assembly with a pretty badly damaged fuel rod,
18 can that go into your system? And as long as they can
19 eventually dry it out, pump it out, and inert it, I
20 agree that that is the end of the line, it's okay.
21 But you don't have any special requirement other than,
22 really, practicality and --

23 MR. EINZIGER: That's right. I mean,
24 almost all the time, if they get into that situation,
25 they will put it in a damaged fuel can. That seems to

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1 be --

2 MEMBER ARMIJO: Yes, I get --

3 MR. EINZIGER: That is the practice,
4 because it is the easiest thing to do. But a place
5 where this definition really came into vogue is
6 recently we had a situation at Humboldt Bay where
7 they --

8 MEMBER ARMIJO: That's really old fuel.

9 MR. EINZIGER: Excuse me?

10 MEMBER ARMIJO: That's really old fuel.

11 MR. EINZIGER: Yes, it is very old fuel,
12 but they couldn't determine that -- whether there were
13 leakers and in how many fuel assemblies. And they had
14 already procured the system, and their system only
15 allowed damaged fuel in half the slots. They didn't
16 have enough -- if they had to declare all of the fuel
17 damaged, then they did not have enough slots in their
18 canisters to put all of the fuel.

19 And so working with the criticality
20 people, we said, "Okay. If the fuel in the middle has
21 defects in it, rods that are defected, but we know
22 that the ones on the outside" -- say the rods on the
23 outside were damaged, they are in damaged fuel cans,
24 but the ones in the middle are of an unknown
25 configuration, they may have breaches in them, can

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1 they do all the calculations to show that it is going
2 to hold up and meet the criticality requirements and
3 the shielding requirements, and all, and it did, then
4 even though there was sort of an unknown condition in
5 the middle, we declared those as undamaged fuel rods.

6 MR. LORSON: See, I think, you know, one
7 thing it's important to consider is in the Certificate
8 of Compliance, the applicant, or in this case the end
9 user, needs to confirm that they are operating the
10 system in accordance with the constraints of the
11 Certificate of Compliance, which, you know, specifies
12 what you are authorized to load.

13 And so they need to evaluate a condition
14 such as you have mentioned that, you know, indicates
15 some degradation or adverse-to-quality type condition,
16 and make their own assessment and confirm that they
17 are either in compliance with the certificate or not
18 in compliance.

19 They may be able to get in compliance
20 through the use of a damaged fuel can. That may be a
21 simpler, more pragmatic route, or, alternatively, they
22 could do some type of analysis. If they conclude they
23 are still within the certificate, they could load it
24 as is. Or if they do the analysis and conclude that
25 they are not in compliance with the certificate, they

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1 can come in for some type of amendment or exemption to
2 the certificate.

3 So those would be the avenues that folks
4 would approach.

5 MEMBER ARMIJO: Okay.

6 MR. PARKHILL: Just to make sure you are
7 not getting a wrong perception here, I think most --
8 it would be fair to say most of the damaged fuel that
9 is out there is canned, and I would say 90 percent.

10 MR. EINZIGER: I am not willing to say any
11 particular number. But most of the applications that
12 I have seen -- and it is only a fraction of them --
13 have indicated they are going to put it into a damaged
14 fuel can.

15 But, for instance, another example is
16 there are a number of assemblies out there where they
17 pull on the nozzle, which is connected to the control
18 rod tubes, to remove the assembly from the pool or
19 from the reactor. And there is some question about
20 whether there is stress corrosion cracking at the
21 joints of the nozzle with the control rod tubes, which
22 could -- if there was, it could mean that when they
23 pull on the nozzle that they -- that it comes loose.

24 One way of handling it is everything that
25 has this corrosion is declared damaged fuel, and put

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1 in damaged fuel cans, let's say. Another way to
2 approach it is that, okay, we are not going to pull on
3 the nozzle; we are going to put some sort of device
4 that gets into the tubes themselves and pulls on the
5 tubes themselves. Therefore, we still meet the
6 retrievability function. Therefore, that fuel is now
7 declared not damaged.

8 So there are a lot of ways around the
9 issue. If you look in this IAEA document, which by
10 the way is on the IAEA website, it has lots of
11 pictures of things that were damaged and are no longer
12 damaged, ways various countries handle damaged fuel,
13 and a way that the damaged fuel definition can be
14 exercised in a number of cases.

15 MEMBER ARMIJO: Okay.

16 MR. LORSON: Okay. If there are no other
17 questions in this area, I think we ought to probably
18 move it along.

19 MEMBER ARMIJO: Thanks, Bob.

20 MR. PARKHILL: Why don't we go to ISG-25,
21 and maybe a break after that, depending on what --

22 CHAIRMAN RYAN: Yes.

23 MR. LORSON: We are scheduled to have the
24 break at 10:15, so --

25 CHAIRMAN RYAN: That works.

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1 MR. PARKHILL: And then, we will regress
2 back to the methodology.

3 CHAIRMAN RYAN: Sounds good.

4 MR. CRUZ: Let me change my name from Bob
5 to Luis.

6 CHAIRMAN RYAN: Sure.

7 (Laughter.)

8 MR. CRUZ: Good morning to all. My name
9 is Luis Cruz. I am a mechanical engineer in SFST. I
10 will be highlighting the main aspects of ISG-25 and
11 its pressure on helium leakage testing and the
12 confinement boundary of the spent fuel dry storage
13 systems.

14 This ISG has been mainly developed to
15 support the SRP in terms of the required ASME pressure
16 testings and the helium leak rate testings that have
17 to be done to ensure that these systems have been
18 fabricated according to the design criteria, and also
19 that these systems comply with the regulatory
20 requirements established for operation.

21 This guidance basically divides in two
22 parts, generally in terms of pressure testings and
23 helium leak rate testing. For the ASME pressure
24 testings, these are basically split into two
25 categories. One is for the pressure testings for

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1 welded canisters, and the pressure testings for bolted
2 casks.

3 For the welded canisters, there are some
4 pressures -- some pressures tested and -- some
5 pressure tests performed in the fabrication shop and
6 out in the field. In terms of the fabrication shop,
7 at this point the canister shell should be pressure
8 tested. In case the canister shell is not pressure
9 tested in the fabrication shop, then an alternative
10 for acceptance will be helium leak rate testings
11 later, since at this point most of the welds in the
12 system will not be accessible.

13 Also, in the field the closure welds have
14 to be also pressure tested. In terms of bolted casks,
15 there has to be a pressure test, but this one shall be
16 performed in fabrication shop, and this doesn't have
17 any other closure welding, since it is just the bolted
18 cask itself.

19 For these ASME pressure testings, well,
20 they are referring in the guidance from the ASME
21 boiler pressure and vessel code, specifically from
22 Section 3, Revision 1, which is rules for inspection
23 and rules for construction of nuclear facility
24 components. And it is basically referred in this
25 guidance.

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1 MEMBER ARMIJO: What pressure levels? How
2 high in pressure do --

3 MR. CRUZ: Well, for these testings, the
4 -- what it specifies in the guidance, there are the
5 design pressure -- the pressure test is I think
6 between 110 and 125, the design pressure. And then,
7 there are other testings that require other -- or a
8 percentage of the design pressure to be tested. I
9 think initially it is 110 to 125 percent for 10
10 minutes, what it is tested.

11 MR. PARKHILL: If it is pneumatic, it is
12 10 percent above. And if it's water, it's 25 percent
13 above.

14 MR. CRUZ: Right.

15 MR. PARKHILL: Depending on what they
16 defined the applicable confinement boundary being,
17 either in NB or NC.

18 MR. CRUZ: Yes.

19 MR. LORSON: But the testing requirements
20 follow the ASME code relative to --

21 MR. CRUZ: Yes, yes.

22 MR. LORSON: -- hydrostatic testing.

23 MR. CRUZ: Yes. Basically, the details of
24 this are provided in Section 3, Revision 1,
25 subsections NB or NC, specifically in the 6,000 --

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1 MR. PARKHILL: While we're on pressure,
2 just -- some of these canisters get up to like seven
3 atmospheres. You know, so they are pressurized mainly
4 for thermal reasons, to remove the heat, but they have
5 a good amount of pressure in them.

6 MEMBER ARMIJO: Okay.

7 MR. CRUZ: In terms of helium leak rate
8 test, both systems have to be leak rate tested. The
9 leak rate test has to be performed in the complete
10 confinement boundary. There may be some exceptions,
11 but they have to be considered on a case-by-case basis
12 in terms of ISG-18. And these subsections are in
13 terms of final closure welds.

14 These helium leak rate testings are to be
15 performed in the -- are typically performed in the
16 fabrication shop for the entire confinement boundary.

17 And then, in the field there has to be a leak rate
18 test for the vent and drain port covers.

19 The guidance referred -- the standard
20 referred in this guidance for this leak rate testing
21 is ANSI N-14.5. That is basically the aspects of the
22 -- as far as the pressure testing and the helium leak
23 rate testing.

24 This ISG was up for public comments in
25 October last year. We received the public comments,

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1 and the staff evaluated these and incorporated these
2 accordingly, in the current version of the ISG.

3 MEMBER ARMIJO: Now, there is no
4 requirement for periodic monitoring of the helium in
5 these canisters. I mean, if somehow, let's say, a
6 weld in one of these vent or drain port covers
7 developed a leak, some stress corrosion, crack, or
8 inclusion in the weld that finally dissolved out, and
9 it starts leaking very, very slowly, but these things
10 are going to be out there for years and years and
11 years, is there any way in which you monitor or assure
12 yourself that the helium pressure is still there in
13 that --

14 MR. PARKHILL: For welded closures, the
15 answer is no, it is all sealed. But for bolted
16 closures, we have a seal monitoring system on it,
17 which is basically a pressurized can with alarms on it
18 that goes between the two seals and the bolted
19 closures. So if you get any loss of pressure, either
20 into or out of the can, you get an alarm and --

21 MEMBER ARMIJO: But my question -- and,
22 yes, I think that's good for the bolted. But the
23 question I have is, the assumption is made that once
24 it is all welded, it is -- you know, it is inerted and
25 it is --

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1 MR. PARKHILL: Right.

2 MEMBER ARMIJO: -- welded, it is leak
3 tested, that it -- everything is going to stay that
4 way for 20 years or more sitting out there in the
5 open.

6 MR. PARKHILL: For its design life. Now,
7 there is another SRP that comes along for license
8 renewal, and that is a separate area. But for our SRP
9 that talks about the initial design life, there is no
10 other criteria. There is the presumption that it is
11 going to be --

12 MEMBER ARMIJO: There is no analysis that
13 says, hey, you know, we know this thing is still full
14 of helium, it is keeping the fuel temperatures below
15 the 400 C, and all of that? There is no way on a
16 welded canister that is in the -- that you require to
17 assure that that's the case?

18 MR. LORSON: That's correct. We do not
19 require monitoring of the canister to detect loss of
20 helium after it has been seal-welded and placed on the
21 pad. However, if you were to have a loss of helium,
22 there is two potential concerns you might run into.
23 One is it could provide some type of dose concern,
24 because of the leakage of potentially particles
25 getting picked up inside the cask.

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1 MEMBER SIEBER: Redistribution of --

2 MEMBER ARMIJO: I am talking about a slow
3 leak. I know you guys can make a really good initial
4 weld and everything else, and your leak test is pretty
5 tough.

6 MR. LORSON: Right.

7 MEMBER ARMIJO: but I'm talking about, for
8 some reason or another, that a weld cracks, or some
9 non-metallic inclusion dissolves out, and now you have
10 a little pinhole, and over time you lose your
11 pressure --

12 MR. LORSON: Right.

13 MEMBER ARMIJO: -- and so the fuel gets
14 hotter.

15 MR. LORSON: Right.

16 MEMBER ARMIJO: And how -- isn't there any
17 way in which you can -- you know, it shouldn't get hot
18 or somebody should notice it.

19 MR. LORSON: Right. And to answer --

20 MEMBER SIEBER: It's the differential
21 pressure, so you aren't going to get a lot of
22 movement.

23 MEMBER ARMIJO: You don't have a pressure
24 gauge on it, Jack.

25 MR. LORSON: You don't have a pressure

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1 gauge, but you do have -- again, as I mentioned, you
2 have two concerns, one being the radiological release.

3 And there are requirements for monitoring for
4 radiological parameters around the cask.

5 So maybe if you had a significant enough
6 leak that resulted in some type of contamination
7 external to the cask, you would hope that a site
8 radiological monitoring program might pick that up.

9 The second point, which I think you are
10 really leading to, is the issue associated with
11 thermal performance. Okay? And what we have done,
12 and Jorge can speak to this directly, is we have
13 modeled various postulated leak sizes. For example, a
14 leak in the neighborhood of 10^{-3} cubic centimeters per
15 second is typically what could be detected through
16 hydrostatic testing if you look at the information
17 that is contained in ANSI 14.5.

18 Now, as you have a leak through some
19 postulated flaw, say you were to have a leak of that
20 size, as a function of time the leak rate is going to
21 drop, because you are going to lose your driving
22 pressure. Okay? And what is going to happen is you
23 have two effects. One is your pressure and your leak
24 rate are decaying as a function of time due to the
25 continued loss of pressure from the canister. The

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1 second effect is that the fuel is continuing to decay.

2 Okay?

3 And Jorge can talk a little bit about the
4 calculation he did. It gives us kind of a framework
5 for how long it takes you to deplete the overpressure
6 from a particular, you know, system based upon some
7 initial assumptions relative to what the thermal
8 performance might be.

9 MR. SOLIS: Yes. For some of the
10 pressurized cans it serves like Hi-Storm 100. We did
11 calculations assuming an initial pressure of six
12 atmospheres. And for a leak rate of -- constant leak
13 rate at about E to the minus three, it would take
14 about 400 years to completely leak the entire helium
15 to get to --

16 MEMBER ARMIJO: Does that include the fact
17 that the -- that as you lose helium pressure the
18 cooling of the fuel is less efficient, and you start
19 heating it up, so it may not depressurize as fast as
20 you think.

21 MR. SOLIS: Right.

22 MEMBER ARMIJO: But you have taken all of
23 that into account in your analysis?

24 MR. SOLIS: Yes. Yes.

25 MR. RAHIMI: Yes. I would like to add to

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1 what Jorge -- we just -- that is a very interesting
2 question. We just did this calculation recently that
3 Jorge determined if we have a leak rate, let's say as
4 large as hydrostatic test, 10^{-3} , you know, that is
5 what was our starting assumption, as he said, you
6 know, it would take about 3- to 400 years to lose all
7 of the helium overpressure, meaning going from
8 5.5 psig to -- all the way to one atmospheric
9 pressure.

10 And then, we had our decay specialist do
11 the decay calculation during that time, and we looked
12 at decay. By then, we will be below 12 kilowatts, and
13 14 kilowatts is the number that the -- below which you
14 do not rely on helium overpressure to transfer your
15 heat through convection.

16 So we showed that the -- if you lose all
17 of the helium overpressure, that by then you will get
18 below 14 kilowatts, that you are fine, your peak clad
19 temperature -- you are below the peak clad
20 temperature.

21 MEMBER ARMIJO: And unless you had leaks
22 that are much bigger than this 10^{-3} , you have no
23 concern. It seemed to me that somehow it would be
24 easy to put a thermocouple on the outside of a
25 container. And if the temperature was not going down

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1 with time the way it should, then you probably have a
2 leak, you know.

3 I am just saying that there is some --
4 seem to be some pretty simple ways to just eyeball
5 these things. One of your pictures you showed a bunch
6 of these canisters out in the field, and all of the
7 snow is melted all around these things, because it is
8 warmer there. And I just think it would be something
9 that would -- if I were a utility, I would think about
10 monitoring it in some way, simple --

11 CHAIRMAN RYAN: Or at least a sample of
12 some --

13 MEMBER ARMIJO: Yes, once in a while, just
14 to -- because these things -- leaks can happen in
15 these steel -- I imagine these are all stainless steel
16 and good materials, and all of that, but there is --
17 there is contamination. They can fail. And if they
18 leak too fast, you would lose the helium that you are
19 counting on. I would expect it would be very rare,
20 but it's something that should be -- periodically, I
21 would monitor it, if it was me.

22 MR. LORSON: And I think, you know, it is
23 kind of a multi-part, you know, response. One is, if
24 it were a slow leak that was coming over a period of
25 time, we would expect there would be some sort of

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1 accompanying contamination external to the canister
2 that would be detectable.

3 MEMBER ARMIJO: That is one indication,
4 yes.

5 MR. LORSON: If it were something that
6 were of slower -- that it didn't result in a
7 contamination event, and it were, you know, in the
8 neighborhood of 10^{-3} , okay, or lower, then what we've
9 shown is through, you know, some analysis at least
10 from one container that we are comfortable that the
11 leak rate is such that you are not going to likely
12 exceed a thermal concern before the heat load has
13 substantially decayed away to the point where you
14 don't require helium overpressure.

15 And I think, as a matter of point, I don't
16 believe that all of the vendors rely upon the helium
17 overpressure. I think it is just the one vendor that
18 we have -- Hi-Trac -- that relies on the helium
19 overpressure, and that is the vendor that we did, you
20 know, the calculation for.

21 And then, if you had a more significant
22 upset type event, you know -- you know, you could
23 postulate maybe somebody drives a forklift into
24 someway. I mean, I don't think that would be
25 sufficient to damage the concrete overpack and cause

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1 damage to the liner. But if you postulate some type
2 of upset event that would be apparent, then you would
3 expect that the licensee's corrective action program
4 would go in and evaluate the adequacy of the system
5 and make a determination whether they are still in
6 compliance or not.

7 MEMBER ARMIJO: Okay.

8 MR. PARKHILL: One point, because I am a
9 little sensitive to the scope of the standard review
10 plan here, is that we are limited by what we have
11 before you to a 40-year time period based on new
12 rulemaking. It was 20 years.

13 And then, after that 40-year time period,
14 we are going to have a new standard review plan that
15 is in public comments right -- it has already gone out
16 for public comments and it is being resolved -- that
17 is going to talk about the license renewal, you know,
18 issues and aging issues associated with a canister.

19 And it sounds like, if we're talking about
20 periods longer than that, that would fall under the
21 scope of that document. I just wanted to --

22 MEMBER ARMIJO: No. I'm not talking about
23 period of time. I'm just talking about things that go
24 wrong that are hard to detect.

25 MR. PARKHILL: Right.

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1 MEMBER ARMIJO: And that could lead to
2 consequences that are far worse than need to be.

3 MR. LORSON: It's a very good question.
4 We had the same concern. That is partially why we did
5 some of the calculations, and what it showed us is
6 that we are comfortable that for various postulated
7 leak sizes that we believe to be credible, we are
8 comfortable that for a 40-year license period that,
9 you know, we can demonstrate safety.

10 When you get beyond that, into the license
11 renewal space, okay, then yes, it would require the
12 applicant or the licensee to have an aging management
13 program. So, you know, as part of that they would
14 have to assess the condition of the exterior boundary,
15 and have an appropriate method for, you know,
16 examining those systems. And that is something that
17 we would be looking at, you know, in the longer term.

18 MEMBER ARMIJO: Okay. Thank you.

19 MEMBER SIEBER: Maybe I could just ask one
20 question. If the backfilled gas was at atmospheric
21 pressure, is there enough heat transfer to maintain
22 the fuel cool enough, so that you don't have this
23 rapid --

24 MR. SOLIS: No, you are not. You need the
25 pressure. You need to have that six atmospheres.

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1 MEMBER SIEBER: How many atmospheres? Do
2 you know or --

3 MR. SOLIS: Well --

4 MEMBER SIEBER: -- do you just know you
5 need some?

6 MR. SOLIS: Now, so far for -- for like
7 the highest pressurized canisters we have licensed,
8 they are required to have seven atmospheres of helium.
9 And that is -- they are not far from the limit. So
10 that's the same.

11 MR. RAHIMI: Yes. And I also would add
12 that depends on the heat load. You know, if you are
13 at the high heat load, you need that overpressure.
14 But if you are loading the, you know, no burn-up, low-
15 cool decay, below 14 kilowatts, you do not need helium
16 overpressures. You can rely on the conduction and
17 radiation heat transfer.

18 MR. SOLIS: And, remember, we did
19 calculations for 400 years, but actually, depending on
20 the initial decay heat, it would decay pretty fast. I
21 think your calculations show that it would take like
22 30 to 40 years?

23 MR. RAHIMI: That's right. Yes, we did
24 the decay calculations, and really, you know, we said
25 if we were off by a factor of 10, you know, within 40

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1 years we will be below 14 kilowatts, that we do not
2 rely on the helium overpressure.

3 MR. SOLIS: Right.

4 MR. RAHIMI: So at atmospheric pressure
5 below 14 kilowatt, you are fine.

6 MEMBER SIEBER: Good. Thank you.

7 MR. LORSON: By the way, one of the public
8 comments that we addressed in response to the ISG is
9 there was a push-back from industry not to do any of
10 this helium leak testing at all. And we didn't think
11 that was appropriate, because of, you know -- and
12 their argument is that these welds have been examined
13 through dye penetrant testing, through radiography,
14 and so, you know, there are multi-test welds, and it
15 is impossible to have a leak.

16 We just didn't accept that argument. And
17 so we require that leak testing be performed, so --

18 MEMBER SIEBER: Okay.

19 MR. LORSON: Thank you, Jorge.

20 CHAIRMAN RYAN: Are there any other
21 questions?

22 (No response.)

23 Anything else, Jack? Sam?

24 (No response.)

25 Okay. Why don't we take our scheduled

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1 break, and we'll come back at the appointed hour of
2 10:30 and start there. Okay?

3 Thank you.

4 (Whereupon, the proceedings in the foregoing matter
5 went off the record at 10:05 a.m. and went
6 back on the record at 10:28 a.m.)

7 CHAIRMAN RYAN: Okay. I guess I'd like to
8 call the meeting back to order please.

9 I think now Dennis are you up? Dennis
10 Damon will be presenting. So please, sir.

11 MR. DAMON: Well --

12 CHAIRMAN RYAN: Oh, I'm sorry, Ron, go
13 ahead. Excuse me.

14 MR. PARKHILL: That's okay.

15 CHAIRMAN RYAN: I went by the name on the
16 screen.

17 MR. PARKHILL: Well, there's two.

18 CHAIRMAN RYAN: Well, yes.

19 MR. PARKHILL: Dennis gets top billing on
20 this.

21 I just wanted to go real quickly over the
22 prioritization methodology. As Meraj said, we went
23 back at your recommendation and took out any
24 references to risk-informing and replaced it with
25 either prioritized or another version of that.

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1 The purpose of the prioritization
2 methodology is to classify the review procedures items
3 into either high, medium, or low as to the level of
4 effort that we think that the staff needs to devote to
5 that item based on our subjective determination and
6 primarily based on our experience.

7 That standard review plan is broken up
8 into these objective areas of review, regulatory
9 requirements, acceptance criteria, review procedures,
10 and evaluation findings. And the only thing that
11 we're really prioritizing is the review procedures.

12 A quick review of the methodology is we
13 ask three questions for each item that we want to
14 rate. The first question is the likelihood that that
15 requirement will not be met by the applicant. The
16 second question is the likelihood that the staff will
17 find that discrepancy. And the third is the perceived
18 risk if those requirements were not being met.

19 We assign a scoring system to the first
20 two questions of zero to four and the third for risk
21 is a one to three. We add up those collective scores
22 and come up with a low, medium, or high ranking that
23 we determine as the risk score.

24 Then we make a defense-in-depth
25 determination. And the scoring for the defense-in-

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1 depth determination is the same as a risk. It's going
2 to be a one, two, or three for a low, medium, or high.

3 Then we decide whether or not which one controls,
4 whether defense-in-depth or risk will control, and we
5 assign the higher score in that case.

6 In no case do we use defense-in-depth to
7 lower the score of an item. So the questions that
8 came back that we have from the last meeting were --
9 the first one was, there was a concern that the
10 uncertainties in the PRA were not addressed. Now in
11 fairness to these questions, they were made as the
12 introductory remarks from the Subcommittee without
13 benefit to the entire presentation. But for
14 completeness, we wanted to go through them.

15 PARTICIPANT: True.

16 MR. PARKHILL: The first one is we really
17 haven't done a PRA. We don't have data for these
18 determinations. It's the, you know, subjective
19 judgment of experienced staff through a process that
20 will allow us to be -- or guide our thought process.

21 PARTICIPANT: The point is still right,
22 though, that uncertainties weren't formally analyzed.

23 MR. PARKHILL: Right.

24 PARTICIPANT: Yes, okay.

25 MR. RAHIMI: Dennis, were you going to say

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1 something?

2 MR. DAMON: What? Well, I could, if you
3 want.

4 MR. RAHIMI: Okay.

5 MR. DAMON: I mean as Ron says, we didn't
6 -- there wasn't really a quantitative risk assessment
7 done. It certainly would have been -- we probably
8 could have done better if we did have such a thing.

9 But if you go back to the first -- the
10 Slide 8 -- or the one that has the methodology and the
11 scoring stuff on it, we didn't adopt this structure
12 lightly. There was considerable effort made up front
13 to think about what we should be assessing here.

14 And so the factors, the factors really are
15 aimed as if you did have a risk information. But the
16 point is we don't have the risk information because
17 basically we didn't have the time and resources to do
18 it.

19 And nobody has ever done such a thing
20 because the kind of risk study you would do in order
21 to inform such a thing to make it more objective would
22 be you want to assess each of these factors, like the
23 likelihood the requirement would not be met, you would
24 do a study, okay? How many times have we -- what kind
25 of applications have we got? How many times has this

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1 thing been found to be not in compliance?

2 That kind of quantitative -- and the same
3 with what is the risk if the requirement is not met.
4 Well, also on the likelihood thing, what you are
5 looking for is not the likelihood that once you build
6 and deploy this thing that something goes wrong, it's
7 what is the likelihood that they have already done
8 something wrong in what they have submitted to you in
9 the design, before they ever build the thing even,
10 that they've actually made a mistake in the design or
11 the analysis of the design.

12 So it is a kind of risk assessment I've
13 never seen anybody do around here. So that's what
14 we're missing, that kind of a risk assessment.

15 CHAIRMAN RYAN: Yes, no, I think after the
16 discussion and particularly the follow up, we
17 understand a little bit better. But you realize
18 you're dealing with PRA folks.

19 MR. DAMON: Yes, I mean it would have been
20 -- that was my reaction is --

21 MEMBER ARMIJO: These changes are going to
22 changes are going to save you a lot of grief at the
23 full Committee meeting.

24 (Laughter.)

25 MEMBER ARMIJO: And that's the whole

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1 purpose of the recommendation.

2 MR. DAMON: Well, what we asked ourselves
3 when we confronted this is okay, if we wanted to do
4 this, what would it take? Well, I estimate this would
5 take us another two years up front before we even
6 started to apply it. And so it wasn't worth --

7 MEMBER ARMIJO: And even then would it be
8 any better than what you've done?

9 MR. DAMON: It's hard to say.

10 MEMBER ARMIJO: I don't see how it could
11 be. I don't see it would be even a practical use of
12 your resources to try and do something like that.

13 CHAIRMAN RYAN: And I think I agree with
14 that, too, Sam, from the standpoint that, you know,
15 you just don't have the historical database of
16 experience to pull on. I mean it's just not there.

17 So, I mean, the phrase you used was, you
18 know, informed professional judgment and that's not a
19 bad thing.

20 MR. DAMON: So that's what we did. And so
21 when you talk about uncertainties in PRA, what is say
22 is okay, yes, that's a valid question. The real
23 uncertainty I would be concerned about is that these
24 professionals made the wrong judgment, you know, that
25 they just flat did it wrong.

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1 And, of course, that's why we involve
2 multiple people and we try to get the best people.
3 But you are, in fact, vulnerable to that.

4 CHAIRMAN RYAN: And I think that is a fair
5 assessment from your part of it that, you know, there
6 is some uncertainty with what is a six or a nine or a
7 four or a seven, you know, those aren't cast in stone.
8 But I think we recognize that.

9 MR. DAMON: Okay. So that's my take on
10 the first one.

11 MR. PARKHILL: Okay. The second bullet,
12 an observation was made or felt that question number
13 one, the values, the places where the applicant has
14 made mistakes. Well, it tries to identify the areas
15 where we have experience where applicants have made
16 mistakes and passes that knowledge along so that
17 hopefully the next person doing one of the similar
18 reviews can have benefit of that.

19 Question number two is a more interesting
20 question. We had to do some data analysis of the
21 sheets that we had. This third bullet, question
22 number two, when we get a low ranking for -- and this
23 is the staff's assessment -- when we value our review
24 as low, meaning that we either omitted finding the
25 mistake or aren't looking for it, should we do

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1 something different?

2 And I think our answer is yes. So what we
3 did, we went back and looked at all 143 items that
4 were prioritized in the standard review plan. And of
5 those, only seven of the 143 were identified as the
6 staff having a low or very low component for question
7 two.

8 One of those was already -- was an overall
9 rated of a medium, so we didn't worry too much about
10 that. But what we looked at was the risk evaluation
11 associated with the remaining six. And of those six,
12 four of them had a low risk rating. So I wasn't
13 concerned about something where we would miss it and
14 it had a low risk rating.

15 Two of those had a high and medium rating.

16 And so those two items we took a harder look at. The
17 first of those items had to do with -- it was in the
18 thermal section and had to do with axial distribution
19 data that is submitted for use in our thermal
20 analysis. And initially that was rated as a risk
21 component as high.

22 We reviewed that and we are kind of going
23 to change our risk rating on that. Our review now is
24 even if you change the axial profile to move it
25 towards the center, down or up, it's just going to

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1 change the values of where your high values -- or your
2 highest temperatures are along the axis. It's not
3 like you're putting more decay heat into the package.

4 So we feel that we conservatively erred
5 initially in our rating and improperly calculated --
6 or not calculated but identified that as a high. We
7 now think that item is low because it has no real
8 overall impact on the overall heat rating of the
9 package or the high temperatures associated with the
10 cladding.

11 The second item had to do was in the
12 materials chapter. And it had to do with periodic
13 inspections. And they are talking about period
14 inspections associated with inaccessible areas where
15 we may require a one-time look over the life to assure
16 that things are still adequate.

17 The other periodic inspection that is
18 mentioned in this paragraph is the possibility of
19 radiation surveys to ensure that the neutron shield
20 material is still, you know, functioning properly.
21 And those were rated as an M. So we're going to keep
22 that rating and increase the rating of this item for
23 periodic inspections in the materials section up to a
24 medium rating based on that.

25 So the point being is yes, we shouldn't --

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1 anytime we leave -- or answer question two and we have
2 a low rating for the value of our review, where we are
3 guided by a standard review plan, and we rate our
4 review as low or very low, then we're going to go back
5 and take a look at that. And we are proposing to
6 tweak the procedure, the prioritization method to
7 reflect that in its guidance.

8 And if there are no further questions on
9 that, we'll go on --

10 MEMBER ARMIJO: So you loop around to make
11 sure --

12 MR. PARKHILL: Yes, we're going to take
13 another look.

14 MEMBER ARMIJO: -- if the consequences are
15 significant, you loop around to see if the answer is
16 still right. And if the answer is still right, maybe
17 you've got to do something else.

18 MR. PARKHILL: Right.

19 MEMBER ARMIJO: Okay.

20 MR. PARKHILL: In the two cases that we
21 came up, one of them we're going to keep the rating
22 and the other we're going to bump it up. But that was
23 based on our assumptions.

24 CHAIRMAN RYAN: So you really made it
25 based on the criteria tools that you set up, the

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1 initial rating. And then you went back -- and let me
2 say it phenomenologically to see if that made good
3 sense.

4 MR. PARKHILL: Right.

5 CHAIRMAN RYAN: And you've ended up
6 changing a couple and leaving a couple alone.

7 MR. PARKHILL: Right. Yes, we're making a
8 commitment to change the process to always go back and
9 look at those.

10 CHAIRMAN RYAN: Right.

11 MR. PARKHILL: And then when you go back
12 and look, you're going to either say well, that
13 decision was right or wrong or we're going to change
14 it. And in one case, we decided that our initial
15 assessment was incorrect for the risk rating for that
16 axial profile.

17 CHAIRMAN RYAN: Okay. Good.

18 MR. PARKHILL: And the third question was
19 -- and that's the risk assessment. And there was a
20 concern where the risk question wasn't weighted
21 equally as the two previous questions. We didn't go
22 back and try to give it the same weight but I guess
23 our perspective is even if you increase the rating to
24 a one to a five, the same as the other ones, it's not
25 going to really impact the results hardly at all.

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1 And, of course, we would change our
2 criteria for being high, medium, and low in that they
3 also would be expanded by those two points.

4 MEMBER ARMIJO: You know, one thing I
5 should have asked earlier is why didn't you have a
6 very high in question three?

7 MR. PARKHILL: Oh, okay, well, that's kind
8 of what we're trying to answer here was all the other
9 ones go from very low --

10 MEMBER ARMIJO: Yes, yes.

11 MR. PARKHILL: -- to very high. And this
12 one just goes --

13 MEMBER ARMIJO: To high.

14 MR. PARKHILL: -- yes, low to high.

15 MR. DAMON: Yes, I think if -- given that
16 we may have a little bit of time here between now and
17 doing this again on something else, my recommendation
18 would be not simply to like stretch this one so it has
19 a broader range of scores but rather to do something
20 to actually inform that judgment about the risk
21 impacts by some more quantitative information about if
22 this is done wrong, you know, what kind of accident
23 can happen.

24 So do something more quantitative. And
25 then take all of the scores and calibrate them so they

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1 are all on an equivalent basis, which would mean to go
2 from these numerical scores that are just sort of
3 arbitrary to taking the logarithms of the
4 probabilities so they are negative numbers then but
5 they are all on the same basis. They are all tied to
6 the same reality so that they will address exactly
7 that point. They will all be equivalent.

8 MEMBER ARMIJO: Yes, well, you know, when
9 you use a term like catastrophic consequences, I don't
10 know how much higher you can go from a catastrophe so
11 --

12 MR. PARKHILL: Well, that's why.

13 MEMBER ARMIJO: -- H, in my terminology,
14 means very high.

15 MR. PARKHILL: That's why we have the
16 quantitative measure there also. Basically, I
17 wouldn't get too hung up on the words. You are
18 looking at an item and you have a perception as to
19 what you think the risk associated with that is in
20 your mind, an experienced review is, is this going to
21 be bad news or is this not going to be so --

22 CHAIRMAN RYAN: Well, thinking about it
23 the way you laid it out here, really -- and I have no
24 problem with the three in number three and the five in
25 number one, that's fine -- but if you take out the

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1 magic words of catastrophic and moderate and all that

2 --

3 MEMBER ARMIJO: Yes, I think if you just
4 use the numbers.

5 CHAIRMAN RYAN: -- the numerical values
6 can really do the job for you.

7 MR. PARKHILL: Okay.

8 CHAIRMAN RYAN: You don't have to give me
9 a qualitative interpretation of that. It's either in
10 the dose range or the risk range or it's not. It's
11 one of the three, you know, or above it. So why do we
12 need to call it catastrophic or modestly unwell or
13 whatever name we come up with.

14 MR. PARKHILL: The answer is we don't.

15 CHAIRMAN RYAN: Okay. So I mean that way
16 no you've got a numerical scheme for one and two and
17 three and four.

18 MEMBER ARMIJO: And it is your
19 professional judgment of your experts that says we can
20 make a judgment that is going to be greater than ten
21 to the minus three or 25 rem. And we don't do it in a
22 quantitative -- using a quantitative methodology.

23 CHAIRMAN RYAN: And you kind of --

24 MEMBER ARMIJO: Yes, because that's where
25 the next question is going to come up at the full

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1 Committee.

2 MR. PARKHILL: I participated, not as an
3 active member, but I was there for all of these panels
4 that Ray went through each and every chapter. And it
5 depended on the reviewer, on his perspective.

6 Some people didn't have a problem going
7 high, medium, and low. Some people looked for, you
8 know, the quantitative guidance over there to help
9 them make that decision. But it's still the
10 subjective experienced judgment of the person making
11 that determination.

12 And then there were three of them and then
13 they kind of hashed it out. So you weren't limited to
14 one person making a judgment. So it was three people.

15 And then they talked it over and came up with a, you
16 know, final high, medium, and low on it.

17 MR. DAMON: And like I say, my view was to
18 prove this is to do some more thinking about what
19 would actually happen because some of the things that
20 could, quote, happen are a little bit subtle like, for
21 example, if something is done wrong in the design and
22 analysis and they produce a package that actually will
23 need to be repackaged to ship or something, where they
24 didn't anticipate doing that, then what they're
25 incurring may be the occupational dose due to having

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1 to do a repackaging.

2 So you need to think it through as to what
3 are the real consequences to people if a particular
4 thing is done wrong. And that's why I say that would
5 be -- that would get us more value for our money than
6 worrying too much about how we're doing --

7 CHAIRMAN RYAN: Yes, and, again, that's an
8 example where just the numerical values in three give
9 you that ability to it's either a low, medium, or
10 high.

11 MR. DAMON: Yes, that's really -- what Ron
12 was saying is when we ask a question about, you know,
13 is the methodology okay or not, we really want to look
14 at what is our bottom line. And where did we come out
15 on this? And did it accomplish what we were trying to
16 do? And --

17 CHAIRMAN RYAN: Yes.

18 MR. DAMON: -- you know, we're trying to
19 get things into high, medium, low to sort of give a
20 starting point for the staff on what to focus on.

21 And like in some of these -- the other
22 questions about like number -- the one on -- we might
23 be devaluing something, are we looking at the right
24 things, this is really just -- the scoring in this SRP
25 is just the starting point.

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1 And there's, I believe, words in the SRP
2 that we would put in there that says this is a
3 starting point. Once you start looking into the
4 actual case you are looking at, and you find things,
5 and then you start deviating from this and you start
6 weighting the things that you find that might be a
7 problem more importantly than other ones.

8 And so this is like a starting point. And
9 then you go into the process.

10 MR. PARKHILL: Yes, the user of the
11 Standard Review Plan, the reviewer, needs to make a
12 judgment whether this collective experience is really
13 applicable to the design they are now reviewing. And
14 if it is new, something new and innovative coming in,
15 then all bets are off. You know it is going to be a
16 very detailed look.

17 So I think we've covered those three.

18 CHAIRMAN RYAN: Okay.

19 MR. PARKHILL: Questions? And the --
20 another question that came out of the last meeting was
21 there weren't any high priority items in the radiation
22 protection and accident analysis chapters.

23 First I'll start off by saying medium
24 isn't bad news. Medium is normal staff review. And
25 they get a pretty good thorough review with that.

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1 The radiation protection, I'll just try to
2 generalize what Liz says. But basically the staff
3 assures that the design can be used in a manner
4 consistent with the radiation regulations there.

5 I mean it is a review of the programmatic
6 or process. And the real implementation of the
7 radiation protection is done in the field. You know
8 we set up the guidelines that you commit to making
9 these programs. And the implementation is with the
10 licensee. And it's monitored by the people at our
11 regions.

12 And so we do the front end of it to make
13 sure it's, you know, the process is okay. And so
14 that's kind of an explanation why, you know, you don't
15 see any items there because we're buying off on a
16 process that we viewed has been adequately implemented
17 previously.

18 So we don't have any hard data coming back
19 that says hey, somebody doesn't know how to set up a
20 radiation process. If we did, some items would be
21 high.

22 Accident analysis, I can see where there
23 is a certain perception. Our standard review plan
24 doesn't talk about specific accidents explicitly.
25 It's done through that ANSI guidance, which describes

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1 the specific events.

2 So what our standard review plan does, and
3 it talks about in the review procedures, it asks them
4 to describe the cause of the event, the means for
5 detecting the event, summary and consequences, and,
6 you know, a corrective action.

7 So, again, it's the programmatic end that
8 we're buying off on in the standard review plan. Now
9 based on our experience, when they come in with an
10 application, in the accident analysis chapter, they
11 will follow the ANSI guidance. And what they'll have,
12 you know, the off-normal events and the accident
13 events.

14 But from our perspective in rating the
15 things that are in there, we have good -- relatively
16 good feedback that, you know, they are good at
17 identifying all of the events that they should.
18 They're not missing any. And they're analyzing them.

19 So that kind of meets the -- you know,
20 that's why, from a programmatic standpoint, we don't
21 have any bad feedback where we would cause the item to
22 be bumped up to more than our normal review. And our
23 normal review ain't that bad.

24 MEMBER ARMIJO: Well, the big difference I
25 saw from last meeting was that in your -- when it's

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1 high, you do independent confirmatory analysis but you
2 don't necessarily do that when it's medium. I think
3 that's different.

4 MR. PARKHILL: That's part of the
5 definition. But, again, it depends on a lot of ifs.
6 How close they are to margins, you know how much time
7 is -- okay.

8 MEMBER ARMIJO: Okay.

9 MS. THOMPSON: Ron, this is Liz Thompson.
10 I'd like to add something here.

11 The independent confirmatory analysis that
12 you may be thinking would be done under radiation
13 protection are probably actually the ones done under
14 the shielding evaluation because there aren't a lot of
15 calculations in the radiation protection where we
16 would have the information to do an independent
17 confirmatory analysis.

18 MEMBER ARMIJO: How about criticality?

19 MS. THOMPSON: Criticality has its own
20 review. That's, again, not covered under radiation
21 protection. I think Michael Call can speak briefly to
22 that.

23 MR. RAHIMI: Yes. Let me add that. To
24 answer the question, generally yes. For the
25 criticality, we do the independent, you know,

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1 calculations.

2 MR. PARKHILL: Whether it is medium or
3 high.

4 MR. RAHIMI: Whether it is medium or high.

5 MEMBER ARMIJO: Just about everything in
6 criticality is high or medium.

7 CHAIRMAN RYAN: And we think the other big
8 area, I mean just to kind of pick on these, is three,
9 there's structural, there's criticality, and
10 materials. Those are the three where the action is.
11 And when you combine medium and high.

12 MR. RAHIMI: Yes.

13 MR. CALL: Mike, if I could add something
14 real quick?

15 CHAIRMAN RYAN: Sure.

16 MR. CALL: This is Mike Call. With the
17 criticality, a lot of times -- well, not a lot of
18 times -- when we're looking at the criticality
19 evaluations, and we do the modeling, that also will
20 encompass anything that may be changes to the cask
21 conditions as a result of the accidents.

22 So if there are certain things that are
23 part of the accident, you know, accident scenarios,
24 those things will be analyzed and considered as part
25 of the criticality review. So that anything that

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1 comes out into the Chapter 12 discussions with
2 accidents wouldn't have an impact on what analyses
3 have been done in the criticality review because those
4 conditions would have already been considered as part
5 of that chapter and any modeling that would have been
6 done for that.

7 CHAIRMAN RYAN: Thank you.

8 MR. PARKHILL: Okay. So here is the
9 summary that we showed you before. It doesn't reflect
10 the one item we told you in materials that we were
11 going to bump to a medium. So those numbers will
12 change accordingly.

13 And if we could, I'd like to fast forward
14 to -- I'm not sure where the slide is -- this was
15 originally intended to all be in order.

16 CHAIRMAN RYAN: No problem.

17 MR. PARKHILL: Okay. Other issues from
18 the previous ACRS briefing. There was a question
19 regarding the linkage between the chapters. In other
20 words, what other things we are doing besides the
21 Figure X.1, you know substitute chapter number for X,
22 that provides the interrelationship between that
23 specific chapter and the other chapters.

24 And that's fairly detailed and can be a
25 little confusing to somebody that's not familiar with

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1 the process. But if you take the radiation protection
2 -- I mean if you take the chapters that we have in the
3 standard review plan, and they're listed there, and
4 next to each one of them is responsibilities of the
5 reviewer as they go about this.

6 This is basically in-bred -- any one of
7 the people that are doing the reviews, so if you pick
8 the shielding area, besides them doing that review,
9 there's also the interfaces that play into it from the
10 other diagrams.

11 So there are certain chapters where
12 there's a specific lead, structural, thermal,
13 confinement, shielding, criticality, materials,
14 radiation protection, and quality assurance all have
15 specific people assigned with the lead responsibility
16 for that.

17 There's other chapters where all the
18 disciplines, including the project manager, need to
19 look at them. So pick on shielding, for example,
20 besides doing a shielding review or she doing her
21 shielding review, would also look at the general
22 description, the principle design criteria, the
23 operating procedures, the accident analysis, the tech
24 specs. So that's generally how we do it.

25 We have a figure that talks about the

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1 interfaces. And then we have a team setup that
2 complements that figure.

3 CHAIRMAN RYAN: Okay.

4 MEMBER ARMIJO: The reviewers -- let's say
5 if you are going to be reviewing the criticality
6 chapter, do you have -- does the NRC staffer have to
7 have some sort of qualification or requirement or
8 training or --

9 MR. PARKHILL: Depending on your age, yes.

10 (Laughter.)

11 MR. PARKHILL: Yes, there is a program, a
12 formal program for qualification for that. Some
13 people have been grandfathered.

14 MEMBER ARMIJO: Okay.

15 MR. RAHIMI: Yes, we do have a formal
16 qualification for all discipline and even project
17 managers that they have to go through the
18 qualification program.

19 MEMBER ARMIJO: Okay.

20 MR. PARKHILL: Okay. We had another
21 question. How do we ensure that the regulations are
22 met? There's a table, not to confused with the
23 previous figure but per chapter that defines the
24 regulations.

25 What we had previously in the standard

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1 review plan was just the listing of the regulations
2 there without the statement of them. So this has been
3 expanded a little bit. We try to identify the topic
4 or area that the regulation applies to in the table.
5 And, you know, that aids the reviewer when identifying
6 items what to cite to and also ensures to see what we
7 need to comply with.

8 There is a regulation that defines the
9 regulations that are specifically applicable to a
10 general licensee or certification of compliance holder
11 that are applicable to this standard review plan. It
12 also identifies the regulations for a specific
13 licensee. And that would be the subject of the next
14 standard review plan that comes through.

15 But there is -- that regulation says hey,
16 here's the regulations that apply to a general license
17 and also a certificate holder.

18 CHAIRMAN RYAN: This is just a point of
19 information, Ron, or anybody, at a power plant
20 location where the ISFSI is kind of co-located or
21 nearby, I'm guessing there's a lot of overlap with the
22 personnel that take care of the ISFSI.

23 How do they handle the programmatic
24 aspects? Is there a completely kind of separate
25 program for the ISFSI? Or is it the same people and

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1 they have, you know, overlapping procedures? Or how
2 is that done?

3 I know they get two separate licenses so --

4 MR. LORSON: Right. You know, it is two
5 separate licenses. The licensee needs to be able to
6 maintain them separately. But they use their own
7 existing site procedures as the framework for how they
8 would comply with -- you know, for example, is there
9 is a surveillance requirement as, you know, we looked
10 at the casks earlier, verify the vents are clear on a
11 periodic basis, that requirement, while it is coming
12 out of their Part 72 license, and there would be a
13 copy of that Part 72 license in the control room along
14 with their Part 50 license with all their requirements
15 and the technical specifications so the control room
16 operator has, you know, immediate access to what, you
17 know, the information is but, you know, the
18 requirement to go out and do that particular
19 surveillance test would be molded into typically their
20 normal maintenance procedures.

21 And so the licensee would have one set of
22 maintenance procedures with, you know, and the
23 requirement to go out and do that test would be
24 integrated into their site work plans and, you know,
25 planning process and stuff. So they don't have two

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1 separate site organizations.

2 It is one site organization. And the
3 requirements from this program would get morphed into
4 and molded into those requirements.

5 CHAIRMAN RYAN: And somewhere in the
6 management chain there is a check to make sure that
7 everybody is doing everything from both licenses. And
8 it's not one of these deals where --

9 MR. LORSON: Right, right. That would be
10 part of their licensing assurance or regulatory
11 assurance function to make sure that --

12 CHAIRMAN RYAN: And it's part of the QA
13 function to make sure things get done under both
14 licenses and so forth.

15 MR. LORSON: Exactly.

16 CHAIRMAN RYAN: And, again, I wouldn't --
17 I'm not offering the question as any kind of a hint or
18 a criticism but whenever you have multiple licenses at
19 one site, there is a coordination issue on meeting
20 requirements, you know. It sounds like that is fairly
21 straightforward for --

22 MR. LORSON: Right.

23 CHAIRMAN RYAN: -- an ISFSI added on to a
24 power plant.

25 MR. LORSON: No, absolutely. And, you

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1 know, you start to talk about some of these power
2 plants that have operating units, an ISFSI and a unit
3 under construction.

4 CHAIRMAN RYAN: Yes, there you go.

5 MR. LORSON: Okay, now they are operating
6 under Part 50, Part 72, and, you know --

7 CHAIRMAN RYAN: Several others.

8 MR. LORSON: Yes, several others. So, you
9 know, how do you coordinate those all. But at the end
10 of the day, they need to have an integrated approach
11 to ensure that they meet all of the requirements --

12 CHAIRMAN RYAN: Right.

13 MR. LORSON: -- for each individual area.

14 MEMBER SIEBER: I think most utilities
15 have a planning and scheduling outfit that does that
16 integration. That's all they do is put schedules
17 today for the next week, the next month, and so forth.

18 CHAIRMAN RYAN: Sure.

19 MEMBER SIEBER: And they are responsible
20 that everything is complied with.

21 MR. LORSON: Correct.

22 CHAIRMAN RYAN: And is that something that
23 you get involved in at this stage of reviewing an
24 application for a Part 50? Or do you pull that string
25 when you --

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1 MR. LORSON: It is something that gets
2 looked at as part of the inspection process.

3 CHAIRMAN RYAN: But not in terms of the
4 licensing process.

5 MR. LORSON: Not in terms of the licensing
6 process.

7 CHAIRMAN RYAN: They make a commitment
8 we're going to do it this way and that's either okay
9 or not. And then you have to go into the inspection
10 space to verify it?

11 MR. LORSON: Correct.

12 CHAIRMAN RYAN: Okay.

13 MEMBER ARMIJO: What is the inspection
14 frequency or cycle time for an ISFSI facility by an
15 NRC inspector, whether it's I guess a site -- people
16 at the site -- is it a year?

17 MR. LORSON: Right.

18 MEMBER ARMIJO: Or two years? Something -
19 -

20 MR. LORSON: We have Jim Pearson here. He
21 is a senior inspector in our group. Maybe he can
22 field the question. The question is what is the
23 inspection process or program for inspection of ISFSI.

24 MEMBER ARMIJO: The frequency.

25 MR. PEARSON: The frequency?

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1 MEMBER ARMIJO: Yes, how often.

2 MR. PEARSON: The frequency may vary some
3 depending on what type of activities are occurring.
4 We perform reactive inspections if there are problem
5 issues that would put us in motion or the regions in
6 motion. The regions typically handle most of the Part
7 72 inspections with our support.

8 If it is a fabricator or a vendor, those
9 inspections occur periodically which, right now, that
10 periodicity is a three-year period.

11 In regard to -- I'd like to also add while
12 I'm speaking is the quality assurance criteria that
13 Ray and you were speaking of in regard to -- and
14 management control as well -- but the quality
15 assurance criteria is the same for Part 50, Part 71,
16 and Part 72. So that criteria rolls across all those
17 different areas and keeps things, I think, more in
18 line, so to speak, as opposed to maybe even management
19 differences.

20 CHAIRMAN RYAN: Fair enough. Yes.
21 Thanks.

22 MR. CALL: Thank you.

23 MR. PARKHILL: Okay. And if there isn't
24 any more questions, we'll go on to the public
25 comments.

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1 You had benefit, I guess, finally of our
2 disposition of all the comments in Appendix D to the
3 standard review plan. We got comments, public
4 comments were received only from industry. We got 192
5 from NEI and we got 30 from NAC. And NAC's were
6 mostly duplicative of the NEI comments.

7 Like I said, they were all dispositioned
8 in Appendix D, identification of their comment, our
9 response to it, and any changes we made to the
10 standard review plan. We agreed with over 60 percent
11 of the comments. So the public comment helped with
12 the improving of this document.

13 And in the previous briefing, we went
14 through chapter by chapter and discussed what we
15 considered to be the major comments on a chapter
16 basis. And so now what we'd like to do is just give
17 you our view of what we considered to be the more
18 significant comments, not to belittle the ones that
19 aren't addressed but we have only a finite amount of
20 time.

21 The first comment I'd like to address is
22 the technical specifications were viewed by NEI to be
23 too arbitrary. We don't agree with that. We felt
24 that based on the diversity of designs plus the
25 applicants' suggested content of the technical

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1 specifications have led to technical specifications
2 that are really geared to a specific applicant.

3 So -- and not to close the door on the
4 issue, we've left this item open for discussion with
5 the industry at the dry cask storage forum. It's just
6 that right now we're not taking any action in the
7 standard review plan based on the comment and our
8 experience with the different designs.

9 Second comment is in the structural area.

10 I'll read it off and Dave can jump in here. Replace
11 Reg Guide 1.60 because it is too seismically
12 conservative and replace it with a NUREG guidance. We
13 didn't agree with that. And we felt that the Reg
14 Guide 1.60 should be still utilized.

15 MR. TANG: This is David Tang, Senior
16 Structural Engineer.

17 On this comment, we noted that Reg Guide
18 1.60 is a broad-based general guidance which takes
19 precedence over NUREG contractor reports. Okay. This
20 NUREG deals with technical basis for revision of
21 regulatory guidance on design ground motions, which
22 was the first NUREG.

23 The next NUREG deals with parametric
24 evaluation of seismic behavior of freestanding dry
25 cask storage systems, which was accomplished many

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1 years ago. And we thought the Reg Guide 1.60 still
2 should govern. And that is the basis we said there
3 shouldn't be any change about this based on these
4 comments.

5 The next general comments we found of
6 importance was the structural analysis, as noted,
7 should have allowed the use of elastic-plastic and
8 other non-linear analysis method as permitted by ASME
9 Code Appendix F, so to speak. And, again, as noted,
10 this is only part of the comment.

11 The second part of the comment, which is
12 not captured in this particular bullet, deals with
13 allowing the strain-based criteria to be used.
14 Nevertheless, we agree that say the elastic-plastic
15 and other analysis method, as captured in the code, of
16 course has been considered already.

17 But the second part dealing with strain-
18 based criteria, which hasn't been really recognized by
19 the code. And for that purpose and like any other say
20 method that we continue to have the position, if the
21 applicant proposed to use strain-based criteria, we
22 are going to consider it on a case-by-case basis. So
23 those are the general --

24 MEMBER ARMIJO: Was that related to
25 something like a drop analysis and deformation of a

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1 canister or something like that? Would that be the
2 topic? Or was it related to the fuel itself?

3 MR. TANG: Correct in that sense. We talk
4 about energy-based driving say function as versus say
5 forced-based driving -- driving force or displacement
6 driving force. For that matter, I think up to this
7 point, the energy based say drop events dealing with
8 handling of casks within the reactor buildings or on
9 the ISFSI pad, generally the challenge has been rather
10 mild relatively speaking.

11 I think what aroused the interest of the
12 applicant or for us was, for instance, in the private
13 fuel storage licensing part, it has been identified
14 that say aircraft crash, which would cause the large
15 deformation in say high strain activity demand for the
16 canisters. So that was the starting point.

17 But, of course, in preparation for say
18 Yucca Mountain licensing event, there could be some
19 events which would still count on the -- say still
20 count on the say strain-based criteria. Of course,
21 it's not going to be the case any more because of say
22 Yucca Mountain say current events.

23 MEMBER ARMIJO: Thank you.

24 MR. TANG: Okay.

25 MR. PARKHILL: Okay. The next public

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1 comment was had concerned the level of detail,
2 specifically time steps being sufficiently small in
3 the models that we are looking at. And they felt that
4 they were too detailed and recommended, I guess, not
5 being included in the standard review plan as
6 guidance.

7 We feel that we disagree with that
8 respectively, feeling that the level of detail depends
9 upon the specifics of the application.

10 And Jorge, do you want to add anything to
11 that?

12 MR. CRUZ: No.

13 MR. LORSON: I think, in essence, the
14 standard review plan is our guidance to our staff in
15 terms of the things we want them to consider when they
16 evaluate applications. So the better tools that we
17 can give to the staff with the more detail regarding
18 how to conduct the reviews and the types of questions
19 they should be thinking about and asking, we think is
20 within our interest.

21 That's not to say that we are imposing a
22 requirement on the industry but we want to make sure
23 our staff have the best tools available to do the
24 review.

25 MR. PARKHILL: And the last comment we

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1 chose to present here had to do with the industry's
2 concern on the release fractions for damaged fuel. We
3 have some data that is out there that gives specific
4 numbers. And we don't -- they are requesting to use
5 that data for damaged fuel.

6 We disagree with that. The data that we
7 have that supports those release fractions is based on
8 a single rod and a single failure, a split in that one
9 rod and the release fractions associated for that.

10 For damaged fuel, we don't have any
11 supporting data. And so we're erring to be
12 conservative and recommend that they generally go to a
13 leak-tight criteria for determining -- I mean for the
14 design of the cask. So they have to test it up to ten
15 to the minus seven standards there.

16 It's also noteworthy to point out that a
17 lot of the canisters are now pressurized, which would
18 provide a driving force. And accident fuel fractures
19 could also contribute to the source term.

20 That's all we had to present here. We
21 chose to present the ones we disagreed with. Last
22 time we presented public comments where we both agreed
23 and disagreed. And, again, we got a lot of comments
24 that were incorporated and have added to the value of
25 the -- oh, it's not all the public comments here.

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1 CHAIRMAN RYAN: I think you accepted quite
2 a large number of comments, too, if I recall. But
3 we'll get to that in a minute. Go ahead.

4 MR. PARKHILL: Yes, well, it was 193, as
5 we said, from NEI, and 30-some from NAC.

6 The next comment has to do with delete the
7 dose rate limits from the technical specifications.
8 We disagree with that because that's one of the few
9 measurable items that we have to ensure that the cask
10 is performing as designed and fabricated.

11 The next public comment, and I believe
12 this is the last one, yes, delete measurements to
13 confirm assembly burnup values. We are not
14 recommending a change with that because that with
15 burnup, we feel that it needs to be measured and not
16 just calculated when it comes to giving them some
17 relief.

18 MEMBER ARMIJO: What --

19 MR. LORSON: Sorry?

20 MEMBER ARMIJO: These are calculations,
21 right, in both cases. I mean they don't have a --

22 MR. PARKHILL: Well, we're recommending
23 measurements for burnup if they come in and they want
24 to use burnup. But I'm going to let Michael Call
25 field this question.

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1 MEMBER ARMIJO: Yes, also tell me how
2 these things would be measured.

3 MR. CALL: Well, my name is Mike Call.
4 The comment here particularly deals with the
5 incorporation of guidance that was in an ISG related
6 to burnup credit. And for burnup credit, of course,
7 as we have it right now, all the systems that we have
8 that are licensed under Part 72 for storage do not
9 relay on burnup credit.

10 They, for criticality purposes, assume
11 that the fuel is fresh fuel or unirradiated fuel in
12 which case there is no recommendation in the guidance
13 for a confirmatory measurement of the burnup.
14 However, if they need to burnup credit as far as there
15 are certain limits in the guidance regarding the
16 minimum burnup limit an assembly would need to have,
17 and that's depending upon the analysis that's used for
18 the burnup credit.

19 And as far as part of the loading
20 operations, there would need to be a way to verify
21 that the assembly itself meets those parameters. And
22 for meeting the minimum burnup, there would be some
23 type of verification measurement.

24 Now what that would entail, I'm not
25 familiar with all the different methods but I do know

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1 of something along the lines of a fork detector where
2 you have a signal that comes out and based off the
3 signal which you would have that detector would be
4 calibrated using measurements of assemblies with known
5 burnups and from the signal that you measure for an
6 assembly with a known burnup, you would use that
7 calibration to pretty much do a check to see that what
8 you've got is actually in the burnup range that your
9 records say that it is.

10 So it is kind of like just a check to say
11 this assembly is where it needs to be, yes. We've got
12 the right one. We can go ahead and load it.

13 MEMBER ARMIJO: So this is a physical
14 measurement. This is not an --

15 MEMBER SIEBER: Radiological --

16 MEMBER ARMIJO: -- independent
17 calculation. It's not the utility's tracking of
18 burnup. I mean they have a pretty sophisticated
19 process for knowing the burnup of their assemblies.

20 MR. CALL: Yes.

21 CHAIRMAN RYAN: So really this is all
22 based on making sure that the fuel element you think
23 you have is the fuel element you actually allow.

24 MR. RAHIMI: That's correct.

25 MEMBER ARMIJO: Well, that's a loading

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1 error kind of mistake. But, you know, I think --

2 MR. CALL: See one of the things that we -
3 -

4 MEMBER ARMIJO: -- it surprises me that
5 you don't have -- if we permit the utilities to
6 operate reactor cores based on their calculations of
7 what the burnup is and what the power is, we would
8 have some confidence that the burnup is what it is
9 after it is out of the reactor. And you wouldn't
10 require a separate measurement of some sort.

11 If it was easy to do, I'd say fine.
12 That's a rational thing to do. But if it is very
13 difficult --

14 MR. RAHIMI: Let me add something to that.
15 Yes, you are absolutely right. Right now what --
16 they're loading based on the reactor records, you
17 know, what their burnup has been signed through, you
18 know, the fuel management code they have and the core
19 power, that's how they are assigned.

20 MEMBER ARMIJO: All of our accidents and
21 everything.

22 MR. RAHIMI: You are absolutely right.
23 That's how each assembly burnup has been assigned.
24 And they are using those records as part of their, you
25 know, check confirmation to put into the cask.

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1 But, you know, we have seen over the years
2 some errors in terms of loading with respect, you
3 know, to other parameters, you know, burnup and
4 cooling time --

5 CHAIRMAN RYAN: Loading what? Loading
6 these casks?

7 MR. RAHIMI: It has varied from misplacing
8 the fuel rack but also included some, you know,
9 loading into the cask. And we do have actually
10 specifically, you know, in the Reactor Event Database,
11 you know, those are reported, some of those mis-loads.

12 So what we have put in the SRP in case
13 that they want to go -- they want to use burnup credit
14 as a design basis, at this point, all the applications
15 we have received and we have approved, they have not
16 taken credit for burnup for storage because during
17 loading, they rely on the borated water in the pool as
18 part of one of the parameters for criticality control.

19 Once on the storage path, they assume sort
20 of a moderate exclusion. The water does not get in.

21 MEMBER ARMIJO: The BWR guys don't put
22 boron --

23 MR. RAHIMI: Right. In the BWR, the
24 design is in such a way they neither need boron nor
25 burnup credit because of small assembly in terms of

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1 criticality, less reactive.

2 So mainly on the PWR, so far, in all the
3 applications we have been received and approved for
4 storage, they haven't invoked burnup credit. But
5 under transportation, it is a different story, you
6 know, they do have burnup credit.

7 So what we have put in the storage SRP, in
8 case they want to go after burnup credit, because on
9 the transportation we have Interim Staff Guidance, and
10 we have approved burnup credit design for
11 transportation.

12 MEMBER ARMIJO: Have you approved a test
13 methodology, short of a bundled gamma scan, that is
14 acceptable to demonstrate burnup credit? Burnup is --
15 is there a way to do it? You know, that's what I'd
16 like. I know how to do it the hard way but is there a
17 practical way --

18 MEMBER SIEBER: Is there a radiological
19 measurement using gamma?

20 MEMBER ARMIJO: Yes, well, you can do
21 bundled gamma scans.

22 MEMBER SIEBER: It's a pretty simple
23 thing.

24 MR. RAHIMI: Yes, as Michael pointed out,
25 there are instruments, and he mentioned fork detector

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1 --

2 CHAIRMAN RYAN: But wait a minute, you're
3 making a gamma ray measurement on inventory of fission
4 product gamma ray in the fuel and you're calculating
5 what the burnup has to be to get that gamma ray
6 profile, correct? You're not measuring burnup in any
7 direct way at all.

8 MR. RAHIMI: We don't. You're right. We
9 do not measure burnup. Yes.

10 CHAIRMAN RYAN: The next question I'll ask
11 is what is the accuracy of this measurement and the
12 accuracy of the back-calculation to burnup?

13 MR. LORSON: Well, and I think, you know,
14 the answer to that -- and I'll let Zhian give you the
15 accuracy if he knows it -- but that would be something
16 you would do in addition to all of the reactor records
17 and administrative controls you have.

18 CHAIRMAN RYAN: Yes, yes, yes, that's not
19 my question. I want to stick with my question.

20 MR. LORSON: Okay.

21 CHAIRMAN RYAN: I'm asking what is the
22 precision and accuracy of this measurement and
23 calculation?

24 MR. LI: That's a really good question.

25 CHAIRMAN RYAN: Thank you.

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1 (Laughter.)

2 MR. LI: As a matter of fact, it is a
3 complicated process.

4 CHAIRMAN RYAN: That means it is probably
5 not real accurate maybe.

6 MR. LI: I think the report, the AEI
7 report says it is pretty accurate, five percent
8 within.

9 CHAIRMAN RYAN: So I'm within five percent
10 of the burnup, what's actually there if I make this
11 measurement and calculation?

12 MR. RAHIMI: Basically -- go ahead, you
13 finish.

14 MR. LI: Yes, they call it the fork
15 detector. It's like a fork. It goes up, down, along
16 the fuel assembly.

17 CHAIRMAN RYAN: Sure, sure, no, I
18 appreciate that.

19 MR. LI: So I think based on the curium-
20 244, the neutrons spectrum, that's the detector, the
21 fundamental basis.

22 CHAIRMAN RYAN: Okay.

23 MR. LI: And then, of course, they have a
24 kind of a calibrate the detector itself for a known
25 burnup fuel.

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1 MEMBER ARMIJO: So we have to have a
2 standard of some sort.

3 CHAIRMAN RYAN: They have to have some
4 fuel rod they've picked out and examined and said
5 that's the reference check source.

6 MR. LI: Right. Yes, the reason I said
7 it's complicated is it is based on a known burnup
8 fuel. That's the complicated part.

9 MEMBER ARMIJO: And there is no
10 methodology where you can take the calculated burnups
11 from the reactor and put a margin on it? It's a well,
12 maybe you're -- we'll put 50 percent margin or some
13 big number and still allow burnup credit?

14 MR. LORSON: Yes, we have a separate
15 activity we're working on with the Office of Research,
16 okay, where we are basically taking a look at what
17 have been the fuel mishandling or mis-load events that
18 have occurred, you know, because now we have a
19 population on our database so we're trying to assign
20 kind of using a probabilistic type of argument to see
21 whether or not we can make any adjustments to the need
22 to do some type of independent measurement
23 verification.

24 And I think there will be a number of
25 factors. One is what is our historical mis-load data,

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1 okay. Two might be what is the licensee's population
2 of fuel in terms of enrichment, predicted burnups, and
3 things of that nature.

4 So the idea would be to come up with some
5 type of, as we develop our ISG, which you'll see, you
6 know, probably early next year, in working with
7 Research to see if we can come up with some kind of
8 definitive better way to do this absent a direct
9 measurement. And I think that's one of the things
10 that is ongoing.

11 With respect to the standard review plan,
12 you know we write the guidance based upon kind of the
13 rules and practices we have in place.

14 MEMBER ARMIJO: Yes.

15 MR. LORSON: It doesn't mean that it is,
16 you know, that we're not continuing to, you know, try
17 to push the envelope and expand into areas where we
18 can make improvements and enhancements. So a lot of
19 these comments speak to things that we are currently
20 working on in the enhancement area. It's just not --
21 this is not the right time to put it into the SRP.

22 CHAIRMAN RYAN: But is it the right time
23 to have the option in the SRP?

24 MR. LORSON: Well, once we complete the
25 User Need from Research, it gives us the technical

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1 basis for why we --

2 CHAIRMAN RYAN: You know what I'm hearing
3 is there is a measurement that is currently available
4 to do burnup credit assessment. There's also a huge
5 amount of records and all the rest dealing with the
6 fuel that's in the fuel pool.

7 So the real question I'm wrestling with
8 here is what does this added measurement give me in
9 terms of controlling individual fuel elements that
10 ultimately end up in a bundle? Because I could make
11 the fuel loading mistake after I make all these
12 measurements.

13 MR. DAMON: I mean my impression from
14 having been involved in this research project is that
15 the primary reason for the verification is not the
16 accuracy or inaccuracy of the determination of burnup.
17 It is mis-loading.

18 MEMBER ARMIJO: That is a different issue.

19 CHAIRMAN RYAN: That is a different issue.
20 We're putting mis-loading and burnup in the same
21 bucket. I don't understand that.

22 MR. DAMON: They are different. Burnup is
23 mentioned because it all ties together. You have to
24 know well if I do a mis-load, how much of a mis-load
25 do I need before I get in trouble.

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1 CHAIRMAN RYAN: But the root cause here is
2 the mis-load.

3 MR. DAMON: Yes.

4 CHAIRMAN RYAN: So I think the focus
5 should be on how do you prevent mis-loads. Not how do
6 you measure burn-up.

7 MEMBER ARMIJO: And Jack wants to say
8 something. We keep interrupting.

9 CHAIRMAN RYAN: All right. Go ahead,
10 Jack. Sorry, Jack.

11 MEMBER SIEBER: I agree that 90 percent of
12 the purpose is prevention of mis-loads. But if you
13 take fresh fuel all the way to the spent fuel storage
14 system, there are four opportunities to make a mistake
15 as to where the fuel is located in the reactor, when
16 it was discharged, was it placed in the right place in
17 the spent fuel pool, and so on.

18 And really what this verification is is a
19 verification that you have the right assembly and you
20 know what it is.

21 MEMBER ARMIJO: But that could be done by
22 --

23 MEMBER SIEBER: It is not as accurate as
24 the burnup calculation that the physics guy would do.
25 It's not as accurate.

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1 MEMBER ARMIJO: But they're all numbered,
2 Jack. They have readable numbers.

3 MEMBER SIEBER: I understand that. I also
4 worked in a power plant and I know what goes on in
5 power plants, okay.

6 MEMBER ARMIJO: Well, you've got to get
7 guys with better eyesight.

8 MEMBER SIEBER: Yes. I like their way of
9 doing it myself.

10 MR. LORSON: I like Jack's comment.

11 (Laughter.)

12 MEMBER ARMIJO: You know I don't think you
13 should tie burnup credit with mis-loading errors. I
14 think they are two separate issues. And burnup
15 credit, it always made me wonder why we couldn't -- if
16 we can credit that we know the burnup in an assembly
17 to operate a nuclear power plant and to do all the
18 accident analyses and everything else, why can't we
19 have some confidence that a burned-up fuel was burned
20 up partly and throw some margin on him and give him
21 some partial burnup credit separate from the issue of
22 mis-loading.

23 That's a different thing. They have to be
24 able to verify that the right assembly is going into
25 that canister. And that's not a physics problem.

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1 That's mechanics.

2 MR. LORSON: Right. And I think that's,
3 you know, what our ISG will attempt to address. And
4 we're still doing the research relative to, you know,
5 address that point.

6 CHAIRMAN RYAN: Well, why try and cast the
7 rock into the wall here now doing this, you know?

8 MR. CALL: Well, the thing is, my
9 understanding is that of course with the analysis, now
10 we have certain parameters. And part of the tech
11 specs are what are the parameters to verify that the
12 contents that you actually put in meet the parameters
13 that were designed for.

14 And that is where with burnup credit, we
15 didn't have to worry about a minimum burnup because
16 the assumption was fresh fuel. Now that we have a
17 minimum burnup with various other reactor operations
18 parameters --

19 CHAIRMAN RYAN: That's not the question
20 now. The question is by what method do we make that
21 burnup credit determination. And what you're hearing,
22 I think, from Sam and me is that if you have the
23 pedigree on where and how long it has been in the core
24 and it is discharged, and you know you are matching up
25 that fuel element with the records, you know that.

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1 The added measurement doesn't give you
2 anything extra except maybe some verification with
3 some uncertainty band that yes, that number is okay or
4 within some bounds.

5 MR. CALL: It proves with certainty that
6 you haven't had a mis-load.

7 MEMBER SIEBER: You don't care whether
8 you've got the right assembly or not if you don't take
9 credit for the burnup.

10 MR. CALL: Right. Right.

11 MEMBER SIEBER: So you can make the
12 mistake. So to me it is pure logic.

13 MEMBER ARMIJO: Well, you always are going
14 to be wanting to know that the right assembly is
15 loaded into the canister whether or not you have a
16 burnup credit. I would think that the requirements
17 wouldn't be so loosey-goosey. Throw anything in there
18 you want because we're not giving you burnup credit.
19 I can't believe that.

20 MR. RAHIMI: Yes, yes, we record the decay
21 time, enrichment, you are absolutely right. You've
22 got to make sure you pick out the right assembly.

23 But I do want to stress the fact, Dr.
24 Ryan, you are absolutely right that the reactor record
25 is the record that we rely on for burnup. And all

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1 these devices that we're talking about burnup
2 measurement, it doesn't even measure the burnup.

3 It is a correlation of the neutron and
4 gamma to the reactor record. What you do, you do a
5 bunch of measurements. You say are the correlating?
6 You do not measure burnup because you cannot measure
7 the burnup.

8 CHAIRMAN RYAN: But, see, in the same way
9 Jack's sees the hand-offs and the discharges of a fuel
10 element as having some potential for, you know, mis-
11 locating it and then getting confused on which one is
12 which, I see this measurement thing as an opportunity
13 where I'm running measurements up and down a fuel
14 element underwater and, you know, there's lots of
15 opportunities to have goof-ups there, too.

16 MEMBER SIEBER: That's okay.

17 CHAIRMAN RYAN: That's okay?

18 MEMBER SIEBER: Because you are going to
19 get a result that is indicative of a burnup similar to
20 the one you think you have, okay?

21 CHAIRMAN RYAN: Well, it is a proof-
22 positive measurement for that fuel element. And,
23 again, I'm skeptical about what proof-positive really
24 means. But I mean what is the error uncertainty in
25 it.

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1 PARTICIPANT: It's interesting. You guys
2 see three different views.

3 MEMBER ARMIJO: Okay, well, look, that's
4 really Technical and Research and all that. But I see
5 two issues. And I think it is clear that you do, too,
6 and you're working on that. I just wanted to speak my
7 piece on it.

8 CHAIRMAN RYAN: And, Sam, I agree with
9 you. I think it's not clear in this document how it
10 will end up because it is work in progress. It's
11 going to come later in an ISG.

12 I guess what I'm reaching for is there any
13 way to avoid another ISG and get it in this one?

14 PARTICIPANT: Well, probably not. It's
15 not ready yet.

16 PARTICIPANT: We're not quite there yet.

17 MEMBER ARMIJO: Is that a fair conclusion
18 on my part?

19 MR. RAHIMI: Yes.

20 MR. LORSON: The one thing I would like to
21 address is, you know, the question regarding burnup in
22 the reactor, we rely upon these burnup records for how
23 we manage the core at-power. But there is a
24 difference in that when you are operating a reactor,
25 you have, you know, flux measurements typically within

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1 the reactor. It's being actively monitored. You are
2 continuously computing and evaluating your thermal
3 performance.

4 Once you put the fuel assembly into a
5 storage container that may be later transported down
6 the road, you really rely upon all the up-front
7 quality controls to make sure that what you have in
8 there, there's no further opportunity to do
9 monitoring.

10 MEMBER ARMIJO: You know, I don't know how
11 all the different PWR fuel designs are marked but in
12 the BWR, it's very -- you know, we have material
13 numbers. Yes, you know, to me that's how you know
14 what assembly you are dealing with, whether it is in
15 the core or whether it is in the fuel pool.

16 And if you make that verification, and you
17 have all this reactor operating information, you know
18 the burnup.

19 CHAIRMAN RYAN: One thing that would be
20 helpful, I think --

21 MEMBER ARMIJO: And so to me they are two
22 different kinds of problems.

23 MR. LORSON: If I could just address that
24 point, you are right, the serial numbers, the bundles
25 are serialized, okay, and, you know, maybe Jack has

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1 looked at a bunch of these and I certainly have. You
2 can't always read the serial numbers all that well,
3 okay.

4 MEMBER SIEBER: If they are under water.

5 MR. LORSON: Underwater, remember you're
6 looking at it through a camera under 40 feet of water.

7 MEMBER ARMIJO: Then that is a mechanical
8 problem to figure out how to read the serial numbers
9 properly with high confidence. And that's a different
10 problem than the physics problem of measuring some
11 gammas coming off and comparing it to a standard and
12 everything else.

13 CHAIRMAN RYAN: And I guess maybe the
14 take-away message --

15 MEMBER SIEBER: That's just a quality
16 control check.

17 MR. LORSON: It's a quality control check
18 and you also have to rely upon your fidelity of your
19 accurate records, right, and occasionally you can get,
20 you know, serial numbers can, you know, be transposed
21 perhaps in a database.

22 MEMBER ARMIJO: Well, with old fuel,
23 really old, old, old fuel, I agree with you because
24 there was a lot of things that went wrong. But I
25 think with the more modern fuel, and I'm talking about

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1 the last 20 years, you should have really -- maybe you
2 have more experience and you can tell me about all the
3 mistakes.

4 MR. LORSON: Well, we just get the reports
5 when the mis-loads occur. And so we say gee, you
6 know, given that they have serial numbers on the
7 handles and given that, you know, they have these
8 databases and it's, you know, within the last 20
9 years, why do we have assemblies that are still not in
10 their right location?

11 MEMBER ARMIJO: But that's what they've
12 got to fix. Right? That part.

13 MR. LORSON: And this is just kind of an
14 additional quality control check, if you will, to make
15 sure that we don't put the wrong assembly in the cask.

16 CHAIRMAN RYAN: I think that it would be
17 helpful to somehow describe this in the guide, that
18 this is a combination of two things. It's not just
19 verifying what fuel element goes into a storage unit.

20 It's -- and we're doing that by this radioactive
21 material measurement or gamma ray measurement, there
22 is a fuel- handling question that you are also
23 integrating into this. And mis-loads is part of what
24 you are addressing and not just burnup.

25 So I think, at least for the user, it

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1 would be very helpful to add some discussion that you
2 are addressing the possibility of mis-loads getting to
3 the fuel canister as well as a radiological condition
4 in the burnup.

5 MEMBER ARMIJO: If there is a really big
6 benefit, I would think that the utilities and the guys
7 that are in this cask business would develop methods
8 that give you confidence that they will load the right
9 assembly into those casks. And so that they can get
10 some credit, if not 100 percent burnup credit, but
11 something based on high quality reactor data.

12 And so the guidance would help them focus
13 their R&D efforts to say hey, we have these super-
14 duper microscopes and jacks -- we can examine fuel in
15 great detail in a pool. We ought to be able to read
16 serial numbers on the handle of an assembly.

17 CHAIRMAN RYAN: And I can tell you that's
18 --

19 MEMBER ARMIJO: If there is any question
20 there at all, just having this conversation in the
21 standard review plan might give people the heads up
22 that if there is any chance whatsoever that you are
23 reading a three as an eight, you'd better think again.

24 CHAIRMAN RYAN: Because, you know, then
25 maybe something where there is some identification

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1 question, you can route it to the measurement. I
2 don't know you could put it together in some way so it
3 might work a little better.

4 MR. LORSON: So we'd only do it in the
5 unusual cases or where you are not absolutely sure.

6 CHAIRMAN RYAN: Perhaps. I'm just
7 throwing that out as an idea to kick around.

8 MR. LORSON: Right.

9 CHAIRMAN RYAN: But, you know, I think the
10 take-away part for me is that there are two issues
11 here. There's not just one. It's not just measuring
12 and verifying burnup. It's making sure that you are
13 actually measuring whatever you are going to measure,
14 if you measure it at all, on the right fuel assembly
15 that you are going to put into the storage unit. So
16 there's a mis-load question as well as the burnup
17 question.

18 MR. LORSON: Right.

19 CHAIRMAN RYAN: Okay.

20 MR. RAHIMI: So we might call it loading
21 verification as opposed to burnup verification.

22 CHAIRMAN RYAN: Yes. Right. Or both.
23 Loading and burnup verification. Why not?

24 MEMBER ARMIJO: I am getting the
25 impression from the conversation that if you could be

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1 certain that you knew which assembly that you had the
2 right assembly, you would have far less concern about
3 getting -- allowing a burnup credit even if you threw
4 some margin on it , you know, and say well, you think
5 it is 60,000, we'll give you credit for 40,000 or
6 something.

7 CHAIRMAN RYAN: Right.

8 MR. PEARSON: This is Jim Pearson. Could
9 I add just a couple of things here?

10 CHAIRMAN RYAN: Sure.

11 MR. PEARSON: And maybe Dennis can speak
12 to this if he needs to when I'm finished.

13 We started down this road some years ago
14 with the cask-drop HRA. And I know that two issues
15 creep into this. And one is fatigue of the handler
16 and also the other one is complacency.

17 And those are two things that are really
18 hard to eliminate because each of us is different for
19 one particular reason. And I know that those two
20 items would be -- would enter into this assurance
21 area.

22 MEMBER ARMIJO: Well, you know, I think
23 that's where you go to machines to do that instead of
24 your eyeballs, you know. A character reader that
25 compares what is supposed to be there with what is

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1 being seen under the periscope in the pool.

2 And if it doesn't match, you've got a
3 potential error. And it isn't some guy straining his
4 eyes at three o'clock in the morning to make sure that
5 he knows that assembly he is moving.

6 But I think that is a technology problem
7 that is really mechanical. And not physics.

8 MR. LORSON: And I think, you know, as we
9 complete the research and develop the ISG, we'll be
10 able to answer some of those questions a little
11 better.

12 MEMBER ARMIJO: Well, the burden on the
13 vendors to come up -- if they know that is the
14 problem, to come up with a solution that the staff can
15 have confidence is reliable.

16 CHAIRMAN RYAN: Okay. Thanks. That was a
17 good discussion.

18 Anything else?

19 MR. PARKHILL: Well, I'm ready for a
20 summary of why we're here.

21 MEMBER ARMIJO: Can I just raise one more
22 question as long as I've got the experts here? There
23 was somewhere in the commentary about the allowance of
24 convection -- cooling by convection outside of the
25 canister but not within. Is that -- did I misread

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1 that? Or misunderstand that you allow thermal
2 convection once it is in the over-pack and sitting
3 out? But you don't allow it within the canister? Or
4 did I misunderstand that?

5 MR. SOLIS: Yes. Actually, yes, they take
6 credit for both, internal and external.

7 MEMBER ARMIJO: Okay.

8 MR. SOLIS: But there was -- the SRP was
9 confusing.

10 MEMBER ARMIJO: Okay. Okay. Because I
11 was wondering how you can turn convection off inside a
12 vertical --

13 MR. PARKHILL: Earlier designs did not
14 design for it. So they didn't have enough, you know,
15 space plenums to allow it to happen.

16 MEMBER ARMIJO: Oh, you're right.

17 MR. PARKHILL: Yes, so --

18 MR. SOLIS: But they were not using the
19 correct tools, analytical tools.

20 MEMBER ARMIJO: Okay. But if they have
21 the correct analytical tools, they can use that?

22 MR. SOLIS: Yes.

23 MEMBER ARMIJO: Okay.

24 MR. PARKHILL: So what have we been doing
25 to this 13-year-old standard review plan that has been

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1 in use? We've incorporated roughly 25 ISGs. We've
2 updated it to reflect the current practices that are
3 in place. We've added a new materials chapter, which
4 isn't really new. It's just consolidating the
5 materials review in one place.

6 We've prioritized the review procedures
7 sections of each chapter to aid in the specific
8 reviewer's ease in looking at what is important or
9 more important versus less important. And we've
10 resolved a bunch of industry comments, a large
11 percentage of which we agreed with.

12 And we think we improved the overall
13 safety focus of our review process. And we're hoping
14 that we'll still go forward here in the main Committee
15 on May 6th. We looking for issuance of this guidance
16 in June as Revision 1. And we're continuing to work
17 on the sister document for storage facilities.

18 CHAIRMAN RYAN: Great. See you on May
19 6th.

20 MR. PARKHILL: Are you supposed to give us
21 some feedback now?

22 CHAIRMAN RYAN: Well, I thought the last
23 half hour covered that pretty well.

24 (Laughter.)

25 CHAIRMAN RYAN: Well, let me ask if there

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1 are any comments.

2 Jack?

3 MEMBER SIEBER: No, expect to say that I
4 think the staff did a great job. And I think you have
5 a good standard review plan now. And I have no
6 comments that would require any significant change to
7 the document.

8 MR. PARKHILL: Great. Thank you.

9 CHAIRMAN RYAN: Sam?

10 MEMBER ARMIJO: I agree with Jack. I
11 think it is something that needed to be done for a
12 long time. I think it puts everything that an
13 applicant really needs to know, not just the staff
14 but, you know, an applicant, of how to deal with these
15 issues.

16 And I think it is a good job. You know I
17 have some quibbles about -- I'd sure like to see some
18 assurance like a surveillance that says that they're
19 still reading those casks even though it's a low
20 probability that a big leak hasn't occurred. But it
21 would be so easy to assure it with periodic
22 surveillance. But that's sort of a quibble.

23 CHAIRMAN RYAN: And, again, I want to
24 thank you all for a great presentation today. It was
25 very responsive to our earlier meeting. And you

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1 addressed the number of points we had raised
2 previously in our first preliminary Subcommittee
3 meeting. So I appreciate that.

4 And, you know, other than this one last
5 little thing that you probably will think about
6 between now and May 6th some more and at least
7 articulate, you know, what the issues are that you are
8 putting forward, maybe either address them in some way
9 or lay them out clearly in this version of the SRP,
10 that would be a welcome discussion for the May 6th
11 meeting.

12 But I think we're -- I agree with my
13 colleagues. It is a very thorough and well done
14 standard review plan. So great update.

15 MR. PARKHILL: Now we're still scheduled
16 for one hour, which means a half-an-hour presentation
17 on our part, right?

18 CHAIRMAN RYAN: Yes.

19 MR. PARKHILL: Okay. So that will factor
20 into what we can present.

21 CHAIRMAN RYAN: May is jam-packed.

22 MR. PARKHILL: Okay.

23 CHAIRMAN RYAN: I will take that as an
24 appreciation for the fact we've worked over a lot of
25 issues that you can cover in the full Committee

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1 meeting as having been addressed with the Subcommittee
2 and so forth.

3 MEMBER SIEBER: And you can have
4 confidence in our opinion because neither Sam nor I
5 have ever made a mistake.

6 (Laughter.)

7 MEMBER ARMIJO: Jack has made several. I
8 haven't. Just to correct the record.

9 CHAIRMAN RYAN: Anyway. Thank you very
10 much. Any other comments, gentlemen?

11 MR. LORSON: Thank you. I think the
12 comments and the discussion have been very productive.
13 And we've taken them back and it has helped us make
14 the product better, which I think is in our common
15 interest. So we appreciate it.

16 CHAIRMAN RYAN: So with that summation of
17 great work, if there's no objection, we'll adjourn the
18 Subcommittee meeting.

19 (Whereupon, the above-entitled Subcommittee on
20 Radiation Protection and Nuclear Materials
21 was concluded at 11:43 a.m.)
22

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Updating the Standard Review Plan for Dry Storage Systems (NUREG-1536)

**Briefing for the ACRS Subcommittee of Radiation
Protection & Nuclear Materials**

**Division of Spent Fuel Storage and Transportation
Office Of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission**

- April 21, 2010 -

Opening Remarks

**Raymond Lorson, Deputy Director
Meraj Rahimi, Acting TCB Branch Chief
Technical Review Directorate
Division of Spent Fuel Storage and Transportation
(SFST)**

February 17, 2010 ACRS Briefing

- Revision to NUREG-1536, Jan 1997
- Dry Cask Storage Background
 - Division of Spent Fuel Storage and Transportation
 - Typical Dry Cask Storage Operations
 - Regulatory Basis and Design Basis
- Std. Review Plan (SRP) Update Project
 - Overall Project Approach
 - Prioritization Method
 - Key Revisions to SRP per Chapter
 - Key Stakeholder Comments per Chapter
- Changed SRP based on ACRS input
 - Replaced “Risk Informed” with Prioritized
 - Identified Polymeric Neutron Shielding Materials as Important-To-Safety

Purpose

- Continue briefing on the update to the standard review plan (SRP) for dry storage systems
 - Discuss carry over items from prior ACRS briefing (2-17-10)
 - Public Comments (only industry submitted)
- Identify areas of interest for future interactions with ACRS on the final SRP

Today's Presentation

- Items from Feb 17, 2010, Briefing
 - Prioritization Methodology (Dennis Damon/Ron Parkhill)
 - Radiation Protection (Elizabeth Thompson)
 - Spent Fuel Oxidation (Robert Einziger)
 - Damaged Fuel (Robert Einziger)
 - Interim Staff Guidance (ISG) 25 (Luis Cruz)
 - Other Issues (Ron Parkhill)
- Public Comments
 - Key Stakeholder Comments (SFST Staff)

Prioritization Methodology

Dennis Damon,

Sr. Level Advisor for Risk Assessment, FCSS

Ron Parkhill, Sr. Mechanical Engineer, SFST

Prioritization Methodology

- focuses staff resources

- Focuses staff resources by assigning **high, medium** or **low** to items in the Review Procedures
- Standard Review Plan Chapter Structure
 - Review Objective
 - Areas of Review
 - Regulatory Requirements
 - Acceptance Criteria
 - Review Procedures (**Prioritized**)
 - Evaluation Findings

Prioritization Methodology

<p>(1) Likelihood that requirement will not be met</p>	<p>VH=4, likely to occur, $P > .5$ H=3, Probably will occur, $0.1 < P < 0.5$ M=2, May occur, $0.03 < P < 0.1$ L=1, Unlikely to occur, $0.01 < P < 0.03$ VL=0, Occurrence improbable $P < 0.01$</p>
<p>(2) Likelihood that staff review will find the discrepancy</p>	<p>Same as (1)</p>
<p>(3) Risk if requirement not met</p>	<p>H=3, Likely to occur or catastrophic consequences, $>10^{-3}/\text{yr}$ or 25 rem to worker or 1 rem to public M=2, may occur or moderate consequences, $<10^{-3}/\text{yr}$ but $>10^{-5}/\text{yr}$ or 5-25 rem to worker or 0.1-1 rem to public L=1, Occurrence improbable or marginal consequences, $< 10^{-5}/\text{yr}$ or less than 10CFR 20 dose limits for workers & public</p>
<p>(4) Add scores from (1), (2) & (3) to get combined Risk score</p>	<p>High is 9 to 11 Medium is 6 to 8 Low is 1 to 5</p>

Prioritization Methodology (Cont'd.)

<p>(5) Determine Defense in Depth- a review procedure impacts DinD if it provides a back up to the first line of defense (e.g. confinement is back up to cladding integrity)</p>	<p>If failure to perform a review procedure could impact DinD (assuming front line safety measure has failed) and has</p> <ul style="list-style-type: none">-a low, medium or high likelihood and/or consequence, then the item should be a low, medium or high, respectively-Same as (3) for low, medium or high <p>Note most SRP review procedure items don't have DinD</p>
<p>(6) Determine which controls (or is more important) DinD (Step 5) or Risk (Step 4)</p>	<p>Assign controlling rating from DinD or Risk</p>

Related Subcommittee Comments from April 17th briefing

- Uncertainties in PRA not addressed
- Question #1 devalues places where the applicant has made mistakes
- Question #2 when low, should we look to see if we are reviewing the right things?
- Question #3 isn't weighted equally as two previous questions.

Why no High Priority Items in Chapters 11 & 12?

- Medium priority means normal staff Level of Effort
- Radiation Protection Chapter 11
 - Staff assures that the design can be used in a manner consistent with 10CFR Part 20
 - Licensee implements radiation protection program with regional inspection oversight
- Accident Analyses Chapter 12
 - ANSI/ANS 57.9-92 describes specific events
 - Review procedures address
 - Cause of event
 - Detection of event
 - Summary of event consequences & regulatory compliance
 - Corrective course of action

Summary of Prioritization Results

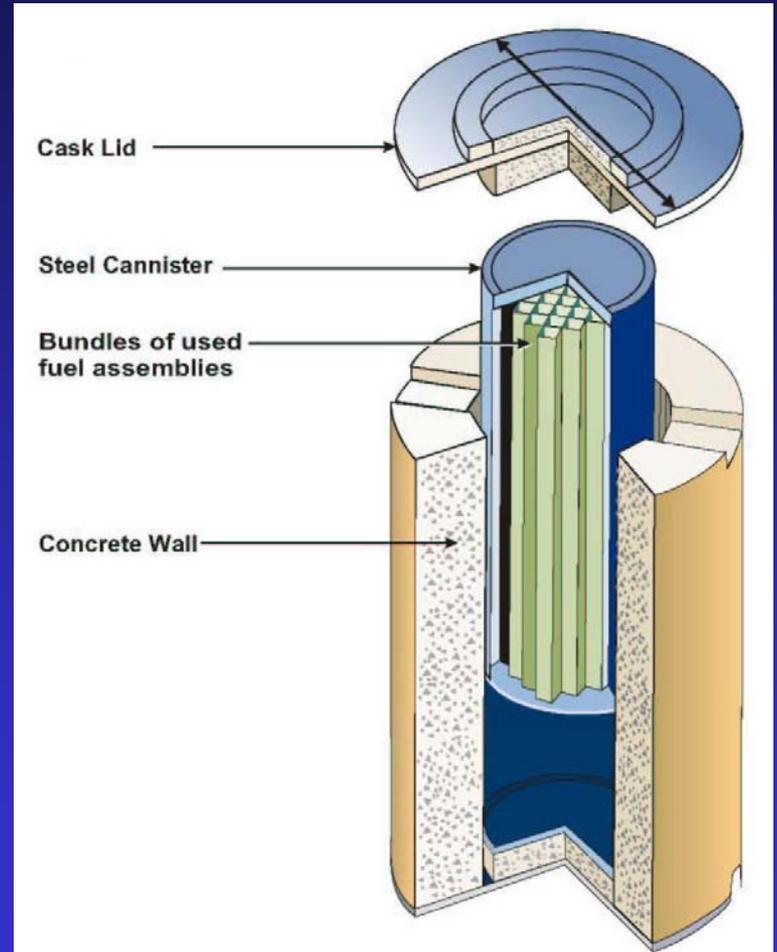
Chapter	HIGH	MEDIUM	LOW	Total
1) General Info	----	4	----	4
2) Principle Design Criteria	----	4	1	5
3) Structural	6	13	7	26
4) Thermal	6	7	5	18
5) Confinement	----	5	2	7
6) Shielding	5	3	----	8
7) Criticality	11	3	1	15
8) Materials	7	12	8	27
9) Operating Procedures	2	5	4	11
10) Acceptance tests and Maintenance Program	5	3	7	15
11) Radiation Protection	----	4	----	4
12) Accident Analyses	----	1	----	1
13) Technical Specifications and Operational Controls & Limits	1	----	----	1
14) Quality Assurance	1	----	----	1
TOTALS	44	64	35	143

Radiation Protection in Dry Storage System Licensing and Operations

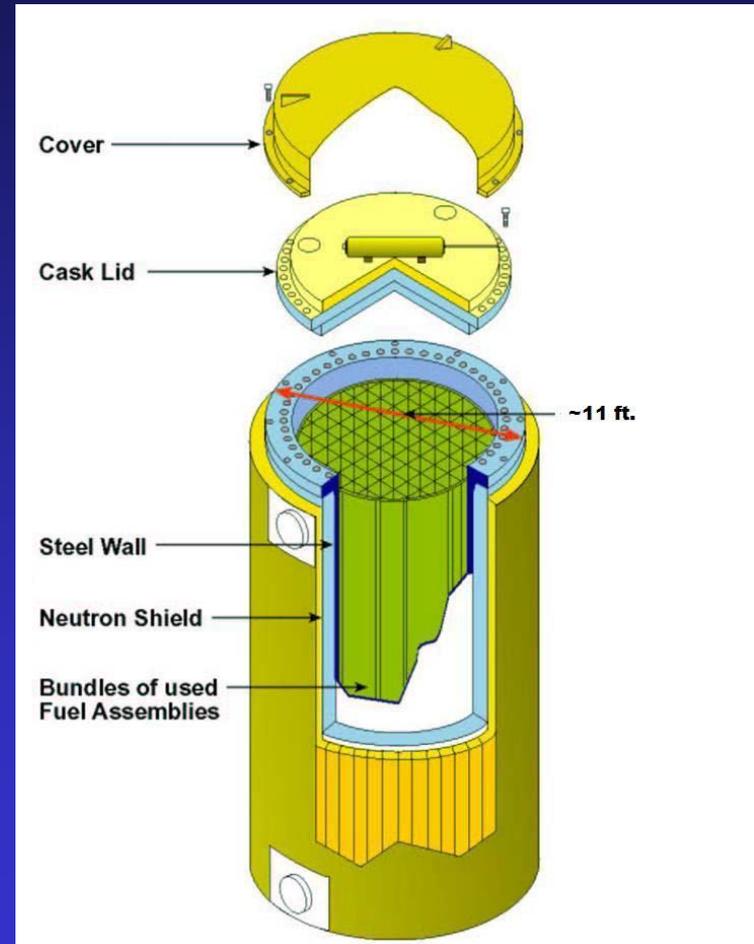
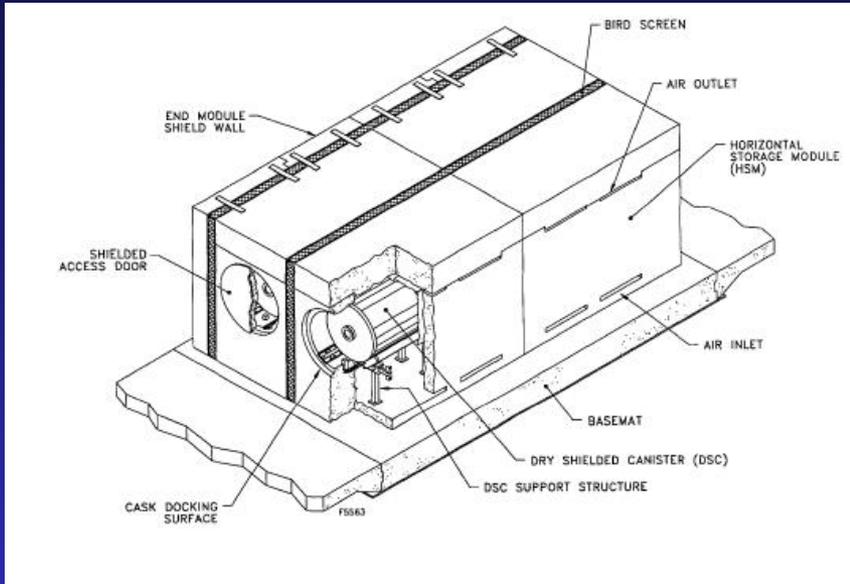
**Elizabeth Thompson, CHP
Senior Health Physicist, SFST**

General License Storage System

- Key radiation protection aspects of the design are reviewed
 - Shielding features
 - Source terms
 - Generic procedures
 - Dose assessments
 - Accident evaluations

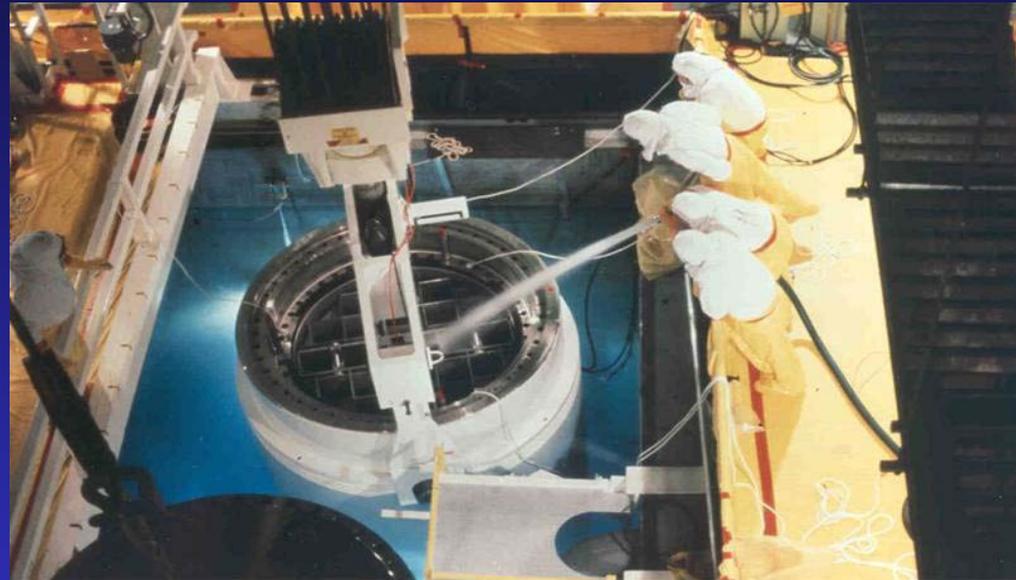


Design Parameters

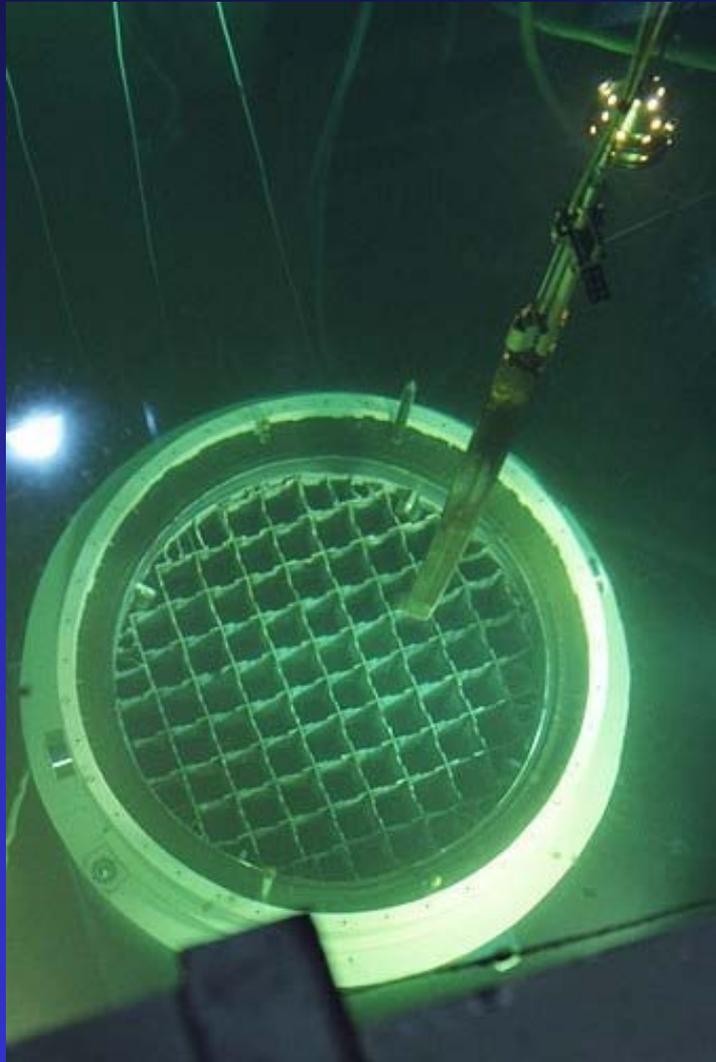


Procedures

- Safety Analysis Report (SAR) includes high-level generic procedures
 - Consistent with As-Low-As-Is-Reasonably-Achievable (ALARA) principles
 - Reviewed by SFST staff during licensing process
- Specific operating procedures
 - Developed at each site
 - Consistent with SAR
 - Consistent with 10 CFR 20
 - Inspected by NRC regional inspectors



Operations



Load fuel in cask in pool

- Conducted under site's radiation protection program
- Dry run inspected by regional inspectors, assisted by SFST staff as needed

Operations

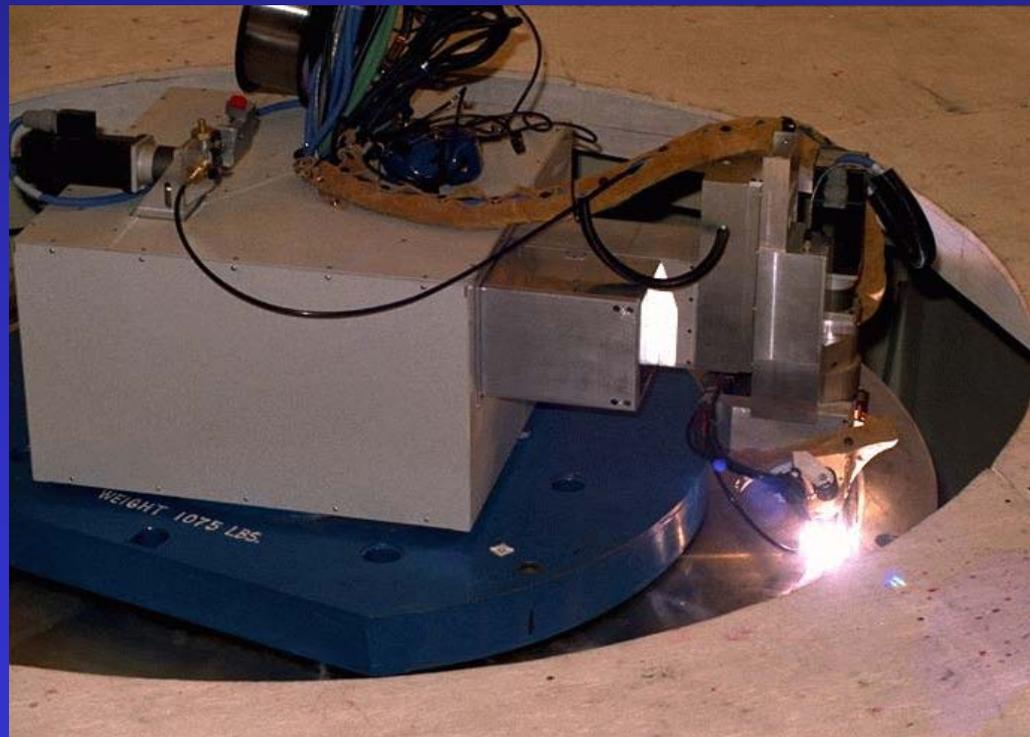


**Move loaded cask to decontamination
area & decontaminate cask**

Operations

- Decontaminate
- Close (weld or bolt) canister
- Dry
- Seal vent & drain ports

Welding of Canister Lid



Transfer of Canister into Overpack



Transfer of Overpack to ISFSI* Pad



* Independent Spent Fuel Storage Installation

Storage Cask Array on ISFSI Pad



Transfer of Canister into Module



Horizontal Module Cask Array



Fuel Oxidation & Damaged Fuel

Dr. Robert Einziger,
Sr. Materials Engineer, SFST

Fuel oxidation

- Breached fuel in air environment can oxidize rapidly at temperatures above 250 C.
- Due to 30% expansion upon oxidation of UO_2 to U_3O_8 cladding can open allowing release of grain size particulates
- To date no cask has been licensed for storage of fuel in an oxidizing atmosphere.
- ISG-22 “Fuel Oxidation” suggests applicants demonstrate fuel oxidation won’t occur by:
 - Backfilling with inert environment when draining cask for welding, or
 - Demonstrating no cladding breaches at an elevation above the drained volume, or
 - Keeping temperature of the fuel below that recommended in the ISG to prevent oxidation

Damaged fuel

- Issue addressed in ISG-1 Rev 3
- IAEA Nuclear Energy Series, NF-T-3.6, Management of Damaged Fuel, June 2009
- Damaged fuel defined as:
 - Any fuel that can not meet it's regulatory or functional requirements, or
 - Fuel assemblies with no rods having breaches greater than pinholes or hairline cracks and being able to be handled by normal means
- Various methods to handle damaged fuel
 - Remediation
 - Canning
 - Analytic determination that the fuel is still functional

ISG-25

Luis Cruz,
Thermal Engineer, SFST

ISG 25- Pressure and Helium Leakage Testing of the Confinement Boundary of Spent Fuel Dry Storage Systems

- ASME Pressure Test
 - Welded Canisters
 - Typically performed in fabrication shop for canister shell
 - If NOT Performed in fabrication shop, will accept shop helium leak rate test as meeting pressure test acceptance criteria since most canister welds are inaccessible during field pressure test
 - Closure weld pressure test done in field
 - Bolted Casks
 - Performed in fabrication shop
- Helium Leak Rate Test
 - Performed on entire confinement boundary (except as permitted by ISG-18 on final closure weld)
 - Confinement boundary typically tested in fabrication shop
 - Vent and drain port covers tested in field

Other Issues From Previous ACRS Briefing

Ron Parkhill,
Sr. Mechanical Engineer, SFST

Linkage Between Chapters

- Figure X.1 in each chapter provides overview and discipline and topic interfaces
- Review team organization
 - General Description (PM + all disciplines)
 - Principal Design Criteria (PM + all disciplines)
 - Structural (reviewer + interfaces)
 - Thermal (reviewer + interfaces)
 - Confinement (reviewer + interfaces)
 - Shielding (reviewer + interfaces)
 - Criticality (reviewer + interfaces)
 - Materials (reviewer + interfaces)
 - Operating Procedures, Acceptance Tests, & Maintenance (PM + all disciplines)
 - Radiation Protection (reviewer + interfaces)
 - Accident Analyses (PM + all disciplines)
 - CoC & Technical Specifications (PM + all disciplines)
 - Quality Assurance (reviewer + interfaces)

How are regulations met?

- Each Chapter has a Table X.1
 - Defines areas of review vs applicable regulations
- 10 CFR 72.13 defines the regulations applicable to a general license or certificate of compliance holder

Public Comments

SFST Staff:

Ron Parkhill, Sr. Mechanical Engineer

Dr. David Tang, Sr. Structural Engineer

Dr. Jorge Solis, Sr. Thermal Engineer

Dr, Zhian Li, Sr. Criticality/Shielding Engineer

Michel Call, Nuclear Engineer

Public Comments

- Only received comments from industry (NEI 192 and NAC 30 - mostly duplicated)
- Dispositioned in Appendix D to SRP
- Staff agreement on over 60% of the comments
- In previous ACRS briefing, discussed the major comments on a chapter basis

Major Public Comments

- Technical Specifications content too arbitrary (NEI 1 & 18)
 - No Change, Diversity of cask designs, plus suggested vendor content of TS. Issue marked for discussion with NEI dry storage task force.
- Replace RG 1.60 because it is too seismically conservative and replace it with NUREG/CR 6728 & 6865 (NEI 46)
 - No Change, RG 1.60 provides general guidance for determining design response spectra

Major Public Comments (Cont'd)

- Structural analysis should allow the use of elastic-plastic and other non-linear analysis as permitted by Code (NEI 49)
 - No Change. Strain based criteria not recognized by ASME Code or other standards. However, applicant can propose to use it and the staff will consider on a case by case basis.
- Level of detail (time steps being sufficiently small) in computational modeling too detailed. (NEI 58)
 - No Change. Level of detail depends upon complexity of application

Major Public Comments (Cont'd)

- Release fractions should not be used for damaged fuel since no driving force (NAC 5426 & NEI 76)
 - No data to support recommendation. Some canisters are pressurized which would provide driving force, and from accident fuel fracture. Staff recommends leaktight for damaged fuel.

Major Public Comments (Cont'd)

- Delete dose rate limits from Technical Specifications (NEI 166)
 - No change- dose rates are measurable and are used to verify cask fabrication and operation
- Delete measurements to confirm assembly burnup values (NEI 162)
 - No change- current analytical methods calculate burnup, which is not separately and independently verified through measurement

Summary

- Incorporated several ISG's
- Updated to reflect current review practices
- Added new materials chapter
- Prioritized the review procedures
- Resolved public (industry) comments
- Improved safety focus of certification reviews

Path Forward

- Full Committee Briefing (May 6th)
- Issue Final SRP Revision 1 (June)
- Continue Work on SRP for Storage Facilities