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UNITED STATES OF AMERICA  
 NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

RESEARCH AND TEST REACTORS SUBCOMMITTEE

+ + + + +

WEDNESDAY, FEBRUARY 3, 2016

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear  
 Regulatory Commission, Two White Flint North, Room  
 T2B1, 11545 Rockville Pike, at 8:30 a.m., Dana A.  
 Powers, Chairman, presiding.

COMMITTEE MEMBERS:

DANA A. POWERS, Chairman

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR., Member

MICHAEL L. CORRADINI, Member

JOY REMPE, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

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## ACRS CONSULTANT:

WILLIAM SHACK

## DESIGNATED FEDERAL OFFICIAL:

QUYNH NGUYEN

## ALSO PRESENT:

ALEXANDER ADAMS, NRR

ROBERT BEALL, NRR

HOWARD BENOWITZ, OGC

TONY BOWERS, NRR

RICHARD CLEMENT, NRO

KEVIN FOLK, NRR

MIRELA GAVRILAS, NRR

ELIZABETH GORMSEN, ICF

DUANE HARDESTY, NRR

JERRY JENKINS, TRTR\*

MARVIN LEWIS, Public Participant\*

KOSMAS LOIS, NRR

MICHAEL MORLANG, NRR

\*Present via telephone

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

8:30 a.m.

1  
2  
3 CHAIRMAN POWERS: The meeting will now  
4 come to order, Mr. Brown, whether you're finished  
5 or not. This is a meeting of the Research and Test  
6 Reactor Subcommittee and Advisory Committee on  
7 Reactor Safeguards.

8 I'm Dana Powers, Chairman of the  
9 Subcommittee. ACRS members in attendance today are  
10 -- and I said only Mr. Look Around is here, but in  
11 fact we have the esteemed Dr. Joy Rempe, noted  
12 authority on reactors and reactor safety, and world  
13 traveler.

14 (Laughter)

15 CHAIRMAN POWERS: We have Mr. Brown,  
16 prestigious member of the technical community with  
17 expertise in digital I&C. We have the Chairman of  
18 the ACRS, Dennis Bley, who has graced us with --  
19 actually just doesn't trust me chairing the  
20 Subcommittee so he's here overseeing to make sure I  
21 do it right. He has brought and marshaled with him  
22 the Vice Chairman of the ACRS, Dr. Michael  
23 Corradini, esteemed professor of the University of  
24 Wisconsin, a member of the National Academy of  
25 Engineering, noted abroad --

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1 MEMBER CORRADINI: Useless stuff.

2 CHAIRMAN POWERS: Useless stuff.

3 (Laughter)

4 CHAIRMAN POWERS: We have John Stetkar,  
5 former Chairman of the ACRS who will be  
6 particularly interested in risk analysis. And Mr.  
7 Gordon Skillman, noted authority on the operations  
8 and maintenance of nuclear reactors, especially  
9 specialized reactors. And we have Professor Ron  
10 Ballinger from the Massachusetts Institute of  
11 Technology, one of the nation's premier  
12 institutions.

13 (Off mic comment and laughter)

14 CHAIRMAN POWERS: Located, however, in  
15 the People's Republic of Cambridge.

16 MEMBER BALLINGER: From which half the  
17 people on this Committee have come from.

18 CHAIRMAN POWERS: Which half?

19 MEMBER BALLINGER: Stetkar.

20 CHAIRMAN POWERS: Okay, those people  
21 from the People's Republic of Cambridge have lost  
22 their voting privileges here. Mr. Quynh Nguyen is  
23 the Designated Federal Official for this meeting  
24 and he tries to keep me on track and probably fails  
25 miserably, isn't that right?

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1           As announced in the Federal Register on  
2           January 14th, 2016, and I'm sure everyone poured  
3           over that announcement in detail. The subject of  
4           today's briefing is the review of the proposed  
5           rulemaking regarding the streamlining of a  
6           non-power production or utilization facility  
7           license renewal process. The rules for  
8           participation in today's meeting were also  
9           announced in the Federal Register notice.

10           We have a telephone bridge line. We  
11           have tried to be inoculated for this but apparently  
12           vaccines failed to prevent one from having  
13           telephone bridge lines. The bridge line is there  
14           for the public and stakeholders to hear the  
15           deliberation. This line will not carry any signal  
16           from this end if we need to enter into a closed  
17           meeting. Also to minimize disturbance the line will  
18           be kept in a listen-in only mode until the end of  
19           the meeting when 10 minutes are allocated for  
20           public comments. At that time, any member of the  
21           public attending this meeting in person or through  
22           the bridge line can make statements or provide  
23           comments, if they desire. This is, indeed, a  
24           Subcommittee meeting and I would invite people in  
25           the audience if they have comments pertinent to the

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1 deliberations to feel free to get my attention and  
2 be recognized. We do have microphones distributed  
3 around the room.

4 The ground rule, of course, is that if  
5 you do make a comment you have to state your name  
6 clearly so that we get you on the public record  
7 because memories on the Committee are not too good  
8 and we sometimes have to go back to the record to  
9 remember what the hell was said.

10 The meeting is being transcribed and I  
11 request that participants in the meeting use the  
12 microphones located throughout this room when  
13 addressing the Subcommittee. Participants should  
14 first identify themselves and speak with sufficient  
15 clarity and volume so they can be readily heard. If  
16 you don't know it, please silence all cell phones.  
17 The consequences for failing to do that are  
18 draconian and horrific.

19 I think we are now -- I think I have  
20 drug this introduction out to the point that we are  
21 now ready to begin the meeting. So I'm going to ask  
22 Mirela if she'd like to make an opening comment.

23 MS. GAVRILAS: Thank you very much, Dr.  
24 Powers. I'm Mirela Gavrilas. I'm the Deputy for  
25 Research and Test Reactors in the Division of

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1 Policy and Rulemaking in NRR and would like to set  
2 the context for what we're going to discuss today.

3 We had the benefit of interactions with  
4 Dr. Powers to lay out our presentation and you're  
5 going to see two things today. We'll devote most of  
6 the morning to hearing about the technology behind  
7 RTRs and the afternoon we'll get into the specifics  
8 of the rulemaking.

9 In terms of general background, the  
10 Atomic Energy Act singled out the research and test  
11 reactors for minimal regulation, so basically we  
12 acknowledged that the intent was for us to create  
13 as little of a regulatory burden as possible on our  
14 licensees in regulating them. And we think that  
15 this proposed rule is consistent with that tasking.

16 In terms of risk profile for research  
17 and test reactors they're unique. When we think  
18 risk in general we think about consequences to the  
19 public. As you'll see in the presentation this  
20 morning, much of the thinking that goes into  
21 protecting and provisioning RTRs for safety pertain  
22 to the workers because the main risk comes from the  
23 experiments that can be conducted there, and that's  
24 how the safety features are set up, and hence the  
25 regulatory framework.

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1           One more important remark. I'm going to  
2 get into the nine aspects of the rulemaking.  
3 There's nine things that we're proposing to do. One  
4 was, as you all know we're going -- the Agency is  
5 going through a re-baselining effort so we're  
6 basically trying to shed those activities that have  
7 little contribution to our mission. And one of the  
8 things that was proposed was this rulemaking was  
9 proposed for shedding because it's a medium  
10 priority rulemaking because of the relatively low  
11 safety significance of RTR. However, the management  
12 of the Agency looked at it and realized that this  
13 rule is actually an efficiency, so in the name of  
14 creating efficiency this rulemaking was preserved  
15 because it does create, as you'll see from the  
16 regulatory analysis part, it does create  
17 efficiencies both for us and most especially for  
18 our licensees.

19           So there are nine aspects. There's no  
20 ornaments on this Christmas tree. The rulemaking is  
21 very -- is laid out to accomplish only that what we  
22 need to accomplish, and there are nine aspects to  
23 it. The first one is to create a definition for  
24 non-power production or utilization facility. The  
25 second one is to eliminate license terms for

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1 facilities other than test reactors of which  
2 there's one, to define license renewal under 10 CFR  
3 50.22, to require all licenses to submit routine  
4 FSAR updates. RTRs are unique in regard to FSARs  
5 because unlike power reactors we don't have a  
6 regular required update to the FSAR and that can be  
7 problematic, so that's a problem that this rule is  
8 intending to address.

9 The next objective is to revise the  
10 current timely renewal provision because for RTRs  
11 they apply at the last minute, they're untimely  
12 with renewal, and that has traditionally caused  
13 significant problems to the Staff because we accept  
14 it rather than shutting them down. We accepted  
15 their applications, and in many cases that  
16 application needed significant revision, so you'll  
17 hear more about that I'm sure this morning.

18 Finally, we want to revise the accident  
19 dose criteria to 1 rem. We want to extend the  
20 applicability to 50.59 to RTRs regardless of  
21 decommissioning status, and we need to clarify  
22 meeting the provisions of 51.45 regarding the  
23 environmental report.

24 And finally, again consistent with the  
25 direction in which we're heading with power

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1 reactors we're aiming to remove the requirement for  
2 financial qualification.

3 So the gentlemen will introduce  
4 themselves but you have in front of you the people  
5 who were the core of this rulemaking, and with that  
6 I'm just going to turn it back to Dr. Powers.

7 CHAIRMAN POWERS: Thank you. Do any of  
8 the Members on the Committee want to have -- pose  
9 opening questions in light of that introduction?

10 MEMBER REMPE: Sure.

11 CHAIRMAN POWERS: Dr. Rempe.

12 MEMBER REMPE: Yes, okay. I'm familiar,  
13 not as much as Professor Ballinger but with the MIT  
14 reactor, and I'm not as familiar with the NIST  
15 reactor, but why is the NIST reactor separated --  
16 yes, it has a higher power level but its mission to  
17 do testing is similar to the MIT reactor. And why  
18 is that one separated out other than it's a federal  
19 facility versus university or the higher power  
20 level?

21 MS. GAVRILAS: So I will answer a little  
22 bit, and then I'm going to turn it over to Al. But  
23 basically its not our sister regulation. The  
24 regulation sets the threshold for what's going to  
25 be a test reactor, and actually indeed for NIST

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1 it's based on the power level. They exceeded the  
2 threshold in the regulation that demarcates  
3 research reactors from test reactors, but there's  
4 other provisions, and Al will get into it. For  
5 example, you could have a large reactivity  
6 insertion because there's experimental work of a  
7 certain diameter that passes into test reactor, so  
8 -- and again, Al will talk more about it. It  
9 doesn't have to do with mission but the regulations  
10 are very specific what the thresholds are.

11 MEMBER REMPE: Okay.

12 MS. GAVRILAS: We question the threshold  
13 and we can tell you that we pulled that string and  
14 we're not clear on the rationale behind the  
15 threshold, but that's the threshold.

16 MEMBER REMPE: Okay, thank you.

17 MR. ADAMS: Would you like to hear more  
18 about it now or later?

19 MS. GAVRILAS: It's up to you.

20 CHAIRMAN POWERS: If you're going to  
21 cover it later, I think it's probably worthwhile to  
22 cover it later.

23 MR. HARDESTY: This is Duane Hardesty  
24 from Research and Test Reactors. The one thing I  
25 will say is that we tried very hard from the get-go

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1 to include all of them because of the similarity in  
2 their mission and the fact that when we regulate  
3 them they do have low consequence, but we were  
4 stymied by the regulations and how they classify  
5 testing facilities is what ended up happening; all  
6 the additional things that are required for NIST  
7 that aren't required for the other Class 104s.

8 MEMBER CORRADINI: Say that last part  
9 again.

10 MR. HARDESTY: The things that are  
11 required for NIST like meeting before you for  
12 license renewal, for mandatory hearings and things  
13 that are required of a testing facility just like  
14 they are for a Class 103 nuclear power reactor.  
15 Those stymied us from including them in this  
16 rulemaking in more ways than one.

17 MEMBER CORRADINI: Okay.

18 MR. ADAMS: I guess since Duane's  
19 talking about it, so back in the late '50s, you  
20 know, a threshold was determined where the  
21 regulatory process would become more rigorous, and  
22 you can assume that that was based on safety  
23 significance. And there's two ways to become a test  
24 reactor; one is pure power level, above 10  
25 megawatts you're a test reactor. You can also

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1 become a test reactor above 1 megawatt if you have  
2 certain features, and those features are liquid  
3 fuel loading. And I think we touched upon that when  
4 we discussed the SHINE technology with the  
5 Committee, in core fuel testing loop, you know,  
6 akin to what you would see at the advanced test  
7 reactor, or a experimental facility in the core of  
8 the reactor greater than 16 square inches in cross  
9 section. And we believe -- you know, if you think  
10 about it we can come up with the safety reasons for  
11 that, you know, liquid fueled reactors, you know,  
12 the gaseous fission products are -- create a  
13 challenge in handling them unlike say solid fuel  
14 loadings. The fuel -- the circulating fuel test  
15 loop, again you're testing fuel in a circulating  
16 loop which creates a greater probability for a  
17 release of fission products.

18 The 16 square inches, that's kind of an  
19 interesting one. We traced that back to either  
20 dropping an MTR fuel element in the middle of an  
21 operating core which would be a very large  
22 reactivity insertion or I guess if you have really  
23 good aim the standard 4 inch by 4 inch graphite  
24 log. So there -- you know, if you think there are  
25 technical reasons for drawing a line.

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1                   Now what we tried to do is figure out  
2 if that line makes sense given what we know about  
3 fission product behavior and technology today, and  
4 because we could not clearly understand why the  
5 decision was made in 1957, for example, I think at  
6 the first meeting of this Committee that regulation  
7 was one of the things that was discussed. We can  
8 find indications of paperwork that there was a  
9 discussion between the Committee and the AEC  
10 regulatory licensing staff but the details of those  
11 discussions are not -- were not in any of the  
12 paperwork.

13                   Given that, when you cross that  
14 threshold the regulatory process changes. Some  
15 examples Duane talked about that your application  
16 comes in front of the ACRS. You may recall that  
17 this Committee looked at and reviewed the license  
18 renewal for the NIST reactor, and this Committee  
19 was involved in the NIST reactor because it was a  
20 testing facility. Mandatory hearing in front of the  
21 Commission for your construction permits, again  
22 similar to SHINE. Environmental Impact Statement is  
23 required to be produced by NRC versus starting with  
24 an EA and seeing where that leads you.  
25 Another important thing is the siting requirements

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1 of 10 CFR Part 100 apply to test reactors and not  
2 research reactors. So the regulations flow from  
3 that greater risk. And, indeed, you talk about the  
4 function of the reactor, a number of years ago we  
5 did have a petition for rulemaking to change the  
6 definition of test reactor based just on function;  
7 that hey, I'm not testing anything. I'm doing the  
8 functions of a research reactor. Even though I'm  
9 above 10 megawatts why should I be a test reactor?  
10 And we at that point, you know, we pulled the  
11 string a lot to figure out what the definition was,  
12 and ultimately we ended up rejecting that petition  
13 for rulemaking because if it would have -- if we  
14 would have granted it the way it was requested you  
15 could have a 2,000 megawatt research reactor, that  
16 threshold where risk increases, where the licensing  
17 process should become more rigorous would be lost.  
18 Although, you know, as what you said, that given  
19 today's facilities, you know, the activities that  
20 NIST does is not what you would think of the  
21 traditional testing reactor activities akin to what  
22 the advanced test reactor does. So sort of tried to  
23 fill in some of the gaps for that.

24 MEMBER REMPE: Thank you.

25 MEMBER BROWN: What was your power level

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1 limit again? My brain hasn't awakened yet.

2 MR. ADAMS: It's 10 megawatts straight  
3 thermal power or 1 megawatt with additional design  
4 feature, the in core hole being liquid fuel loading  
5 or the circulating fuel test --

6 MEMBER BROWN: So if you're 10 megawatts  
7 exactly it's okay, but if you're 10,001 you're not.

8 MR. ADAMS: Yes. I mean, you know, you  
9 see that all over in the regulations that, you  
10 know, we draw lines all over the place where --

11 MEMBER BROWN: That's down to the line.  
12 The Missouri-Columbia one.

13 MR. ADAMS: Yes. Missouri is licensed at  
14 10 megawatts and they're a research reactor. If  
15 they would be licensed at 10.001 megawatts they'd  
16 be a test reactor.

17 MEMBER SKILLMAN: Dana, replying to  
18 your--

19 CHAIRMAN POWERS: Yes, Mr. Skillman?

20 MEMBER SKILLMAN: -- question. I'm  
21 curious in the discussions today to hear about  
22 licensing burden and streamlining. It seems that a  
23 lot of what we're going to talk about today is  
24 being based on the issue of streamlining, but it  
25 seems to me there's a soft undercurrent here of

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1 licensing burden. I recognize that all of nuclear  
2 power is an expensive undertaking and it's  
3 particularly difficult for small operators with  
4 limited funds to meet burdensome requirements. On  
5 the other hand, some of the requirements have  
6 served the public and the people at the reactors  
7 very, very well, and has protected them. It seems  
8 to me that there is an exercise here to make sure  
9 that under the guise of streamlining we fail to  
10 provide the protections that are necessary  
11 particularly for the students and the workers at  
12 the small facilities, and also for the public.

13 MR. ADAMS: And I think you have hit the  
14 nail on the head as to what I think the fundamental  
15 question that we need to discuss with this  
16 Committee, is that given all the processes we have  
17 in place that we'll talk about today, given what  
18 this rulemaking will add to those processes, then  
19 the question becomes does what we do now every 20  
20 years in some cases we haven't looked in 40 years,  
21 is that 20, 30, 40 year look that we call license  
22 renewal that we do today, does it significantly add  
23 to safety? And that's the question we asked  
24 ourselves over and over again. And again, given  
25 that the Atomic Energy Act doesn't require a term

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1 on these types of facilities, given minimum  
2 regulation, given our development of -- just in  
3 1996 was the first time we had format and content  
4 guidance and a standard review plan that we are now  
5 in the set of license renewals we're doing today,  
6 and we've been doing for the past several years  
7 that included NIST that we're applying our guidance  
8 to these license renewals where we have a good  
9 safety base to build upon, given that, and then  
10 given these changes does every 20 years, every 30  
11 years, every 40 years having this license renewal  
12 discussion, you know, enhance safety or contribute  
13 to safety? We've asked ourselves that question many  
14 times as we move forward on this and we've come to  
15 the conclusion that it really doesn't; that it  
16 basically consumes a lot of resources without a  
17 commensurate return on safety. So I think that's  
18 the basic question.

19 MEMBER SKILLMAN: I'll also be curious  
20 to hear how the proposed change in requirements  
21 affect daily scrutiny at these small facilities. A  
22 lesson from the Merchant Marine and a lesson from  
23 those who have gone to sea, and a lesson from all  
24 of us who have worked in the plants is that you  
25 must look carefully constantly. You don't walk away

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1 from one of these machines and ignore it for days,  
2 or weeks, or months. The devil is in the detail,  
3 and unless you're doing your rounds, unless you're  
4 keeping track it's possible that a very low  
5 threshold item grows into an item of such  
6 significance you now have a safety issues, where  
7 had you attended to it a week, or two weeks, or a  
8 month before that would have been of no  
9 consequence. So there is hiding within this  
10 streamlining the potential for a long time period  
11 of low vigilance and I believe that that's  
12 something that we need to hear about.

13 MR. ADAMS: And, you know, I think we  
14 need to have that conversation in that area, but  
15 that's another example where we did ask ourselves  
16 the question given the processes we have in place  
17 that are, you know, applied continuously what does,  
18 again showing up every 20, 30, 40 years and doing a  
19 license renewal add to that day to day vigilance,  
20 that day to day safety? And again, we came to the  
21 conclusion that it's not significant. So again, I  
22 think these are exactly the kind of things we want  
23 to talk about with the Committee.

24 CHAIRMAN POWERS: Any other comments  
25 that members of the Subcommittee would like to

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1 make? Hearing none, I will call on Mr. Hardesty to  
2 begin the presentation.

3 MR. HARDESTY: Okay. So we've gone over  
4 a few -- touched on a few things that I'm going to  
5 hopefully talk about in a little bit more detail.  
6 I'm here today before you guys for a new passionate  
7 project I've been involved with, and obviously it's  
8 a Navy project that I know most of you from, was  
9 something that was a great success and I come here  
10 to you today with equal vigor and belief in this  
11 project. I've been working on this since 2010. We  
12 took a little bit of hiatus for 18 months there to  
13 get the ford out, and we went through several  
14 iterations as Mirela alluded to about funding, not  
15 funding this rule. And, ultimately, this was deemed  
16 something that was the right way to go, and so with  
17 that I would like to start off by getting everyone  
18 up to speed on what the community of licensees that  
19 this rulemaking touches, will explain who they are,  
20 what they do, and we'll give you a little bit of  
21 categorization about how we view them, and why we  
22 think that they're -- essentially the risk profile  
23 will allow us to proceed with these non-expiring  
24 license, just like Mr. Skillman had mentioned. And  
25 then I'll turn over the presentation for a little

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1 bit deeper dive into the technical content, our  
2 technical aspects of the various types of reactors  
3 that we currently regulate. But the one thing I'm  
4 going to point out early on is this new name that  
5 we have, NPUF, for our facilities because  
6 everything you'll hear about will be in terms of  
7 NPUF, but regulatorily that doesn't exist. So I  
8 just want to caveat that, explain to everybody that  
9 term. But in general, the one thing that is  
10 important to know is that everything that exists  
11 now is categorized as a research or a testing  
12 facility, research reactor testing facility, and  
13 then of course we have the SHINE and Northwest  
14 Medical Isotope facilities, but I'll get into that  
15 as we go ahead with this.

16 So the regulatory authority for  
17 licensing both nuclear power reactors and our  
18 non-power facilities are contained in Section 101  
19 of the Atomic Energy Act of 1954, as amended, which  
20 I'll just simply refer to as the AEA or the Act  
21 from hereon out. All of the --

22 MEMBER BLEY: Excuse me a second.  
23 Richard, would you watch your paper on that  
24 microphone? Thank you.

25 MR. CLEMENT: Thank you.

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1 MR. HARDESTY: Okay. All of the power  
2 reactors and the non-power facilities --

3 MEMBER BROWN: Explain.

4 MR. HARDESTY: Pardon?

5 MEMBER BROWN: For the somewhat  
6 uninitiated since I'm not familiar with all the  
7 nuances of research vice test --

8 MR. HARDESTY: I will absolutely go over  
9 that.

10 MEMBER BROWN: You're going to discuss  
11 that during the --

12 MR. HARDESTY: Yes, sir.

13 MEMBER BROWN: Thank you.

14 MR. HARDESTY: I certainly will. So the  
15 framework I'm trying to establish right now is that  
16 we're all -- all of the facilities that are in Part  
17 50 or Part 52 licensing, Part 52 being specific to  
18 the power reactors, come from 103 and 104 of the  
19 Atomic Energy Act. However, most of our facilities,  
20 those research and test reactors are in the 104,  
21 and so that's what I'm going to go into the detail  
22 of.

23 The Section 103 facilities are the  
24 commercial licenses. Now this is where all the  
25 power reactors lie, but it also contains our

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1 commercial facilities; for example, SHINE will be  
2 licensed as a Class 103. And then the Section 104  
3 reactor is the research and testing facilities are  
4 classified under 104A and C of it.

5 Just to go into a little bit more of  
6 how those are divided up before we start  
7 concentrating only on the non-power facilities, I  
8 just wanted to point out some of the basic  
9 differences between a power versus a non-power  
10 facility. Obviously, the power reactors, their  
11 concentration is making electricity. They want the  
12 maximum possible heat and energy generation that  
13 they can have, very large core volumes, operating  
14 at maximum power density for long periods of time;  
15 whereas, the goal of a research facility, a  
16 non-power facility is to make radiation. They want  
17 to make neutrons, they want high flux in their beam  
18 traps, they want -- in their beam ports and their  
19 traps so that they can do experiments. They have  
20 very high irradiation flux positions so that they  
21 can get the highest fluence possible to do these  
22 experiments. And in contrast to a power reactor  
23 they want the lowest possible power fuel  
24 consumption and stored energy that they can have to  
25 accomplish that, so all of our facilities on the

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1 non-power side range from 5 watts to 20 megawatts,  
2 the 20 megawatt facility being the NIST, our  
3 testing facility; versus the power reactors which  
4 are all very high powered, greater than 1,000  
5 megawatts and much higher than that typically. And  
6 those facilities operate at high temperature, high  
7 pressure saturation conditions; whereas, the  
8 non-power facilities generally operate at  
9 atmospheric pressure and very low temperatures.  
10 They have passive simple safety systems because  
11 that's all they need; whereas, we know that the  
12 power reactors have very complex safety systems.

13 And then finally the contrast between  
14 having this low peaking factor, low leakage core  
15 with a very high stored energy on the power reactor  
16 side versus a very high leakage core by design so  
17 that they can get that -- feed those beam tubes  
18 with those neutrons and a high peaking factor in  
19 the flux trap for experiments, and a compact core  
20 design, very small design.

21 So with that, I'll go into the  
22 specifics about the 104 type facilities. Again,  
23 we'll get into it later mostly in the rule where  
24 the license renewal that we're proposing for the  
25 commercial facilities and NIST is no different than

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1 it is now. It's just clarified. But generally the  
2 -- or in general rather the non-expiring license  
3 applies to these research and medical therapy  
4 license, the Class 104(a) and 104(c). For  
5 completeness, I've also included the 104(b) which  
6 is the commercial demonstration reactors. They are  
7 considered power reactors, they're not considered  
8 research facilities under our licensing branch, so  
9 all of our facilities are either licensed as --  
10 well, actually they're all licensed as 104(c) for  
11 research and development, and one facility which is  
12 MIT also holds a Class 104(a) license for medical  
13 therapy.

14 MR. ADAMS: Can I step in for a second?  
15 When we say medical therapy we're not talking about  
16 the production of radioisotopes like we talked  
17 about for SHINE. It's -- medical therapy is the  
18 application of the reactor itself as the medical  
19 therapy device, boron neutron capture therapy in  
20 which neutrons from the reactor were used in  
21 conjunction with a boron-containing drug given to  
22 the patient to fission the boron at the cancer site  
23 within the body and apply the therapeutic results  
24 of that at that point. So it's a different type of  
25 medical therapy than the medical isotope production

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1 facilities that we are now actively pursuing for  
2 licenses. And for 104(b), the commercial -- those  
3 were the commercial power reactors, the  
4 demonstration power reactor project. If you look at  
5 a power reactor license and the license of the DPR  
6 license you'll see it's licensed under 104(c)  
7 versus a nuclear NPF license is a 103, so the early  
8 power reactors were considered partially research  
9 and development, and then there came a day I think  
10 in the 1970s where a decision was made that  
11 technology had matured to the point where it moved  
12 from licensing under 104(b) to 103. But none of the  
13 104(b) facilities are within the scope of what  
14 we're talking about.

15 MR. HARDESTY: And so that's essentially  
16 what this slide was to talk about, was that the  
17 104(a) are the medical therapy licenses, and these  
18 are excerpts straight out of the Act. The Class or  
19 Section 104(a) reactors are for medical therapy, as  
20 Al just described. Then the 104(c), there the  
21 Commission is directed to allow -- permit the most  
22 -- the highest conduct and widespread diverse  
23 research and development. And the two -- the common  
24 thread between both of them and why we're here  
25 before you today is that in each of those clauses

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1 the highlight of it is that the Commission is  
2 directed to impose the minimum amount of regulation  
3 consistent with their obligations, our obligations  
4 under this Act to promote the common defense,  
5 security, protect the health of the public while  
6 still allowing for this maximum medical therapy,  
7 and research and development. So we'll talk a  
8 little bit more about it, but we have a very  
9 different set of regulations that apply to the  
10 Class 104 facilities than they do at the 103  
11 facilities, a much smaller subset of those  
12 requirements all in keeping with the -- consistent  
13 with the Act. Did you have a question?

14 MEMBER CORRADINI: No.

15 MR. HARDESTY: Okay.

16 MEMBER CORRADINI: I have a lot of  
17 questions. I'll get to them.

18 MR. HARDESTY: So these slides are --

19 MEMBER CORRADINI: Maybe since you give  
20 it to me, and you don't have to go back but under  
21 Al's thing where it's 104(b) is not part of this,  
22 what are some historic examples of a 104(b)  
23 license? I don't know.

24 MR. ADAMS: 104(b) licenses were power  
25 reactors that were developed under the

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1 Demonstration Power Program.

2 MEMBER CORRADINI: Like Pathfinder,  
3 those sorts --

4 MR. ADAMS: Saxton.

5 MEMBER CORRADINI: Long, long ago.

6 MR. ADAMS: Right, and even reactors  
7 operating today. If you look at some of the older  
8 plants that are operating today, if you open up a  
9 power reactor license and, you know, like there's  
10 license numbers, if you see DPR-a number, DPR is  
11 Demonstration Power Reactor. If you go and dig  
12 through that license you'll see it was licensed  
13 under 104(b).

14 MEMBER CORRADINI: Then they get  
15 upgraded or moved to --

16 MR. ADAMS: They never -- it's still a  
17 104(b) license. And then there was a date where it  
18 was decided that it was no longer a demonstration  
19 technology, that power reactors were  
20 commercialized. The newer plants are under 103, and  
21 those are NPF licenses. There's no more 104(b)  
22 licenses. You know, for advanced reactors or  
23 something like that we want-- MEMBER

24 CORRADINI: But nobody -- of the new ones that we've  
25 been discussing about the this, and the that, and

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1 all these, historically this hasn't been used for  
2 decades.

3 MR. ADAMS: There hasn't been a 104(b)  
4 license since I think the '70s.

5 MEMBER CORRADINI: Okay.

6 MEMBER REMPE: Didn't you in another  
7 place tell us that that's no longer an option. And  
8 I thought that was why it was a different color.

9 MR. ADAMS: No.

10 MEMBER REMPE: On your slide earlier. Is  
11 it still a possible opportunity you go to the  
12 104(b) path?

13 MR. ADAMS: We've had some of those  
14 discussions given advanced reactor designs and  
15 things like that. There would probably need to be  
16 some rulemaking or some Congressional --

17 MEMBER REMPE: To go back and do that  
18 again, because I thought that that was no longer an  
19 option. You were at that other place, too.

20 MEMBER CORRADINI: Then I misremember. I  
21 guess I don't remember Joy's -- the reason I asked  
22 about the 104(b) was for the advanced reactors as  
23 you're aware of DOE is going through this planning  
24 study.

25 MR. ADAMS: Right, and we've had

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1 discussions --

2 MEMBER CORRADINI: The anticipation was,  
3 and my memory is wrong, Joy is maybe right, my  
4 thought was that they still have that option to go  
5 through the 104(b) path.

6 MR. ADAMS: You know, I don't know. I  
7 know we've had those discussions, but if you look  
8 in 50.21(b) which is where in 50 it talks about,  
9 you know, it talks about that. The activities under  
10 104(b) are very specific. You know, there's federal  
11 regulations around them.

12 MEMBER CORRADINI: That's a -- well, I  
13 don't want to take --

14 CHAIRMAN POWERS: Well, if it's not too  
15 long.

16 MEMBER CORRADINI: Yes, go ahead.

17 MR. BENOWITZ: Howard Benowitz with OGC.  
18 50.21(b)(1), a production or utilization facility,  
19 the construction of operation of which was licensed  
20 pursuant to Subsection 104(b) of the Act prior to  
21 December 19, 1970. That's what -- these are Class  
22 104 licensees.

23 MEMBER CORRADINI: So anything after  
24 1970 is not available to go through 104(b)? That's  
25 what I understand that to mean.

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1 MR. BENOWITZ: That's how we read it,  
2 too. I'm not an expert on that section.

3 MEMBER CORRADINI: Okay.

4 MR. BENOWITZ: But that's in line with  
5 what Al is saying, you have to use this --

6 MEMBER CORRADINI: Thank you.

7 MR. ADAMS: This is one of the  
8 discussions we're having because we -- the research  
9 reactor group has been involved in some of these  
10 discussions.

11 MEMBER CORRADINI: Well, there is  
12 actually a webinar occurring as we speak where this  
13 is part of the discussion today, which is not just  
14 what are these potential demonstration reactors,  
15 but also how do they get through the regulatory  
16 process.

17 MR. HARDESTY: Okay.

18 MEMBER CORRADINI: Thank you.

19 MR. HARDESTY: So, Mr. Brown, this is  
20 the definitions that I was alluding to.  
21 Specifically, currently in the regulations we  
22 define a non-power reactor which is a research or  
23 test reactor licensed under 50.21(c), and that  
24 corresponds to Class 104(c), or 50.22 which  
25 corresponds to Class 103, it's the reverse, of this

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1 part for research and development, and that comes  
2 out of 10 CFR 50.2.

3 And then a research reactor is defined  
4 as a nuclear reactor licensed by the Commission  
5 under the authority of Section 104(c) of the Act.  
6 And that, as I said before, comes under Section  
7 50.21(c) of the regulations. And then you see the  
8 exclusions there where the research reactor is  
9 defined not to go into the categorization of a  
10 testing facility, so it has to have a thermal power  
11 of 10 megawatts or less, and not be a testing  
12 facility as defined in Paragraph M of that same  
13 section. This comes from Part 170 -- yes, 170.3.

14 MEMBER BLEY: And from our recent  
15 experience with SHINE, your words "a nuclear  
16 reactor" somewhere else in the regulations means it  
17 produces power.

18 MR. HARDESTY: So what we did there is  
19 we didn't change the definitions for a research  
20 reactor and non-power reactor but because it's not  
21 a reactor, we added them, their docket number --

22 MEMBER BLEY: And it's not a reactor  
23 because it's zero power.

24 MR. HARDESTY: Right.

25 MR. ADAMS: Well, it's not -- in 10 CFR

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1 50 a reactor has that chain reaction undergoing, so  
2 if there's no chain reaction there's no reactor  
3 which is why we needed to do the rulemaking for  
4 SHINE to make it a utilization facility because it  
5 was subcritical.

6 MEMBER BLEY: It was -- criticality  
7 makes it a reactor --

8 MR. ADAMS: Yes, criticality --

9 (Simultaneous speech)

10 MR. ADAMS: Criticality makes your  
11 reactor.

12 MR. HARDESTY: Which is an excellent  
13 segue into two slides from now, but before I get  
14 into that let me talk about the testing facility.  
15 These are -- Al already mentioned all of these, but  
16 here they are in front of you, the testing  
17 facilities and nuclear reactor which is licensed  
18 under 50.21(c), so it's specifically only a Class  
19 104(c) reactor, has a thermal power of 10  
20 megawatts, greater than 10 megawatts or 1 megawatt  
21 with the special conditions that we talked about.

22 MEMBER CORRADINI: And these guys fall  
23 outside of the realm of our discussion.

24 MR. HARDESTY: For most of it, not all  
25 of it.

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1 MEMBER CORRADINI: Okay.

2 MR. HARDESTY: Because one of the things  
3 we're going to do is clarify license renewal to  
4 also streamline what those reactors have to do when  
5 they come in for license renewal.

6 MEMBER CORRADINI: Okay, thank you.

7 MEMBER REMPE: So -- okay, earlier when  
8 you said the 10 megawatt I thought oh, okay, MIT's  
9 reactor is less than 10 megawatt, but don't you  
10 have a circulating loop through the core where you  
11 can conduct fuel experiments, so how did you guys  
12 get away with this?

13 MEMBER BALLINGER: Lying and deceit, I  
14 don't know.

15 (Laughter)

16 CHAIRMAN POWERS: I wonder, Joy, if that  
17 is an issue pertinent to our discussion.

18 MEMBER REMPE: Well, I just --

19 MEMBER BALLINGER: No, there's a  
20 definition between a moveable and a non-moveable  
21 experiment, has to do with the amount of reactivity  
22 that you can insert all at once. This is a  
23 removable fixed -- a removable experiment that  
24 can't be -- yes, it's an insert that replaces a  
25 fuel element in the core. So it's a --

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1 MEMBER REMPE: Okay.

2 MEMBER BALLINGER: It's not a loop that  
3 comes in from outside and goes through the core and  
4 around. It's a self-contained replacement of a  
5 package.

6 MR. ADAMS: Yes, it's a --

7 MEMBER CORRADINI: It could be a rabbit,  
8 a whale in a -- just a big version of it.

9 MR. ADAMS: You notice the words are  
10 experimental facility, not experiment.

11 MR. HARDESTY: Right.

12 MEMBER CORRADINI: Right.

13 MEMBER REMPE: Okay.

14 MEMBER CORRADINI: And this is anchored  
15 into the core, so it can't be, what do you want to  
16 call it, accidentally moved which would change the  
17 reactivity of the core. So there's another  
18 definition that's there.

19 MEMBER REMPE: Okay. And I appreciate  
20 what Dana said, but it just seems like it would be  
21 nice, and I know you guys have felt that way, too,  
22 that you could have put them all in there together  
23 and included NIST.

24 MR. ADAMS: And I think that that's part  
25 of our discussion with this group today, that

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1 obviously if you -- at the end of the day if you  
2 want to give us an opinion on that, you know, we  
3 can take it back and think about it.

4 CHAIRMAN POWERS: It seems to me that  
5 the exploration of these definitions is useful  
6 only to the extent that we see opportunities for  
7 people misusing the definitions or using them  
8 contrary to what the intent is.

9 (Off mic comment)

10 CHAIRMAN POWERS: Yes. Otherwise, I  
11 think the definitions are pretty much what they  
12 are.

13 MR. ADAMS: Yes, and they were  
14 historically developed, they were developed at  
15 different points in time for different reasonings.  
16 For example, the definition of non-power reactor,  
17 that definition came into the regulations when we  
18 were developing 50.64, the regulation on HU to LU  
19 conversion. The research reactor definition you can  
20 see it's not in Part 50. You can dig through Part  
21 50 and you're not going to find research reactor  
22 defined. It's back in 170, which are the  
23 regulations for sending out bills, it's the fee  
24 regulation. So it's --

25 CHAIRMAN POWERS: That raises the

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1 question, should any -- if you're going to go  
2 through and revise regulations, should you do it  
3 wholesale and get these definitions all squared  
4 away so that there are not lots of exceptions and  
5 not lots of things that you can't understand why  
6 the definition is such as it is? I mean, suppose we  
7 were to recommend to the Full Committee that we  
8 write a letter to the Commission, say gee, this  
9 regulatory action that Staff is proposing is just a  
10 really good idea, except we think we ought to add  
11 to it, get these definitions all squared away and  
12 sound. How would you welcome that?

13 MR. HARDESTY: Actually, the rule  
14 started out when the regulatory basis where we were  
15 going to do a lot of that, and we had -- Mirela,  
16 she's gone now, but Mirela referred to ornaments,  
17 and that's what we -- we coined that term based on  
18 a lot of these definitions that we wanted to make  
19 consistent, and fix, and get all in the right place  
20 for the purposes of our rule. And we have done a  
21 little bit of that as you'll see on the next slide,  
22 making this new definition for non-power production  
23 or utilization facilities to kind of capture it.  
24 And if you think about a VEN diagram you have this  
25 class of testing facility, and you have these class

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1 of research reactors, and then you have the one  
2 that takes in both of those as non-power reactors,  
3 and then drawing around all of that is non-power  
4 production or utilization facilities, which brings  
5 in SHINE.

6 CHAIRMAN POWERS: Well, my concern is  
7 that -- alluded to by Professor Corradini, who I  
8 have all these people running around proposing all  
9 kinds of new and novel designs for power reactors,  
10 but they don't want to go through the 103 licensing  
11 process because they don't fit very well. So they  
12 come and say gee, I'll put it in in 104 and locate  
13 it on a military reservation, and do all kinds of  
14 interesting things, and so my concern is that they  
15 use this regulation which you never intended, never  
16 thought about using it that way, but they've got  
17 lawyers, you've got lawyers, everybody's got  
18 lawyers, and they can figure out a way to do that.  
19 And I don't want to do that. Same time I've got a  
20 Commission that's very concerned about what they  
21 call the rationale basis of the regulations, and  
22 I'm wondering suppose the Subcommittee recommended  
23 to the Full ACRS to write a letter that says fix  
24 all this. You know, and -- I mean, do you guys slit  
25 your veins and say oh, my God, or do you come back

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1 and say oh, my goodness, you've added 10 years to  
2 this process and we want to get it done in the next  
3 six months? I mean, how do you respond to that?

4 MR. HARDESTY: That's the thing is the  
5 timeline.

6 MR. ADAMS: And where these -- you know,  
7 the ornaments on the tree, we are looking at other  
8 opportunities to address some of this, but there  
9 are inconsistencies in the regulations, and if you  
10 go back a slide or two back to the definition of  
11 non-power reactor, if you look at non-power reactor  
12 we see -- we say it's licensed under 50.21(c) or  
13 50.22. If you look at the definition of research  
14 reactor, it only talks about 50.21(c). Well, again  
15 it's because this definition was actually created  
16 to address who pays fees and who doesn't, and at  
17 the time, you know, there was no commercial  
18 research reactors in existence, so this definition  
19 was written for what existed at the time. So there  
20 are inconsistencies that it would be good to fix,  
21 and frankly, we ran out of time given the timeline  
22 for this. And we didn't want to delay this rule  
23 given the budgetary situation within the NRC. You  
24 know, a window of opportunity has opened here and  
25 we wanted to get through that window before someone

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1 closed it on us, so the answer is yes, that you  
2 know, if you said that we should, you know, focus,  
3 that we should take a look at the various  
4 definitions and make sure they're consistent, and  
5 they harmonize, and they look forward to the  
6 future. You know, again, would we slit our wrists?  
7 No. And these are --

8 MEMBER CORRADINI: But would the window  
9 of opportunity close on you, too? That's -- the way  
10 you framed it is what I thought, and the way Dana  
11 asked the question was that if the window closes  
12 and you want to be comprehensive, but you've lost  
13 your opportunity, then --

14 mR. ADAMS: Right.

15 MEMBER CORRADINI: -- it sounds like  
16 you've made -- things aren't any better than they  
17 were.

18 MR. ADAMS: Right. And so we would have  
19 to look at do we do that here, or do we try to find  
20 another place to do it? And these discussions,  
21 again, you know, we're looking at advanced reactors  
22 but we have had a lot of internal discussions about  
23 103, 104, research reactor, test reactor, and how  
24 those would relate to someone coming in the door  
25 and say hey, you know, I have an advanced concept I

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1 want to test, and I want to build this. You know,  
2 where would you end up licensing it? So we've had  
3 those discussions about what our understanding is,  
4 what's the waterfront given the current  
5 definitions.

6 CHAIRMAN POWERS: Recognize that I can  
7 just imagine Mr. Bley sitting in front of the  
8 Commission in March saying that the Subcommittee  
9 has looked at this regulation and they said yes,  
10 and now you've overlaid an already confusing  
11 definition with another set of definitions. Why did  
12 you allow that to happen, Mr. Bley? And I don't  
13 think they would be very kind to you.

14 MEMBER BLEY: They never are, are they?

15 CHAIRMAN POWERS: To you they're always  
16 kind. To Mr. Brown on the other hand, they are  
17 openly abusive.

18 MEMBER CORRADINI: But all kidding  
19 aside, I think we need to get an impression from  
20 you all that -- because I agree with Dana. This  
21 would be the time to clean it up, but if the  
22 opportunity of the window to clean up any of this  
23 disappears because you want to be comprehensive we  
24 need to know that from you guys because we can't  
25 judge that.

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1 MR. ADAMS: Yes, I don't -- two things I  
2 don't want to do. I don't want to lose the window,  
3 and also I need to be, you know, consider the scope  
4 of what we're doing, that this was strictly a  
5 research reactor ruling. Believe me, a lot of folks  
6 came and said oh, here, here's a problem I've got,  
7 I'd like to fix. And that sort of leaked over into  
8 power reactor regulation, and we basically said no,  
9 go away. So the problem is if we're fixing these  
10 because of what we see in the future maybe advanced  
11 reactors and that area, I think that that should  
12 really be a discussion separate from this. For the  
13 purposes of regulating research and test reactors  
14 these definitions along with our NPUF definition we  
15 believe will work.

16 MR. BEALL: This is Rob Beall. I'm the  
17 Rulemaking PM for this activity. We do have a  
18 window of opportunity here to do this rulemaking,  
19 but as Mirela talked about in the beginning, this  
20 is a medium priority rulemaking. And with the  
21 Commission directions we've gotten lately on  
22 rulemaking, we wanted to keep this rulemaking  
23 moving along so we do have a certain time frame to  
24 get these regulations done with the resources the  
25 Commission has allotted us. So we would definitely

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1 have -- we'll definitely consider any  
2 recommendation that comes out of the Subcommittee,  
3 but we also have to consider --

4 CHAIRMAN POWERS: You'll get no  
5 recommendations from the Subcommittee.

6 MR. BEALL: Well, from the letter,  
7 excuse me.

8 CHAIRMAN POWERS: You will get -- a  
9 recommendation will come from the Full Committee,  
10 and I think I want to take you up on your offer.  
11 Let us focus on what you've got here now, and then  
12 once we've gotten through this let's meet again and  
13 say what would it take to do this more  
14 comprehensive work? Because I know the Commission  
15 is interested in this, that they have expressed to  
16 us, and I think they've even expressed to the EDO  
17 an interest in rationalizing the regulatory process  
18 so we don't have lots of inconsistencies and  
19 overlaps, and things like that. But let us put it  
20 on our to-do list to meet again in perhaps a more  
21 collegial format to understand what it takes to do  
22 that in this regard once we've gotten through this.  
23 I mean, I -- it won't be this year, but we might  
24 want to pencil it in on our 2017 calendars to say  
25 let's talk about this more. And let us as a

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1 Subcommittee think about saying to the -- I'm  
2 concerned that the ACRS -- I know that it's  
3 personality somewhat might get into its idea to say  
4 no, no, let's do comprehensive now instead of  
5 later, and I'd like to defer them and say no, we've  
6 got a window on a medium priority. Let's take  
7 advantage of what we can do now and not try to do  
8 something more comprehensive. Anyway, I'd ask the  
9 Subcommittee to think about that, and then I ask  
10 that we move on.

11 MEMBER BROWN: Can we move on after I  
12 make one observation for the uninitiated?

13 CHAIRMAN POWERS: Because we desperately  
14 need your input.

15 MEMBER BROWN: I'll work on that one. As  
16 I went through all the stuff that we were presented  
17 or given to to review I kept -- particularly after  
18 I looked at the table of the range of power levels  
19 and think these are nuclear reactors, they produce  
20 radiation. People get hurt if they're overexposed,  
21 health and safety, and all that other kind of  
22 stuff, and what I've experienced over the last  
23 eight years in the power reactor world stuff we've  
24 been reviewing. How in the world can we -- and here  
25 I see all these definitions are based on

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1 configurations and nuances of what may or may not  
2 be done with the reactor, not so much as why is it  
3 safe? When I finally got to the part on the  
4 environmental assessment, you actually had some  
5 valid technical information as to why it appeared  
6 okay; 27 of 31 units you talked about, if you lose  
7 all your cooling you're just fine, air cool. I  
8 mean, in other words, why take this little nuanced  
9 approach to saying what is a test versa what's a  
10 research? Why shouldn't they be more associated  
11 with look, if you can turn off all the stuff that's  
12 necessary to in the old mind set to keep it safe  
13 and nobody cares because it's not going to be a  
14 problem, there's a different way -- I'm just  
15 scrambling a little bit.

16 MR. ADAMS: And you see -- there's  
17 another number that's not in the regulations, but  
18 is within our internal processes and that's -- it  
19 is in the regulations, 2 megawatts. And, for  
20 example, in the -- in 73.60(f), the Sabotage Rule  
21 that we had the option to consider sabotage for  
22 facilities 2 megawatts and greater, so there's a 2  
23 megawatt number, and that sort of represents where  
24 aluminum clad plate fuel reactors in a loss of  
25 cooling accident if there's no ECCS probably are

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1 going to have some difficulty. So there are other  
2 safety thresholds, and that 2 megawatts you see in  
3 a couple of regulations, you see it in our  
4 inspection program, that's considered -- later in  
5 the slides you'll see it's a Class 1 reactor which  
6 has a more vigorous inspection program than the  
7 under 2 megawatt. So there are -- you know, there's  
8 a lot of ways to sort of chop up the world and  
9 present it. You know, this is what we have at the  
10 moment, but there are other, you know, break  
11 points. And, you know, and there's design features  
12 that make some designs more resistant to certain,  
13 you know, accident initiators and others, you know,  
14 TRIGA reactors, reactivity addition, for example  
15 the Pulstar reactor just loss of coolant.

16 MEMBER BROWN: Well, but you made an  
17 argument for those even when you talk about some of  
18 the other four because a couple of paragraphs later  
19 you talk about those that even though they had  
20 limited times when they could go like this, there  
21 was still plenty of relative time to go do such and  
22 such, and therefore you made the judgment that  
23 those still fell into the research reactor category  
24 and didn't require -- so allow like the elimination  
25 of all the licensing time, and re-licensing --

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1 MR. ADAMS: Again, you know, we asked  
2 ourselves that question. And we went through that  
3 to understand, you know, what the risks and hazards  
4 were. But given that we have a good, you know, we  
5 have a good license renewal at this point, we have  
6 a good licensing basis and a good staff SER that  
7 supports that licensing basis, what's the safety  
8 gain doing this all over again in 20, 30, 40 years?  
9 So that's the question we kept coming back to.

10 MEMBER BROWN: I'm not disagreeing with  
11 you. I'm just saying you made a rationale argument

12 -- MR. ADAMS: Yes.

13 MEMBER BROWN: -- for those that were  
14 outside the -- you don't -- you can walk away from  
15 it, ignore it for the next 60 years, and that's  
16 still okay.

17 MR. ADAMS: Right, and that's part of  
18 our basis along with all the things we talked about  
19 that, you know, in the scheme of things these  
20 facilities represent a lower level of risk to  
21 public health and safety say than high-power  
22 facilities. But the Staff realizes, and you'll see,  
23 we'll talk later on that if something is going to  
24 go wrong, and if it's going to have an impact, it's  
25 probably going to be internal to the facility

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1 versus external to the public health, you know, to  
2 members of the public.

3 MEMBER REMPE: One more quick comment  
4 I'd like to make based upon what Robert Beall and  
5 Dana said. You erroneously referred to meeting with  
6 us as the ACRS, and that error exists in the  
7 documentation that was issued, the draft letter  
8 from McCree, et cetera. Please correct those --  
9 today you met with the Subcommittee, and that  
10 occurs several times in the documentation we were  
11 provided.

12 MR. ADAMS: Okay.

13 MEMBER REMPE: Thank you. Sorry. Go  
14 ahead.

15 MEMBER SKILLMAN: I was going to build  
16 on Charlie's comment, but kind of take the  
17 contrarian point of view. I understand for these 31  
18 facilities the owners, particularly the  
19 universities and the folks who have the license  
20 would like to reduce as much as practical the  
21 burden. I understand that, and I understand there's  
22 incentive in the NRC to streamline the regulation  
23 because it reduces the burden inside this  
24 organization.

25 It wasn't so long ago I sent my two

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1 sons off to college. I would hate to be a parent  
2 sending my son or daughter off to college to these  
3 highly respected institutions that have these  
4 licenses and have my son or daughter injured, in  
5 all candor, because people were sleeping at the  
6 switch or gaming the data. I would not want my son  
7 or daughter to be injured because of complacency  
8 that was bred into the organization because in 2016  
9 folks said hey, school is out. We don't have to do  
10 this heavy duty reporting any more, we don't have  
11 to be as accountable as we previously had been on  
12 the material condition of these facilities, and now  
13 we have a young man or young woman who's been  
14 injured because of incompetence and because of  
15 complacency.

16 MR. ADAMS: Sure. And --

17 MEMBER SKILLMAN: Those two,  
18 incompetence and complacency, are the killers on  
19 this technology. If you're not on top of it, it'll  
20 bite you.

21 MR. ADAMS: And I'm going to argue that  
22 we believe that the changes we're making I think  
23 enhance safety because, for example, one of the  
24 things we're talking about is a requirement for  
25 these licensees to maintain their SAR. Right now

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1 they don't, there's no regulatory requirement for  
2 that. That, you know, literally as an NRC, you  
3 know, reviewer I see the full SAR when it comes in  
4 for license renewal, and some of the license  
5 renewals we're doing now were originally 40-year  
6 licenses. This is the first time, you know, the  
7 reviewers are doing those, this is the first time  
8 the Staff has seen this since, you know, since the  
9 1960s, or 20 years ago, that it's 1980s. So, you  
10 know, I agree with you, and given the other things  
11 we'll talk about, the reporting requirements and  
12 the tech specs, the inspection program, annual  
13 reports, the data we get from the licensee that  
14 along with the fact that now the licensees will  
15 maintain their licensing basis and give it to us,  
16 and we will look at that licensing basis, I think  
17 enhances knowledge transfer both within the  
18 licensee, within the Staff, and requires the  
19 knowledge to be maintained and kept current versus  
20 once every 20 years it's like oh, license renewal  
21 again. Well, we better get out the pen and, you  
22 know, do something with the SAR, or in some cases,  
23 you know, they take the SAR from 20 years ago and  
24 put a new cover letter in and mail it to us. So I  
25 understand what you're saying, and I think that

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1 these additional -- that the requirements that  
2 we're adding in in lieu of the periodic license  
3 renewal I think enhances safety by requiring  
4 continuous maintenance of documentation.

5 Now as a regulator we do things for a  
6 lot of reasons, and at the end of the day if a  
7 decision is made that despite, you know, the safety  
8 significance of this, if there's a -- you know, if  
9 we do this because of, you know, perception  
10 reasons, then that's the answer.

11 MEMBER SKILLMAN: That's a great answer,  
12 and for that I'm going to change the location of my  
13 tie clip.

14 MR. ADAMS: Thank you.

15 MEMBER SKILLMAN: I thought you would  
16 appreciate that.

17 MEMBER BALLINGER: I can't follow that.

18 (Laughter)

19 MEMBER BALLINGER: But more along the --  
20 I think along those lines, wasn't there recently  
21 one of these facilities cited for somebody  
22 literally being asleep at the switch and leaving  
23 the facility unattended, and it got a big fine?

24 MR. ADAMS: Well, the civil penalties at  
25 research reactors are relatively rare. They do

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1       happen. Later on we'll talk about violations that  
2       have occurred, you know, over the past several  
3       years. And they fall into some areas, you know,  
4       that we occasionally have an operator leave the  
5       control room and --

6               (Off mic comment)

7  
8               MR. ADAMS: Yes. You know, we see it,  
9       you know, every couple of years it happens, and we  
10      take appropriate actions. You know, that's the  
11      inspection and enforcement program, and those  
12      things are, you know, reported by the licensees.  
13      You know, there's a certain -- you know, when you  
14      give these folks a license to run a nuclear reactor  
15      there's a certain level of trust but verify, and we  
16      do that, we do verify, but there's a certain level  
17      of trust that, you know, when a problem occurs  
18      you're going to tell us about it. The other areas  
19      you'll see is, you know, this internal that we  
20      haven't had over-exposures but we've had instances  
21      where radiation protection has broken down and  
22      someone got greater exposure than ALARA would  
23      dictate. And those tend to be when you pull that  
24      string it's an individual basically not following  
25      the established program. But we'll talk about those

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1 things. But yes, I mean, there's -- it's -- I'm not  
2 going to sit here and say this is a community that  
3 has zero violations of requirements, you know, that  
4 we do run into issues and we track them, we look  
5 for trends, and if we see something that looks like  
6 it's developing throughout the community then we  
7 start, you know, talking to the community about it.  
8 So every year we meet, you know, with TRTR which is  
9 the organization of the Research Reactors at their  
10 annual meeting and one of the things we talk about  
11 is the performance over the past year, you know,  
12 from the inspection program and what's been  
13 reported in. We encourage the licensees to give  
14 presentations at these meetings about, you know,  
15 here's a problem I had, here's a problem I got  
16 into, here's how I got into it, here's the  
17 Corrective Actions I've taken. So just like, you  
18 know, any other violation that we send -- you know,  
19 we run it through the enforcement program and take  
20 the appropriate steps, and part of that is  
21 Corrective Actions from the licensee. And you know  
22 when you see repeat violations then our attention  
23 and response, you know, escalates. That's the same  
24 for research reactors.

25 MEMBER BLEY: You forced me to ask a

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1 question to get the answer on the record here. Is  
2 there anything in what you're proposing that in any  
3 way affects inspection and enforcement? And I guess  
4 I should ask is there anything in parallel you're  
5 aware of going on in cost-cutting measures that  
6 would affect inspection and enforcement for these  
7 kinds of facilities?

8 MR. HARDESTY: No, the inspection  
9 program is not changed. In fact, we have a very  
10 robust inspection program, although we don't have  
11 resident inspectors like the power reactors do.  
12 What we do have is dedicated inspectors here at  
13 headquarters, and I'll go into how -- what the  
14 inspection activities are. I'll also go into some  
15 of the recent findings for the last several years  
16 that show that we have a very robust program that  
17 is either allowing self-reporting or findings from  
18 the inspections. So that program is not going to be  
19 diminished at all. They are actually working in  
20 parallel with us to make some of their procedures a  
21 little bit more robust in terms of like 50.59  
22 evaluations, that's one of the inspection modules,  
23 to -- it wasn't really part of this rule but they  
24 were doing it in parallel, so we worked together to  
25 make sure that we wouldn't diminish anything they

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1 were doing.

2 MR. ADAMS: So if you look at between  
3 license renewals, you know, this 20, 30, 40 year  
4 time period, a lot can change the license, a lot  
5 can change the licensing basis between those two,  
6 and there's two major areas. One is license  
7 amendments and, you know, those come in and the  
8 Staff obviously, you know, reviews them, sends them  
9 through, you know, the process against the standard  
10 review plan and the Staff makes a determination  
11 that what they're proposing is either safe or  
12 unsafe and approves it or doesn't approve it. The  
13 other area is 50.59 changes which 50.59 applies to  
14 research reactors just like it applies to power  
15 reactors that we get normally in the annual  
16 reports, we get a summation of those 50.59s. The  
17 inspectors out in the field look at the 50.59  
18 process and look at the individual 50.59s. I think  
19 that's one area where if we move forward with this,  
20 that we will focus, we will enhance our focus on  
21 looking at individual 50.59 reviews that are done.

22 And, of course, the other thing is a  
23 change that, you know, doesn't fall into either of  
24 those. An example of that is say, you know, someone  
25 builds a building across the street from your

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1 reactor that changes your site description. It's  
2 not a 50.59 because it's not a change to the  
3 facility, it's something across the street, but  
4 right now we wouldn't know about something like  
5 that until, you know, that 20, 30, 40 year mark  
6 comes in and, you know, here's -- yes, I think we'd  
7 be aware of it because the inspector on site, the  
8 inspectors are looking around and there's  
9 continuity of inspectors. And I know our inspectors  
10 would go wait a minute, that building wasn't -- you  
11 know, what's this building that's getting built?  
12 But there's an example where a periodic 5-year  
13 update of the SAR that we would, you know, formally  
14 find out about that in the SAR update sooner than  
15 we would. And sometimes those changes around the  
16 site are significant. We talked about MIT, you  
17 know, years ago the Necco Wafer plant was across  
18 the street, and had one of the best Necco Wafer  
19 stores you can imagine but they changed their  
20 cooling process from a Freon base to an ammonia  
21 based and, you know, if that had failed it could  
22 impact the reactor. MIT, you know, ammonia alarms  
23 were put in the air intakes, you know, Scott air  
24 packs were available for the operators, so there's  
25 an example of change to the external environment

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1 that, you know, the operator took the -- you know,  
2 the licensee took the right steps to, but as far as  
3 the documentation, you know, it could be --

4 MEMBER BALLINGER: You might know that  
5 it's actually worse now because Novartis Research  
6 and Development Laboratory has replaced Necco. And  
7 not only that, the administration is about to  
8 convert that giant warehouse that's right next to  
9 the reactor across the tracks into what I would  
10 call a cell block, but they're calling it a dorm.

11 MR. ADAMS: I'm guessing the factory  
12 store is probably not as good as a Necco Wafer, so  
13 --

14 MR. HARDESTY: Anyway, to get back on  
15 track with the presentation --

16 (Laughter)

17 MEMBER SKILLMAN: Duane, let me just  
18 build on Dr. Bley's question. He asked about the  
19 inspection results. I have communicated with Quinn  
20 last week in my prep for this meeting that you  
21 would please present inspection data, and I'm  
22 hoping that you will do that sometime later.

23 MR. HARDESTY: Yes, sir.

24 MEMBER SKILLMAN: Thank you.

25 MR. HARDESTY: The definition that we

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1 have was the -- is considered very carefully by the  
2 working group, went through the Steering Committee  
3 to insure that we did the best possible job of  
4 capturing all of the facilities that we want these  
5 rules to apply to, and the exceptions. And so this  
6 new definition, and you'll hear everyone is  
7 referred to an NPUF from now throughout the  
8 presentation. It doesn't exist as a regulatory  
9 definition yet. That is part of this rulemaking,  
10 but it is meant to capture the non-power reactors,  
11 the testing facilities, and any other production or  
12 utilization facility which brings in the SHINES and  
13 the Northwest. Licensed under 50.21(a) or (c),  
14 104(a) or (c) clause of the Atomic Energy Act, and  
15 then 51.02 which corresponds to the 103s. That's a  
16 new acronym that we have.

17 MEMBER CORRADINI: Pardon?

18 MR. HARDESTY: A new acronym.

19 MEMBER CORRADINI: Yes. I was trying to  
20 figure out on your second slide what the hell is an  
21 NPUF but now --

22 MR. ADAMS: We struggled. Our basic  
23 rules were that you could use it in a public  
24 document and that when we said it, you know, no one  
25 broke into hysterical laughter, so we think we

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1 found one which, you know, NPUF, it's good.

2 MEMBER BLEY: Just for me, non-power  
3 reactor is still a reactor which means it --

4 mR. HARDESTY: Correct. And that was the  
5 finding --

6 MEMBER BLEY: So things like the old  
7 zero power reactors and subcritical multiplication  
8 facilities are not NPUFs, or they are?

9 MR. HARDESTY: So like, for example, RPI  
10 is considered a critical assembly, and we'll talk  
11 about their specific facility. They are licensed  
12 under 104(c), and they are considered a reactor.

13 MEMBER BLEY: Okay. I don't know if  
14 there's still any, there used to be some  
15 subcritical modification facilities called ZPR,  
16 Zero Power Reactors, and I don't see any of the  
17 list. Are they on or are they --

18 mR. ADAMS: They're gone. So, you know,  
19 we've expanded this, you know, production or  
20 utilization facility, you know, to capture the  
21 medical facilities, and also other facilities that  
22 would be under Part 50 that are not power reactors.

23 MEMBER BLEY: So if a university wanted  
24 to build one of those ZPRs in the past, they would  
25 come under this?

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1 MR. ADAMS: If it truly does not reach  
2 criticality?

3 MEMBER BLEY: Truly does not.

4 MR. ADAMS: If it doesn't reach  
5 criticality, it's probably a fuel cycle facility.

6 MEMBER BLEY: Okay.

7 MR. ADAMS: Again, it depends on what  
8 they're doing here that, you know, just like for  
9 SHINE we considered the level of subcriticality and  
10 decided where it made the most sense. If someone  
11 actually came in and wanted to do that, we would  
12 have to look at it. I mean, I could tell you  
13 sub-crits, you know true sub-crits like many  
14 universities have your tank of water with uranium  
15 slugs, those are not Part 50. Those are state  
16 licensed or NRC materials license.

17 MR. HARDESTY: That's what I was going  
18 to add, is that a lot of the research reactors,  
19 university reactors have them but they're licensed  
20 on other material license. So anyway, moving on the  
21 -- this graphic is just meant to give you an idea  
22 of where the current license facilities are.  
23 There's actually 36 licensed research and test  
24 reactors, the graphic only shows the 31 that are  
25 operating in the 21 states. Five reactors are

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1 permanently shut down and in decommissioning, but I  
2 wanted to give you that as a frame of reference for  
3 the total number that the NRC is currently  
4 regulating.

5 MR. ADAMS: If I can add, you know, the  
6 Staff has a long history of regulating these  
7 machines. You know, some of the first reactors  
8 regulated by the AEC were research and test  
9 reactors. If you add all of them up there's  
10 probably -- there's been about 150 research  
11 reactor, test reactor, critical assembly licenses  
12 issued over time, so there is a large body of  
13 experience running these facilities, and regulating  
14 them.

15 MR. HARDESTY: I won't linger on the  
16 next two slides much. They're really just designed  
17 to give you a tabulation of these current U.S.  
18 research and test reactors, a test reactor. It's  
19 mostly here for reference, but in the next several  
20 slides I'm going to provide you various  
21 categorizations of those reactors to provide you a  
22 little bit more of an insight into how we  
23 categorize, and what we are currently regulating.  
24 So that's the list of them all.

25 The characterization of operating

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1 non-power production utilization facilities by  
2 decade license, this was kind of just to show you  
3 an idea of how old they are, how long they've been  
4 around. The 31 represent the 1950s, '60s, '70s and  
5 '90s. The two at the bottom there are not currently  
6 licensed. That would represent our construction  
7 permit applications from SHINE and Northwest which  
8 are going to be Class 103 medical isotope  
9 facilities, but we wanted to include them so that  
10 you understood that they're coming in this current  
11 decade that we expect, anyway.

12 By power level we have four facilities  
13 that are less than 1 kilowatt thermal, 12 that are  
14 in the 1 kilowatt to 1 megawatt range, 10 that are  
15 in the 1 megawatt but less than 2 megawatt range,  
16 and then five that are over the 2 megawatts.

17 By fuel type we'll go a little bit more  
18 to what an AGN is. It's AeroJet General Nucleonics.  
19 It's a specific vendor. We have three of those  
20 currently. Again, we'll tell you who all they are a  
21 little bit more when we tell you about the reactors  
22 themselves. Eight plate-type fuel reactors, 16, the  
23 bulk of our licensees were TRIGA reactors, and then  
24 we have four what we consider unique reactors. But  
25 I will say that in fact all of these reactors are

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1 extremely unique. Despite having common designs,  
2 common manufacturers, no two are identical, and so  
3 that's always something that the Staff is very  
4 careful to consider, the differences. At one point  
5 in our history we had generic studies that we  
6 applied to the reactors for licensing, license  
7 renewal, and things. We have moved away from that  
8 because in most cases because the general analysis  
9 don't fully apply, we still leverage that  
10 information but we've also made them in this last  
11 license renewal go around update all their analysis  
12 so that we make sure that we have the most  
13 up-to-date and current licensing basis we can as  
14 part of that license renewal process, and that as  
15 you'll find out later is one of the entrance  
16 criteria to becoming a non-expiring license if this  
17 rulemaking goes through, is that we want to make  
18 sure that we have an absolute firm basis of their  
19 licensing -- firm licensing basis so that we can  
20 then maintain it rather than try to at some point  
21 rebuild it. So we want to make sure it's absolutely  
22 there, and then moving from that maintain it going  
23 forward.

24 MEMBER CORRADINI: So maybe I -- so I'm  
25 not sure -- so going back to Al's point and your

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1 point earlier, so that if in the past University X  
2 had a research reactor and had the SER, or the SAR,  
3 excuse me, their onsite safety analysis report, and  
4 then decades pass and they realize their licensing  
5 basis should have been kept. Are you saying it's  
6 hard to recreate it when they're coming in for  
7 renewal? That's how I interpreted what you were  
8 just saying, so that the 5-year updates make it  
9 easier for all of that. Am I understanding it?

10 MR. ADAMS: It's -- you're on the right  
11 track, and so, you know, I'll go back, you know,  
12 ancient history. You know, in my life, I was a  
13 licensee, we came up for license renewal. There was  
14 no NRC guidance document so, you know, first thing  
15 you did is you pulled out what worked 20 years ago  
16 and you looked around and you said well, here's  
17 some licensees are getting renewed and this seems  
18 to work, and you give it to the NRC and, you know,  
19 cross your fingers and wait to see what happens.

20 When I came to the NRC there was no  
21 standard review plan. You know, when I got here,  
22 you know, the gray beard sat me down and gave me  
23 the ancient knowledge and that was -- you know, it  
24 was very -- you know, it was not documented. And in  
25 the late '80s/early '90s when we started

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1 consolidating the research reactor regulatory  
2 program within NRC, one of the things we realized  
3 is that, you know, we needed documentation. And,  
4 indeed, Commissioner Remick, Commissioner Rogers  
5 were very helpful on that and gave us, you know,  
6 the go ahead to go ahead and develop what became  
7 NUREG-1537.

8 MEMBER CORRADINI: Okay.

9 MR. ADAMS: So what we want is the  
10 entrance into a non-expiring license that you have  
11 gotten a license renewal where your SAR was based  
12 on NUREG-1537 and the Staff's review was based on  
13 the standard review plan in 1537 so we have a  
14 common set of yardsticks that we've applied.

15 MEMBER CORRADINI: Got it, thank you.

16 MR. HARDESTY: But you're exactly  
17 correct, the idea is that 5071 for updating their  
18 FSARs or Final Safety Analysis Reports did not  
19 apply or does not apply currently. And we intend to  
20 make that apply as part of this rule so that we are  
21 getting those routine updates of the facility  
22 changes, as well as the already requirement for  
23 annual reports that lists their changes to the  
24 facility so that we can maintain the licensing  
25 basis, and if we see anything that requires further

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1 investigation that we can do so at that point.

2 MEMBER CORRADINI: And just a quick one.  
3 So even though you don't require it now but in the  
4 new format you would, a particular facility ought  
5 to be tracking this anyway if they're really  
6 keeping track of what's happening in their facility  
7 as it goes on whether it be a new fuel type, or  
8 change in facilities, or whatever. Right?

9 MR. HARDESTY: Absolutely.

10 MEMBER CORRADINI: Okay.

11 MR. ADAMS: And I think, you know, we  
12 see various levels of attention to that detail. You  
13 know, there's some facilities that I think, you  
14 know, there's some paper there that you can  
15 recreate. Some facilities do a good job. You know,  
16 they have, you know, what they call a training  
17 document which is an SAR that they keep up to date.

18 MEMBER CORRADINI: Okay.

19 MR. ADAMS: So what we've seen out in  
20 the field varies significantly depending on --

21 CHAIRMAN POWERS: You have --

22 MR. ADAMS: -- the licensee.

23 CHAIRMAN POWERS: You have quite a range  
24 of ownership on these facilities. It goes from  
25 private institutions to academia.

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1 MR. ADAMS: Next slide.

2 MR. HARDESTY: Yes, next slide.

3 CHAIRMAN POWERS: Do you see differences  
4 across the spectrum of ownership and the attention  
5 which they pay to maintaining their license basis,  
6 or does this range that you describe work within  
7 each one of these categories as well?

8 MR. ADAMS: No, it's -- you know, I  
9 can't make a generality like the federal  
10 government does a superior job, you know, to  
11 academia. It's individual licensees. Probably, you  
12 know, the most extreme example is one facility at  
13 the beginning of license renewal came in and said  
14 you know what, you know, I don't know my licensing  
15 basis. However, you know, look at my reactor. You  
16 can tell, you know, it's running safe, and they  
17 actually came in and I think had a discussion with  
18 the Commission about do they really need to update  
19 their licensing basis? And the answer was yes.

20 (Laughter)

21 CHAIRMAN POWERS: I mean, what causes  
22 one pause?

23 MR. ADAMS: I think, you know, if I can  
24 state a generality, it's -- you know, obviously if  
25 you have a staff of two you're in a different

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1 situation, if you have a staff of 122.

2 MR. HARDESTY: We'll get to that, too.

3 MR. ADAMS: But on the other side the  
4 facility that's running with a staff of two, we  
5 find that that licensing basis is a lot more stable  
6 than the facility with a staff of 122 because  
7 they're doing a lot more stuff, and that license  
8 needs more sort of regulatory maintenance.

9 CHAIRMAN POWERS: Good. Thank you.

10 MR. HARDESTY: One of the important  
11 takeaways I would like you to have from that is  
12 that our yardstick to them doesn't change whether  
13 they have one staff or 200 staff, or whatever they  
14 might have. Probably the only thing we experience  
15 is maybe the response time in terms of getting to  
16 the point we want to be on that licensing basis,  
17 it's harder for the smaller staff at the reactors  
18 to respond to everything we need to do, and over  
19 the course of license renewal we've been given the  
20 ability to guide them towards getting DOE help, you  
21 know, to help them answer the questions that we've  
22 had, so we've gone through a very good process of  
23 getting them to where we want them to be in terms  
24 of their licensing basis.

25 Probably everyone has had a chance to

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1 review this. Now you can see that most of the  
2 facilities are academic institutions. We do have  
3 three private industry ones, and three federal  
4 government ones. The private industry ones are  
5 Aerotest performing service radiograph services.  
6 They're currently not doing that, they're shut  
7 down, but we also have DOW and GE. And then we have  
8 three federal government facilities, AFRRRI right  
9 down the street here in Bethesda, NIST up in  
10 Germantown, and of course USGS out in -- out west.

11 MR. ADAMS: I just want to add. Aerotest  
12 is not in operation at the moment. In fact, they're  
13 shut down under order, and that's being driven by  
14 an issue in foreign control and domination. There  
15 is -- we do -- we'll talk about it later but we  
16 have seen some issues with fuel at Aerotest but,  
17 you know, that would be a -- so that would be an  
18 issue that would have to be looked at if we get  
19 past the foreign control and domination issue, and  
20 we work to bring that license renewal back into an  
21 active status. So it's not a nuclear safety issue  
22 that has Aerotest shut down at the moment, it's a  
23 legal issue.

24 MR. HARDESTY: Thank you. Moving on more  
25 into the missions of our academia reactors. Their

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1 basic purpose is to have laboratory classes, do  
2 basic nuclear research, and then these other  
3 activities which they do at various different  
4 levels, neutron activation analysis, neutron  
5 radiography, scattering, irradiation, and then some  
6 actually do some isotope generation.

7 MEMBER BROWN: At the academic ones, I  
8 guess at any of them, since you've got students  
9 you're trying to illustrate stuff to students,  
10 you're trying to various things that I guess bring  
11 their knowledge level up, who operates the  
12 reactors, do the students do that, or is there a  
13 specific set of people licensed to run that reactor  
14 as part of the university?

15 MR. HARDESTY: So Part 55 requires that  
16 there is a licensed operator at the controls at all  
17 times. However, they are allowed to have under  
18 instruction people, so you will find unqualified  
19 people that are operating the controls but they're  
20 under the direct supervision of a qualified  
21 operator.

22 MEMBER BROWN: Okay.

23 MR. ADAMS: And it varies from facility  
24 to facility. Some places are -- it's strictly, you  
25 know, university employees that are running the

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1 reactor, and some places it's a mixture of  
2 employees and students, and some facilities it's --  
3 you know, there's faculty and students.

4 MEMBER CORRADINI: That's the most  
5 dangerous.

6 (Laughter)

7 MR. ADAMS: What?

8 MEMBER CORRADINI: I said you don't want  
9 faculty touching anything.

10 MR. ADAMS: So one extreme example is  
11 Reid College, something like 1 or 2 percent of the  
12 population of the college holds a license to run  
13 the reactor, and it's a liberal arts college, no --

14 MEMBER CORRADINI: And it's a chemistry  
15 department, there's no nuclear engineer.

16 MR. ADAMS: Yes, there's no engineering,  
17 nuclear engineering or any engineering in sight.

18 MEMBER BROWN: 1 to 2 percent of the  
19 college itself?

20 MR. ADAMS: Of the student population of  
21 the college hold a license.

22 MEMBER BROWN: So 100 students and only  
23 two people, or is this 1,000 students and there's -  
24 -

25 mR. ADAMS: It's a small college but

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1 there's something like 30, 40, maybe 50 licensed  
2 operators. We give an enormous amount of exams  
3 there every year.

4 MEMBER BROWN: Okay.

5 MR. ADAMS: Basically, we dispatch  
6 several of our licensed operator examiners and  
7 they're there for several weeks giving exams.

8 MEMBER BROWN: Does that include  
9 operational demonstration of the skills --

10 MR. ADAMS: Yes, it's the -- it's  
11 basically the same requirements that the power  
12 reactor operators go through that they have to pass  
13 -- for an operator's license you pass a written  
14 exam and a demonstration of competence, oral exam  
15 for an upgrade to SRO. It's a demonstration of  
16 competence.

17 MEMBER BROWN: Okay.

18 MR. HARDESTY: All right. So this is  
19 just a brief summarization to give you an idea of  
20 their operation activities, so the bulk of the  
21 reactors operate a few hours per week. There are  
22 some that operate very infrequently, either a few  
23 hours per year for laboratory classes. Then there's  
24 a few facilities that operate higher activities, 20  
25 to 40 hours per week. And then a couple that

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1 operate basically 24/7, that's the NIST, the MURS.  
2 It just depends on what they're doing, and they  
3 slip in and out of these categories depending on  
4 the activities that they've got and the contracts  
5 they've got for different types of experiments,  
6 people want to come in and do things. But the  
7 important thing to understand about the research or  
8 the non-power production utilization facilities  
9 that are predominantly doing these type of research  
10 activities is that there's no requirement for them  
11 to maintain power. You know, an experimenter may  
12 say I've got to have this much exposure time, but  
13 that never preempts the safety. So if there's a  
14 problem, they immediately shut down and they  
15 resolve it before they come back up, so there's  
16 never a problem with them trying to continue  
17 operations under these kind of activities. And, in  
18 fact, the activities that you'll -- or I guess the  
19 responses that the tech specs typically have for  
20 any kinds of actions or they don't meet the  
21 conditions of operation, essentially require that  
22 they immediately shut down.

23 MR. ADAMS: And in the 30 years I've  
24 been regulating at NRC I've only run across one  
25 research reactor where continuity of operation was

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1 important for what they were doing, and the  
2 facility doesn't exist any more, but they were  
3 doing long-term testing of thermionic devices for  
4 possible space propulsion application, and so  
5 running that experiment for several years straight  
6 without giving it the shock of scrambling the  
7 reactor was important, so this was a reactor that  
8 had additional redundancy and diversity and  
9 systems to reduce the possibility of shutting down.  
10 So I've only seen that once in all the years I've  
11 been in NRC.

12 MR. HARDESTY: So moving into a little  
13 bit about their staffing, just to give you an idea.  
14 Most of the facilities have very small staffs. One  
15 or two is a generality, but there's a lot of them  
16 that have very small staffs, and so that consists  
17 of essentially the immediate reactor staff, the  
18 director, the reactor manager, reactor supervisor,  
19 and maybe some part-time grad students or something  
20 have qualified as a reactor operator. And then they  
21 have outside support from the Radiation Safety  
22 Office, clerical support, typical support they  
23 would get from the college itself.

24 Whereas, the larger organizations of  
25 which I've kind of categorized five of them, the

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1 Texas A&M TRIGA, MUR, NIST, MIT, AFRRRI, and Oregon  
2 State that have a larger staff. Is it Oregon or  
3 Ohio? I think Oregon, that have a larger staff.  
4 They have a built-in administration, and  
5 operations, and engineering as part of the reactor  
6 staff, so they have dedicated staff that's part of  
7 the reactor operations. That's just to give you a  
8 contrast. And with that I'm going to turn this over  
9 to -- I'm sorry, did you have a question?

10 MEMBER SKILLMAN: Just back up a slide.

11 MR. HARDESTY: Sure.

12 MEMBER SKILLMAN: I see those five, MUR,  
13 NIST, MIT, AFRRRI, Ohio State and TAM.

14 MEMBER CORRADINI: That's Oregon State.

15 MEMBER SKILLMAN: Oregon State. If you  
16 go back for a second to slide 12, just stick with  
17 me on this, go back to 12 just for a second. Are  
18 there other reactors that are not NRC licensed but  
19 are somehow licensed under state or some other  
20 licensing organization which if shown on this  
21 graphic would double, triple, or quadruple the  
22 number --

23 mR. ADAMS: No, there's three places  
24 within U.S. law that you can regulate reactors,  
25 utilization facilities, and that's Section 91(b) of

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1 the Atomic Energy Act gives the Department of  
2 Defense the authority to regulate their own  
3 reactors. The clearest example is, you know, naval  
4 reactors. 91(b) has been used over the years for  
5 research reactors. For example, the reactor that's  
6 now at University of California Davis was built by  
7 the Air Force at McClellan Air Force Base and the  
8 Air Force made a conscious decision that they were  
9 going to regulate the reactor under 91(b).  
10 Interesting enough, when that base was lined up to  
11 be on the BRAC program the Air Force came to us and  
12 talked about transferring licensing authority to  
13 NRC, so it was still an Air Force reactor, but we  
14 regulated it. So 91(b) is a choice; for example,  
15 the AFRRRI reactor down the street in Bethesda, we  
16 regulate that reactor; however, they can call us up  
17 tomorrow and say guess what, we're going 91(b), but  
18 nice being regulated by you. So Department of  
19 Defense has the authority to regulate their  
20 utilization facilities. DOE has the authority to  
21 regulate reactors within their space, and their  
22 space is -- there's not a lot of reactors, the  
23 HIFAR, ATR, ACR, Sandia. So, you know, again it's  
24 four or five facilities. You know, the old Army  
25 program that doesn't exist any more was also under

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1 91(b). And the only other place is NRC, so if  
2 you're not within -- sitting on a DOE laboratory or  
3 within the confines of the military, then your  
4 reactor is regulated by NRC. You know, the idea of  
5 NRC regulating DOE's test reactors, research  
6 reactors does come up periodically. During my  
7 career I've been involved in, you know, doing  
8 evaluations of what it would take to regulate DOE's  
9 facilities. DOE has a program which looks a lot  
10 like what we do. So, you know, if we brought DOE's  
11 reactors on board, you know, we'd have four or five  
12 more reactors, but they would tend to be very high  
13 powered.

14 MEMBER SKILLMAN: So for all intents and  
15 purposes you're saying hey, these 31 are really the  
16 whole story at this point in the nation's history,  
17 and so the regulations that we're contemplating  
18 changing really do get to the bulk of the research  
19 and test facilities. Yes, there are a couple of  
20 more but they're not regulated by this body of  
21 regulation.

22 MR. ADAMS: Exactly.

23 MEMBER SKILLMAN: Copy that. Okay, back  
24 to 22. Thank you.

25 MEMBER BLEY: Al, for information, 91(b)

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1           apparently isn't under Title 10. What's it under?

2                       MR. ADAMS: It's 91(b) of the Atomic  
3 Energy Act.

4                       MEMBER BLEY: Of the Atomic -- of the  
5 Act itself. Okay.

6                       MR. ADAMS: I'm sorry, do I --

7                       MR. HARDESTY: No. Okay. At this point  
8 I'm going to turn it over to Al to talk about  
9 specifics about each one of the reactors, the AGNs,  
10 the Argonauts, those are all unique designs, and  
11 Pulstar. We'll talk about coolant tank reactors  
12 because there's a couple in there that are -- you  
13 know like for example, a TRIGA reactor is a pool  
14 reactor, but they're categorized and described  
15 under TRIGA reactors not in the pool, so I don't  
16 want there to be any misconceptions on how I  
17 generated the slides. But Al's going to give this  
18 presentation.

19                       MR. ADAMS: So I'm wondering, so it's  
20 sort of a background we're sort of switching here.  
21 You want to take a break now or do you want to wait  
22 until 10:30?

23                       CHAIRMAN POWERS: We will take a break  
24 at 10:45.

25                       MR. ADAMS: 10:45, okay. So it's -- I'm

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1 going to go over the various types of research  
2 reactors, talk about some of their driving design  
3 features for safety. As Duane indicated, there's a  
4 lot of ways you can chop this world up and get to  
5 where you're going. You know, it's -- and you see a  
6 couple of ways here. You know, sometimes you see  
7 fuel type, sometimes you see are they in a pool or  
8 not in a pool, what's their power level? So there's  
9 a lot of ways to chop these up, but the way we  
10 normally do is what you see here.

11 So I'll start with the AGNs, named  
12 after the company that built them, Aerojet General  
13 Nucleonics. They were one of the two designs of  
14 homogenous reactors that were developed. This is a  
15 solid homogenous reactor. There was another company  
16 that produced a liquid homogenous reactor, L77s,  
17 L54s, all of those are gone. AGNs still exist,  
18 there's a couple of them. Compact, self-contained,  
19 portable. These reactors came off an assembly line  
20 in California and on the assembly line they became  
21 reactors, so the construction permit was actually  
22 for what was going on on the assembly line. I'm  
23 sorry we don't have the picture but we have an old  
24 picture of them just, you know, it looks like the  
25 Chevy plant, instead of Impalas it's, you know, AGN

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1 reactors in line. You know, they were very popular  
2 in the early days because they allow the university  
3 to get into the nuclear business relatively cheaply  
4 and have a compact, simple machine.

5           The fuel, it's enriched 20 percent,  
6 less than 20 percent enriched. It's a mixture of  
7 uranium oxide powder in a polyethylene moderator so  
8 that's the solid homogeneous aspect of it is that  
9 the moderator and the fuel are blended together. If  
10 the fuel was sitting on the table here it would  
11 look like, you know, plastic donuts. You can see  
12 it's not a big reactor, 10 inch diameter core.  
13 There's holes that enter into the core for  
14 insertion of control rods, and the control rods of  
15 these reactor are made out of fuel so to shut down  
16 the reactor you actually pull the control rods out  
17 of the -- the control rods drop out of the bottom  
18 of the core, so it's an interesting design.

19           It has a unique safety feature, you  
20 know, and besides its power level, it has what's  
21 called a thermal fuse. The donuts that make up the  
22 core are held together by this fuse and it's  
23 basically a piece of polyethylene that has a little  
24 higher density of uranium oxide powder mixed in.  
25 It's the hot spot in the core, and if the reactor

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1 runs over power that piece, the plastic melts, the  
2 core falls apart. So that's an interesting safety  
3 feature it has. It lives in a tank. There's a  
4 graphite lead water shield surrounds the core, and  
5 then there's a water tank. So here's a picture of  
6 one on the right there at Texas A&M. So, these are  
7 actually AGNM, 201Ms. M stands for modified. The  
8 modification is these are the supped up AGNs, they  
9 run at 5 watts. The original AGNs ran at a tenth of  
10 a watt. If you look at the reactor on the right  
11 there you see some cinder blocks around it, so when  
12 they up the power to 5 watts they had to put more  
13 shielding around the reactor. So you have 5 watts,  
14 three of them are still in existence, Texas A&M has  
15 one. That we're in the process of working on a  
16 license amendment to actually move it from the  
17 engineering building to a new facility that's going  
18 to be built. Idaho State has one, and University of  
19 New Mexico. You know, they're useful for teaching  
20 students, because they're homogeneous they're sort  
21 of pure -- purer from a nuclear power, nuclear  
22 engineering approach than say exogenous reactors.  
23 And these are all located in campus engineering  
24 buildings, and they're all Class 104.

25 Mainly used for teaching students. You

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1 know, it's a laboratory tool for teaching students.  
2 It does have the ability to do some simple, you  
3 know, activation analysis. We're talking fluxes 10  
4 to the 10th, 10 to the 11th, you know, nothing that  
5 -- it takes a long time to do anything in these  
6 reactors, but what they do well is they show the  
7 effects of reactivity coefficients, they show, you  
8 know, the -- going through criticality, you know,  
9 source critical versus real critical, you know, all  
10 those things that you teach in the classroom you  
11 can come and do as a lab.

12 Any questions about those? Again,  
13 they're portable. In the early days these things  
14 used to be hauled around from place to place.

15 MEMBER REMPE: Has anyone ever melted  
16 their fuse and do they still make the fuel for  
17 these reactors?

18 MR. ADAMS: As far as I know, my  
19 historic knowledge is that no, that the -- we've  
20 never -- there's never been one that has melted the  
21 fuel. No, it's a lifetime core. There is some spare  
22 fuel in existence. There's at least one facility I  
23 know of that decommissioned the reactor but still  
24 has the core, so there is some spare fuel around.  
25 I'm not sure how many spare thermal fuses are in

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1 existence, so DOE probably has some fuel in storage  
2 for these but again it was a lifetime core. And,  
3 you know, literally, you know, you shut down the  
4 reactor, you basically, you know, put gloves on  
5 and, you know, you put your lab coat on and after a  
6 certain period of time you can open up the reactor  
7 and you basically handle the fuel directly. Again  
8 it's -- there's not a lot of activation in these  
9 machines.

10 MEMBER SKILLMAN: Alex, what's  
11 interesting to me is that for every one of these  
12 small reactors the training programs breed a  
13 population of reactor operators and people who are  
14 interested in what the device is doing, but in  
15 order for that to occur they also have to breed an  
16 entire population of instrumentation and control  
17 people who are able to provide the instrumentation  
18 and calibrate it so that the people who are  
19 operating the reactor know what in the world  
20 they're doing. So you end up with a couple of  
21 different populations out of these activities.

22 MR. ADAMS: And we're at the point where  
23 the original I&C systems that came with the  
24 reactor, basic -- you had a reactor, you had a  
25 console, you plugged the console into the reactor,

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1 you plugged the console into the wall and, you  
2 know, you have a reactor. Texas A&M, for example,  
3 is working on designing a newer instrumentation and  
4 control system, and I think once they design that  
5 and we look at it, and pass -- you know, if we pass  
6 judgment on it, then I'm guessing that design will  
7 then move on to the other reactors. But, you know,  
8 it's basically we're at the point where there's a  
9 lot of -- you know, there's parts for these  
10 facilities that, you know, the spares are  
11 non-existent.

12           Next, Argonaut. Again, you know, there  
13 used to be -- you know, when I came to -- right now  
14 there's 31 reactors. When I came to NRC there was  
15 about 80 some licensees, so they've been slowly  
16 through the years, they've been dropping off. A lot  
17 of the AGNs have dropped off, and a lot of the  
18 Argonauts, so there's one Argonaut left named after  
19 Argonne National Laboratory which was the  
20 organization that invented it. It's a heterogeneous  
21 reactor. The fuel is MTR material test reactor type  
22 and that's basically your standard uranium  
23 dispersion fuel in aluminum cladding in plate form  
24 that then goes into fuel elements that then go into  
25 the reactor core. So it's your standard MTR plate

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1 fuel which a lot of the -- which is probably, you  
2 know, as common as TRIGA fuel.

3 It's a force flow reactor, reflector  
4 graphite, mineralized ice water graphite blocks,  
5 biological shield is unique. Why don't we go to the  
6 next slide, the picture. So it's basically a  
7 reactor core in a big monolith of shielding blocks,  
8 and can you kind of move the mouse pointer to where  
9 the core is? So the reactor core actually sits in  
10 two what's called core boxes, so it's two boxes  
11 that hold the fuel elements and not much more and  
12 water -- the coolant passes through the boxes, and  
13 because the core does not sit in the bottom of a  
14 pool the shielding is provided by as you can see  
15 this monolith that surrounds the core. It does have  
16 an interesting safety feature in that you can shut  
17 down the reactor by putting the control rods in.  
18 You can also drain the coolant out of the core  
19 boxes, so there's two ways to shut down the  
20 reactor.

21 The University of Florida, 100  
22 kilowatts. There's a picture of what the monolith  
23 looks like. The -- can you point out where the  
24 control rod drive is. Control rod drive, it's a  
25 semaphore rod that puts itself in between the two

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1 core boxes. Again, relatively low power, used  
2 mainly for teaching nuclear engineering students.  
3 Florida does have a very vigorous nuclear  
4 engineering program with a lot of students, so it's  
5 again sort of like, you know, what we saw the AGN  
6 reactor doing, only there's a little bit more  
7 capability to do activation, you know,  
8 demonstrating some of the technologies, radiography  
9 and technologies on that.

10 I guess I probably should go back and  
11 I'll just quickly mention, you know, each of these  
12 reactors has what we consider the bounding accident  
13 that we look at as the staff. For the AGN reactor  
14 it's somehow you get a chunk of uranium fuel and  
15 you put it in the irradiation part and you create  
16 a large reactivity addition, that's the accident we  
17 look at there. In the case of this reactor, it's  
18 dropping one of the shielding blocks on the core.  
19 It's a mechanical core crushing disruption accident  
20 is what we look at.

21 CHAIRMAN POWERS: Is fire a  
22 consideration?

23 MR. ADAMS: Fire? Part of looking at  
24 these reactors, yes, we do look at fire. A number  
25 of years ago when stored energy, Wigner energy in

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1 graphite became a concern we went and looked at all  
2 graphite used in all of our research reactors  
3 wherever they are, and we did an -- the community  
4 did an evaluation that they then gave to us that we  
5 reviewed and we determined, for example, that the  
6 graphite fires were not an issue mainly because  
7 there just wasn't enough flux to build up a  
8 significant amount of stored energy. But as, you  
9 know, the accident scenarios we look at, you know,  
10 fire is one of those areas.

11 CHAIRMAN POWERS: Most of these are  
12 located in engineering facilities.

13 MR. ADAMS: Yes.

14 CHAIRMAN POWERS: And things  
15 unassociated with the reactor can produce fire. And  
16 that seems to me that those external events like  
17 that are at least as likely as inserting reactivity  
18 in a core.

19 MR. ADAMS: We look at these events. You  
20 know, we don't have -- you know, we have  
21 probabilistic insight so to speak. I mean, there's  
22 -- none of these facilities have PRAs or PSAs, so I  
23 can't tell you what the probability of a fire in  
24 the engineering building versus any other event. I  
25 mean, I could tell you in our -- you know, in the

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1 history I don't think we have an event where, you  
2 know, an engineering building burnt down and  
3 threatened the reactor. You know, the engineering  
4 buildings tend to be, you know, protected in that  
5 way. You know, university, Environmental Health and  
6 Safety programs, you know, look at what we find is  
7 that it's a university, that's normally part of a  
8 state that normally has a lot of requirements on  
9 things like fire loading, fire response, fire  
10 protection. When I was a licensee, you know, fire  
11 in the facility was, you know, one of the events  
12 that we practiced. All the facilities have, you  
13 know, as part of the emergency planning process,  
14 have working relationships with the first  
15 responders, the ambulances, the fire brigades. The  
16 fire brigades that responded to the reactor I  
17 worked at, you know, at least once a year went  
18 through the reactor, were trained. You know, here's  
19 what to look for, here's the hazards of fire and  
20 radioactive material, and then they were involved  
21 in the active emergency drills which these  
22 licensees conduct every two years which is a full  
23 external response, you know, drill. So it is looked  
24 at.

25 MEMBER SKILLMAN: Al, let me ask this.

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1 I've never been around a large quantity of  
2 graphite. Is carbon monoxide and carbon dioxide a  
3 concern around this type of machine?

4 MR. ADAMS: If there's -- no, I mean,  
5 not -- you know, a normal operational point of  
6 view are you talking?

7 MEMBER SKILLMAN: No. Just curious.

8 MR. ADAMS: Well, it turns out there's  
9 not a lot -- you know, we talk about graphite.  
10 There's really not a lot of graphite in these  
11 machines. You know, thermal columns are -- you  
12 know, a lot of facilities have graphite thermal  
13 columns. You know, that's normally four feet by  
14 four feet by maybe four feet square block of  
15 graphite blocks. The reflector elements are about  
16 the same size as a fuel element. You know, in the  
17 case of a TRIGA reflector it's, you know, a  
18 diameter of about that and the length of about  
19 that. So there really isn't a lot of graphite in  
20 these machines.

21 CHAIRMAN POWERS: Well, it takes very  
22 little graphite to be an awful lot of moles.

23 (Laughter)

24 CHAIRMAN POWERS: But in truth the  
25 graphite is usually configured so that its

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1 conduction is very high, so even if you get the  
2 front face very hot producing carbon monoxide on  
3 it, it conducts the heat wave so well that it puts  
4 itself out. It's not like a gas cooled reactor core  
5 where all the graphite is very hot, and so there's  
6 no conduction pathway, where here there's always a  
7 conduction path.

8 MEMBER SKILLMAN: Okay, thank you.

9 MR. ADAMS: I mean, a lot of the  
10 graphite is in the form -- you know, it's in the  
11 cladding of some sort. You know, the thermal  
12 columns that normally when -- you know, if you're  
13 not doing something, changing out an experiment,  
14 you know, they're basically a large shielding door  
15 that closes that basically protects the graphite  
16 pile. So, again, you know, in our history we have  
17 not -- we have not seen these issues arise. And  
18 we'll talk a little bit later on how we get  
19 information about what's going on in the world back  
20 to us where we can look for trends, and spot  
21 trends. Indeed in some areas we've seen trends in  
22 the past, and we focused on those trends. So  
23 Argonaut, and again it was a very common reactor,  
24 but right now in the U.S. there's only one that's  
25 still in operation.

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1           Pulstar, there's one Pulstar left in  
2           the U.S., well, there's only two Pulstars. That's  
3           my native reactor technology. I grew up in the  
4           world of Pulstar. It was originally an MTR reactor  
5           designed by American Machine and Foundry, AMF, and  
6           the Pulstar was a conversion of the AMF MTR core.  
7           It went from a high enriched MTR core to a --  
8           actually, it was the first HULU conversion I would  
9           think to a low enriched Pulstar core. It's a pool  
10          reactor, you know, core sits at the bottom of the  
11          pool. Its fuel is unique for research reactors. The  
12          fuel is uranium dioxide pellets in Zircaloy clad.  
13          It looks like miniature PWR fuel. And it's ver low  
14          enrichment. The one I worked at was 6 percent  
15          enriched, the remaining at NC State is 4 percent  
16          enriched, so a lot of uranium-238 in the core, a  
17          lot of Doppler, and that gave it the capability to  
18          pulse, so it was a pulsing reactor. NC State no  
19          longer has the authority to pulse in their license,  
20          and at Buffalo when I was there when we renewed in  
21          the early 1980s we removed the authority to pulse  
22          that reactor from the license, too.

23                 The reactor pulsed, it was a lot of  
24                 complexity you had to go through compared to a  
25                 TRIGA reactor to pulse. The biggest one was that

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1 you had to have pulse core, so the day that you  
2 decide that you needed these fuel elements for  
3 normal steady state operation that was sort of the  
4 end of pulsing. So they pulsed, it was a lot of  
5 things that you had to do, a lot more you had to  
6 do. When I came to the NRC and saw my first TRIGA  
7 they go, you know, you want to see it pulse, and I  
8 said well, wait a minute, just how many days am I  
9 going to have to wait here? And they go okay, you  
10 know, want to see it pulse again? So, you know,  
11 it's an interesting reactor. Like I say, it looks  
12 like -- the fuel looks like miniature PWR fuel.  
13 Because of the uranium dioxide, because of the  
14 Zircaloid, you know that those are materials that  
15 have very high melting points. You know, this  
16 reactor is very safe at 1 megawatt. My Pulstar was  
17 a 2 megawatt. When we renewed we actually made a  
18 case to the NRC to eliminate our emergency core  
19 cooling system, again because of the peak  
20 temperatures that were reached during a loss of  
21 cooling accident that challenged the fuel or the  
22 cladding, and the NRC did that. When we renewed in  
23 the '80s the requirement to have an ECCS was  
24 removed from our license.

25 There's a picture of it. Again, it's at

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1 1 megawatt that your starting to see -- you know,  
2 you're starting to have some capability. Again,  
3 training students is the primary responsibility  
4 but, you know, you have enough neutron flux there  
5 to start doing some good work in the area of  
6 neutron activation analysis. And that's sort of one  
7 of the bread and butter activities that research  
8 reactors do. The joke is, you know, NAA won't get  
9 you from A to Z, archaeology to zoology. You know,  
10 there's a lot of applications.

11           You start seeing experiments on beams.  
12 For example, you see prompt neutron gaps or neutron  
13 radiography. You know, this reactor can do, you  
14 know, good work, but it's also, it's where you  
15 start training the students that, you know, you  
16 can't walk into a place like NIST and use their  
17 beam lines, you know, to train because those beam  
18 lines are so valuable for research. So, it's where  
19 students that become the future researchers, and  
20 that is where they start learning the business. You  
21 can see the intense low positron beam, Ultrical  
22 neutron source, you know, so you see the  
23 technologies that you have at NIST, that you have  
24 at HIFAR, that you have at these very -- at these  
25 high powered, high flux cold neutron facilities, so

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1 this is where they learn to do these things.

2 From a safety point of view, you know,  
3 the accident we look at is the failure of a fuel  
4 pin in the release of the radioactive material in  
5 the gap. But, you know, at these facilities, you  
6 know, you start having significant radiation beams,  
7 you start active -- you know, you start having the  
8 capability to activate materials. And this is where  
9 you start focusing on the safety of the radiation  
10 protection program that you handle materials  
11 properly, that you assume the worst before you --  
12 until you survey it and know what you have, that  
13 you make sure that you don't violate procedures and  
14 interlocks and put yourself into a situation where  
15 there's a beam open. So, you know, you start -- at  
16 1 megawatt you're starting to see those safety  
17 considerations.

18 Pool reactors. This one is kind of  
19 tough. It's a pool reactor, and we sort of break  
20 them up into TRIGAs and you're not a TRIGA. And if  
21 you're not a TRIGA, you normally have MTR fuel, the  
22 plate fuel, but you see a wide range of power  
23 levels and designs here. So, you know,  
24 commonalities, they're in a pool. And later on  
25 we'll -- when we talk about what we've learned from

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1 the inspection program, from the reports from  
2 licensees that, you know, we've learned that pools  
3 are an area where we do look at the aging of those  
4 structures and what can happen.

5 In like water you can see it ranges  
6 from 2,000 gallons to, you know, beyond Olympic,  
7 71,000 gallons, and the pool water there is mainly  
8 for shielding purposes. There's normally a bridge  
9 that the control rod drives and excess external  
10 facilities, and detectors are mounted on. We see  
11 sort of two types where the core is fixed sitting  
12 on the bottom of the pool and the bridge is there  
13 with the apparatus that extends from the bridge. We  
14 also see a design where the core is mounted to the  
15 bridge, and the core can actually move around. That  
16 basically you have your pool, you have your bridge  
17 core assembly, you have some tracks and you can run  
18 that entire assembly up and down the tracks and put  
19 them in different places in the pool. That gives  
20 the licensee some flexibility that for example, you  
21 can run the core up against a thermal column or a  
22 dry chamber and you do certain experiments, you can  
23 put the core, you know, you can move the core away  
24 from those to -- you know, for radiation safety  
25 purposes.

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1           Some of the larger pools actually have  
2           like a gate in the middle of the pool so you can  
3           actually put the reactor in one half of the pool or  
4           the other and theoretically close the gate and drop  
5           the water level in the other half of the pool to do  
6           repairs or maintenance.

7           CHAIRMAN POWERS: So this particular  
8           configuration also makes them somewhat more  
9           seismically bold?

10          MR. ADAMS: So the facilities were --  
11          again, depending on the power level were designed  
12          to withstand seismic events. The lower power  
13          facilities what we find historically, they were  
14          built to building codes or some sort of multiple of  
15          the building codes. The higher power facilities,  
16          when you look at those, there was an acceleration  
17          that was picked and the facility was designed to  
18          withstand that acceleration. You know, like the  
19          discussion we had when we were looking at the NIST  
20          license renewal.

21          What we find is that robustness of  
22          seismic response is proportional to the  
23          consequences of a loss of cooling accident. For  
24          those facilities where loss of cooling results in  
25          ECCS systems, you know, those are the reactors that

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1 you see a -- I would say a more rigorous design as  
2 far as seismic goes. But the answer is that, you  
3 know, like all structures, you know, they're  
4 subject to seismic constraints.

5 The pools come in a couple of different  
6 designs. There's the pools that have liners either  
7 stainless steel or aluminum liners that basically  
8 lines the tank, so from the primary coolant there's  
9 the liner, then there's the cement biological  
10 shield that the pool -- that the tank sits in. And,  
11 you know, these -- the pool structure not only is  
12 it keeping the water in, but in a lot of these  
13 reactors it's also the biological shield, so again  
14 from a response point of view it tends to be a very  
15 robust structure.

16 The other type of pool is the ones  
17 where you've dug a hole in the ground and the pool  
18 lives, you know, in the ground. So there's -- the  
19 ground sort of is --

20 CHAIRMAN POWERS: Well, the interest  
21 comes because you're going through quite a lot of  
22 revision. You are thinking about seismicity in the  
23 Central and Eastern United States, three of your  
24 examples of pool type reactors are located in a  
25 high seismic region of the country, and may not --

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1 I don't know for sure but may not have been  
2 designed for the higher level of seismicity that we  
3 now anticipate in those regions.

4 MR. ADAMS: That's a possibility, and  
5 when that -- when we get to that point, you know,  
6 we'll have to make a decision what we do. Do we  
7 require some upgrading, or given the safety  
8 significance of the failures, do we move forward?  
9 Now, you know, we've sort of had, you know, sort of  
10 introduction to this issue with post-Fukushima  
11 examination of the research reactors. And what  
12 we've done, you know, after we looked at the safety  
13 significance of the various failures in those  
14 reactors, where we focused is on the three highest  
15 powered reactors to understand, you know, where  
16 they are from a seismic response.

17 MEMBER CORRADINI: Just one  
18 clarification. You said it and I just want to make  
19 sure. The five you picked as examples, if my memory  
20 is, at low enough power their MC is such you think  
21 that the coolant could disappear and they're fine.

22 MR. ADAMS: Yes.

23 MEMBER CORRADINI: I mean disappear  
24 literally. That's essentially from a credible  
25 accident just one minute --

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1           mR. ADAMS: Well, for a loss of cooling  
2 accident for most of these facilities we assume  
3 that water just disappears. It makes the  
4 calculations a lot easier. By the time you get up  
5 to Rhode Island, you know, then you start looking  
6 -- you know, asking yourself questions. And at that  
7 2 megawatt threshold, that becomes important. You  
8 know, the reactor has to run 24/7/365 to get that  
9 decay power level up. What we saw for most of these  
10 reactors that -- you know, it could be a 2 megawatt  
11 reactor but if it's running one hour a day, you  
12 know, five days a week, either the decay heat is  
13 not there, or what we see is when you shut down the  
14 reactor, even sometimes with this assumption when  
15 you shut down the reactor that, you know, once  
16 you've been shut down for, you know, five hours, 20  
17 minutes, you know, depending on what the facility  
18 operating history is, you reach a point where the  
19 ECCS system is no longer needed. So it's different  
20 windows here.

21           You mentioned loss of coolant flow.  
22 That's also something we look at for those reactors  
23 that have forced flow. You know, most of these  
24 reactors, you know, up to around 2 megawatts, what  
25 you see is natural convection cooling. What you're

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1 used to seeing at the University of Wisconsin.

2 MEMBER CORRADINI: Right.

3 MR. ADAMS: You know, by the time you  
4 get above it, you know, by the time you get to the  
5 MIT, you know, their natural convection isn't going  
6 to work any more. So you can see they're pool  
7 reactors, but you can see there's a wide range in  
8 power levels here from, you know, Perdue had a  
9 kilowatt and indeed we're looking at -- Perdue has  
10 asked for a power increase I think up to 10  
11 kilowatts for their license renewal, so that's --  
12 you know, we're looking at upping that power level,  
13 but you can it's -- you know, there's a range of  
14 powers here, and you can see some pictures. But  
15 it's mainly the fact that they live in pools.

16 I mentioned stainless steel, aluminum  
17 lined pools. The other one we see are just concrete  
18 pools that are -- some have some epoxy coating on  
19 them. What we've seen is, as these type of  
20 facilities age we see, you know, pool failures  
21 where there's, you know, a loss of primary coolant.  
22 And so what we've done in response to that is, you  
23 know, you look, you know, back in the '70s or '80s  
24 when we evaluate a facility, yes, we did a loss of  
25 cooling accident. You know, the water just goes

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1 poof, and you analyze decay heat and direct SHINE  
2 for the core sitting there until you get the fire  
3 truck or the hose or something. But we didn't look  
4 at what if the pool starts leaking. Now that's an  
5 accident that NUREG-1537 says, you know, licensee,  
6 you need to tell us about that. And the Staff, we  
7 analyze that, so what's the safety significance of  
8 these small leaks determining? So we ask licensees  
9 well, you know, what's the smallest leak you can  
10 actually detect? You know, when you've got 70,000  
11 gallons of water and it's evaporating, and all  
12 these processes are going on, that the loss has to  
13 reach a certain point before you even can recognize  
14 it. So that's one question we asked, what can you  
15 see, and what's the consequence from a public  
16 health and safety point of view if this happens?

17 It turns out the majority of these  
18 reactors at the low powered level, you know, the  
19 water that's in the pool meets Part 20 limits for  
20 either, you know, release to the environment,  
21 release to the sewer. Years ago some facility  
22 director took a drink of primary coolant to show a  
23 tour how safe his reactor was. We didn't like that  
24 but --

25 (Laughter)

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1                   MEMBER SKILLMAN: On that note, what  
2 oversight or what attention is given to the water  
3 itself? The water is great, it's a great shield,  
4 it's a great heat absorber, but if it's the wrong  
5 pH or the wrong chemistry it can doing more harm.

6                   MR. ADAMS: Well, water quality is  
7 important, so there's technical specifications on  
8 conductivity and/or pH. Now in some cases if you  
9 limit -- if you maintain conductivity in these very  
10 low conductivity systems that you end up having a  
11 pH range that you can't go outside of just because  
12 of, you know, the chemistry. So depending on that -  
13 --

14                  MEMBER SKILLMAN: Then my real question  
15 is what oversight or what attention is given to  
16 that through the inspection program?

17                  MR. ADAMS: That's -- when the  
18 inspectors do operations inspections they look at  
19 the records of pH and conductivity.

20                  MR. HARDESTY: There's also a tech spec  
21 limit on conductivity.

22                  MR. ADAMS: Yes, so it's a direct  
23 license requirement. And as an operator you do it  
24 for safety reasons, too. All my in pool lighting  
25 was just bare wires because the water was such high

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1 purity that it wouldn't conduct electricity, so  
2 it's -- you do it to protect structures from  
3 corrosion, you know, some low level corrosion is  
4 going to occur, but the pH and conductivity levels  
5 we look at are sort of adjusted for protecting  
6 stainless steel and aluminum systems. You need to  
7 control water purity to keep activation down  
8 because, you know, the water is going through the  
9 core. Any impurities that are in that water are  
10 going to start activating which is going to give  
11 you a radiation protection problem. So there's  
12 another reason you maintain water quality at a high  
13 level, so it is something we look at.

14 MEMBER SKILLMAN: Thank you.

15 MR. ADAMS: You know, when we -- so we  
16 ask licensees, you know, we look at the radioactive  
17 content of the water, and it turns out, again, as I  
18 said, the water meets Part 20. What we've seen  
19 historically is the isotope that normally in these  
20 high purity systems, that the isotope that normally  
21 is a concern is sodium-24, you know, comes from the  
22 aluminum structures that put aluminum in the water.  
23 I think a 12-hour half-life, so even that isotope,  
24 you know, once the reactor is shut down for a short  
25 period of time, that drops off.

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1           Facilities have replaced pools. When I  
2 worked at Buffalo, we had to replace the pool  
3 because of corrosion, and then the University  
4 replaced the pool a second time. USGS reactor, for  
5 example, replaced the pool. You know, other  
6 licensees, the cement pools that are epoxy lined  
7 that we've had licensees that have basically, you  
8 know, done maintenance to remove the coating and  
9 re-coat the pool. I think, for example, Penn State  
10 did that maintenance. So we look for that type of  
11 aging and when the licensees discover it, they take  
12 steps to address it; address it through actively  
13 fixing things. TRIGA reactors, a certain type of  
14 TRIGA we find that if they develop a small leak  
15 it's normally sort of in the same place, and that  
16 can be prevented by maintaining water temperature  
17 within a certain range. It turns out that it's --  
18 that sort of run up and run down of temperature  
19 which really is, you know, stresses out these  
20 structures. So it is an anticipated operational  
21 occurrence that the licensees have to tell us about  
22 and we analyze, pool failure and heat exchanger  
23 failure.

24           CHAIRMAN POWERS: At this point, I think  
25 we will interrupt for about a 15-minute break, and

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1 return because I know that once you're through  
2 these backgrounds we're going to get into the  
3 subject of some interest which is the findings that  
4 have occurred over time. So let us return at 11:00.

5 (Whereupon, the proceedings went off  
6 the record at 10:42 a.m., and went back on the  
7 record at 10:59 a.m.)

8 CHAIRMAN POWERS: Are we ready to come  
9 back into session? Mr. Brown, you had a question?

10 MEMBER BROWN: Yes, if I can find my  
11 chair before I leave since I was attacked on my way  
12 out.

13 CHAIRMAN POWERS: This is a very  
14 hazardous subcommittee. People get attacked.

15 MEMBER BROWN: Yes.

16 CHAIRMAN POWERS: Actually, only  
17 Charlie gets attacked.

18 MEMBER BROWN: I'm used to it. It's on  
19 the pool reactors. You talked about conductivity  
20 and that the conductivity was kind of the metric  
21 you use for ensuring that the water stayed okay and  
22 didn't --

23 MR. ADAMS: Right. Conductivity and/or  
24 pH.

25 MEMBER BROWN: Okay. Fine. Is that a

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1 sampled thing, or is that a continuously monitored  
2 --

3 MR. ADAMS: Most facilities have --  
4 makeup demineralizers and cleanup demineralizers.  
5 There's normally a conductivity meter on the intake  
6 to the cleanup demineralizer. So, they, you know,  
7 they have an instrument that's continuously looking  
8 at it. They, you know, they --

9 MEMBER BROWN: Based on the input,  
10 right?

11 MR. ADAMS: Yes. Yes.

12 (Simultaneous speaking.)

13 MR. ADAMS: It's before the water --  
14 it's before the water is cleaned up, you know. For  
15 purposes the tech specs say, you know, tech specs  
16 will say, you know, once a week, once a -- there  
17 will be a period that they actually have to take  
18 the measurement and write it down.

19 MEMBER BROWN: So, and that's -- is  
20 there any -- on the pool reactors, is there a flow  
21 such that you don't have stratification in these  
22 pools, I mean, if it's a static pool, or is it a --  
23 and I don't mean a forced cooling type, but is  
24 there some minimal flow to prevent stratification  
25 so that you don't get pH or conductivity

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1 stratification within the pool itself?

2 MR. ADAMS: I don't -- we haven't seen  
3 anything like that.

4 MEMBER BROWN: Would you know?

5 CHAIRMAN POWERS: As soon as you turn  
6 the reactor on, you're going to get --

7 (Simultaneous speaking.)

8 (Laughter.)

9 MR. ADAMS: Normally the reactor -- the  
10 reactor stirs up the water pretty good.

11 MEMBER BROWN: Just through natural  
12 circulation --

13 MR. ADAMS: And even forced  
14 circulation, you know. Normally the, you know, the  
15 return lines into the pool are nowhere near the,  
16 you know, near the suction from the core to get  
17 that -- to get that circulation.

18 You know, can you get stratification?  
19 To some extent, but what we've seen is, you know,  
20 again the environment is an environment that pH  
21 and/or conductivity would not change rapidly, you  
22 know.

23 There's just -- it's, you know,  
24 temperatures from bath water to, you know, 110, 120  
25 degrees Fahrenheit, atmospheric pressure. There's

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1 just, you know, there's not a driver there to send  
2 conductivity or pH, you know, out of, you know,  
3 that would be an acceptable band quickly. I mean,  
4 we've never seen, you know, we've never seen that.

5 MEMBER BROWN: But you say you only  
6 monitor it maybe once a week or something to write  
7 it down. I mean, is there an alarm on the  
8 conductivity or anything to measure it?

9 MR. ADAMS: Normally not.

10 MEMBER BROWN: So, there's no concern  
11 that you would have some difficulty with the  
12 conductivity or pH increasing to the point where it  
13 would be degrading within a week's period.

14 MR. ADAMS: Right. I mean, I'm not  
15 aware of anybody having to stop operation because  
16 of conductivity or pH.

17 MEMBER BROWN: Okay. Thank you.

18 MR. ADAMS: Again, it's just, you know,  
19 it's just a -- it's just a -- just because of the,  
20 you know, the operational conditions of the system.

21 MEMBER SKILLMAN: Alex, I think it's  
22 safe to say that most of the people who operates  
23 these pool reactors don't anticipate water  
24 chemistry excursion. And the data probably show  
25 that for many, many years these pools remain clean,

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1 quiescent, managed. And I think I heard you just  
2 say to Charlie you've never known of a significant  
3 excursion.

4 I would ask you to think hard about  
5 that. It doesn't take much for an excursion to  
6 accelerate on its own. A slight amount of organic  
7 material with the pool at about eight parts per  
8 million oxygen, which is where they run at  
9 atmospheric temperature and pressure, can become  
10 quite a problem very quickly.

11 MR. ADAMS: And so, you said that --  
12 you've triggered my memory. There is an event that  
13 happened a while back where there as an issue with  
14 pool water quality. And the licensee picked up on  
15 that really quick and looked, you know, looked for  
16 the cause of it.

17 I think that's in the --

18 (Off mic comment.)

19 MR. ADAMS: Yeah. Strangely enough  
20 they -- it's a facility that did research with --

21 (Off mic comment.)

22 MR. ADAMS: AFRRI, yeah. That they --  
23 that it was either the animals that, you know, that  
24 they used in their research, or even the floor wax  
25 they were looking at that was, you know, that was

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1 used on the floor.

2 So, yeah, there has been one event  
3 where the, you know, the licensee, you know,  
4 realized there was an issue quickly and tracked it  
5 down.

6 You know, even though there's a  
7 requirement that, you know, that this information  
8 gets, you know, written down for compliance issues,  
9 you know, showing the NRC, you know, at a certain  
10 periodicity to meet the tech specs, what we see is,  
11 for example, you know, each oncoming shift does a  
12 walk-down of the plant.

13 And, you know, even though for  
14 regulatory purposes I wrote down a number once a  
15 week every, you know, at least once a shift if the  
16 reactor is running, you know, these systems are  
17 looked at that there is startup check sheets,  
18 shutdown check sheets.

19 So, you know, things like conductivity  
20 meters are looked at with, you know, with a greater  
21 regularity than required by the technical  
22 specifications.

23 MEMBER SKILLMAN: Thank you.

24 MR. ADAMS: Let's see. Where were we?  
25 Tank reactors. So, tank reactors, the design

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1 feature they have there is the reactor lives in a  
2 tank. The reactor at Missouri is slightly  
3 pressurized, about 70-75 pounds.

4 I say normally used for the highest  
5 power reactors. If you go to the next slide,  
6 you'll see the first tank reactor we talk about is  
7 General Electric at a hundred kilowatts. So, again  
8 it's -- you see a lot of different design features.

9 The GE reactor is sort of unique in  
10 that its fuel form is unique. The fuel looks like  
11 silver dollar size which are on a, you know, which  
12 you're going to skewer and, you know, and put on  
13 your grill. the fuel silver dollars are on a  
14 structure that holds them and then those are the  
15 fuel elements that go into the tank.

16 The other two research reactors, you  
17 know, MIT, the reactor is located in the tank.  
18 Missouri, the reactor is located in the tank. The  
19 difference between Missouri and MIT, the reactor at  
20 Missouri, the tank that the reactor is in, is in a  
21 pool. In the case of MIT, the tank is -- the tank  
22 is self-contained.

23 So, you know, at this point you're, you  
24 know, you're at higher power levels, five  
25 megawatts, ten megawatts, you know, different uses,

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1 you know, different safety concerns come into play  
2 for these reactors.

3 MEMBER CORRADINI: So, I guess in the  
4 previous stuff, I thought MIT would be with MURR as  
5 a 104c.

6 Is it a 104a because of their former  
7 boron neutron capture here?

8 MR. ADAMS: So, MIT is the only reactor  
9 that's licensed under 104a. So, if you read their  
10 license, the license will say in, you know, in  
11 accordance with sections 104c and 104a of the Act,  
12 blah-blah, blah-blah, blah-blah.

13 MEMBER CORRADINI: And the reason is  
14 the BNCT?

15 MR. ADAMS: Yeah. And if you look  
16 historically, it appears back in 1957 when they put  
17 in their application. They said we want one of  
18 these and one of these, and the AEC said, here you  
19 go.

20 MEMBER CORRADINI: Okay. Thank you.

21 MEMBER REMPE: So, they did a  
22 re-licensing not long ago.

23 MR. ADAMS: Yes.

24 MEMBER REMPE: And why did they keep  
25 the 104a? Because it's not really being used.

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1 MR. ADAMS: There are -- so, there was  
2 a lot of work done in BNCT in the late '50s, early  
3 '60s. And then in the late '90s there was another  
4 interest in BNCT and MIT did, you know, did come to  
5 us and there was a lot of discussions we had and  
6 put a -- developed a tech spec specifically for  
7 BNCT. And they did do a number of radiations on  
8 humans using the 104a license.

9 And BNCT is still a technology that is  
10 being actively researched at a number of  
11 facilities. There are facilities that are doing  
12 animal studies.

13 The focus of the research in this area  
14 now is improving the boron-containing drugs to  
15 deliver more boron to the tumor. So, it's still an  
16 area of research and development. They didn't want  
17 to close the door. And indeed if you're familiar  
18 at MIT, the original medical room under -- there's  
19 a medical room underneath the reactor. They built  
20 a -- they built a neutron multiplier that fed into  
21 a beam line, which went to a new irradiation room.

22 So, they put a lot of effort into  
23 updating the facility. And that was done through  
24 license renewal.

25 Next. By the time you get to, you

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1 know, by the time you get to these reactors you see  
2 a large number of, you know, of teaching, but you  
3 also see a lot of research.

4 Missouri is -- their primary focus is  
5 on life sciences. They make a number of isotopes  
6 that end up being radiopharmaceuticals. You start  
7 seeing neutron radiography, neutron tomography, a  
8 lot of imagery with neutrons.

9 Explosives, all I'll say is that  
10 there's a lot of facilities who tech specs allow  
11 radiation of explosives. We rarely see these  
12 experiments being done.

13 There was a lot of work done in this  
14 area like back in the '50s and '60s. For example,  
15 the Army built a research reactor just to do  
16 radiography on explosives, but it's one of these  
17 things that, you know, that they keep it in their  
18 technical specifications and we evaluate it.

19 NAA, again a lot, you know, a lot of  
20 capability with NAA teaching. BNCT research,  
21 there's only a number of facilities that are  
22 actively pursuing it. Research and training.

23 General Electric, that reactor  
24 supported, you know, General Electric control and  
25 research in the fuel.

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1           With Aerotest being shut down at the  
2 moment they -- GE does a lot of radiography on  
3 things like explosive bowls, explosive cords,  
4 turbine blades for high-performance engines.

5           Again, you see -- you see a large  
6 number of experimental facilities, beam ports,  
7 systems radiography. We see in-core facilities,  
8 pneumatic transfers, you know. We see a lot of  
9 facilities and, again, you know, the safety focus  
10 is internal to the users making sure that they  
11 handle the sources of radiation properly.

12           Next. Critical assembly facilities.  
13 Well, actually the S there is a little too much.  
14 There's one reactor license as a critical assembly.  
15 It's a research reactor that's owned by RPI.

16           It was licensed as a critical assembly  
17 originally. The original licensee of that facility  
18 was ALCO, the American Locomotive Corporation.  
19 They were one of the companies that was doing the  
20 Army -- that developed the Army package power  
21 reactors. And this was ALCO's critical assembly  
22 for doing the core research on the Army reactors.

23           It's still licensed as a critical  
24 assembly although RPI uses it as a research  
25 reactor. Historically there's been about 25-30

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1 critical assemblies licensed. So, its RPI, it runs  
2 at a hundred watts.

3 It was -- a HEU reactor. It was  
4 converted to LEU and DOE took a very interesting  
5 approach to converting the reactor. So, you can  
6 see it's UO2 pellets and stainless steel tubes.  
7 What it's fueled with now is surplus fuel elements  
8 from the SPERT program that DOE had. So, it's  
9 basically SPERT fuel.

10 It has a design feature similar to the  
11 argonaut where you can drain the water out of the  
12 tank as an additional way of shutting the reactor  
13 down. Like I say, it's -- the university's use of  
14 it is like a research reactor, not really a  
15 critical --

16 MEMBER BALLINGER: As a point of local  
17 interest at the current -- currently they're  
18 building a casino --

19 MR. ADAMS: Yes, we're aware of that.

20 MEMBER BALLINGER: -- that's wrapping  
21 around this reactor. They refuse to sell the  
22 reactor. And so, they want to build a casino on  
23 the bank of the Mohawk River, which is where this  
24 is, and are building the casino around the reactor.

25 MR. ADAMS: And apparently they're

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1 going to make the reactor look like --

2 MEMBER BALLINGER: Going to make it  
3 look like a casino, I guess. I don't know.

4 MR. ADAMS: Yes, we're aware of it.  
5 And, you know, they're not on site. So --

6 (Laughter.)

7 MR. ADAMS: Next. TRIGA stands for  
8 Training, Research, Isotope-production, General  
9 Atomics. General Atomics was the developer of the  
10 TRIGA. It's probably the most common reactor  
11 design in existence.

12 Their pool reactor is light water  
13 moderated. Solid homogeneous core. They have  
14 pulsing capability. You can see the power levels  
15 in the U.S. range from 250 kilowatts to 2.3  
16 megawatts.

17 The unique part about it is the  
18 zirconium hydride fuel has a very strong negative  
19 temperature coefficient which allows the reactor to  
20 pulse.

21 My understanding is during development  
22 GA pulsed these reactors to, you know, very high  
23 power levels, you know, four or 5,000 megawatts  
24 during fuel development. So, 16 of them.

25 Their fuel pins, aluminum clad,

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1 stainless clad. The original fuel was the aluminum  
2 clad. There's not a lot of aluminum clad left out  
3 there being used. The second type of fuel was the  
4 stainless steel clad.

5 Fuel comes in low enriched, high  
6 enriched -- used to. High enriched is gone.  
7 There's multiple fuel densities that you'll see out  
8 there.

9 From an accident analysis we assume a -  
10 - the hot pin fails in air and releases its fission  
11 products in the gap to the atmosphere. The failure  
12 mechanisms for aluminum fuel and stainless steel  
13 clad fuel differ.

14 The stainless steel clad fuel has a lot  
15 higher temperature safety limit than the aluminum  
16 clad fuel. And they're all natural convection  
17 cooled.

18 A lot of tank configurations.  
19 In-ground, several biological shields, several  
20 unique applications, fixed cores, movable cores.  
21 The design feature that links them together is the  
22 fuel.

23 General Atomics developed and marketed  
24 what we call TRIGA convert -- what was called TRIGA  
25 conversion, and still is. And that was not a

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1 conversion from HEU to LEU. It was a conversion  
2 where they developed a grid, a box that held four  
3 fuel elements that would go on an MTR grid plate.

4 So, there was a number of original MTR  
5 reactors. that converted to TRIGA so that they,  
6 you know, they have the square grid plate that you  
7 would expect to see with the MTR. Only when you  
8 look down, you see TRIGA fuel elements and they  
9 have pulsing capability. They were given a pulse  
10 rod.

11 Pulse rod, it's a pneumatic rod. You  
12 use air to eject a rod from the reactor and the  
13 reactor pulses.

14 There was technical specification  
15 limits on how much reactivity can be introduced in  
16 these pulses. And it's one of the when we license  
17 these, the TRIGA is one of the things that we do  
18 take a careful look at.

19 Again, used for a variety of purposes.  
20 Teaching neutron activation analysis. The facility  
21 at University of California-Davis that was built by  
22 the reactor -- built by the Air Force was  
23 originally built to do neutron radiography on the  
24 F-111 wings and parts. So, it's sort of a unique  
25 setup that fills with radiography bays around --

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1 surrounding the reactor.

2 So, there's a lot of different  
3 configurations. Dry thimbles, dry tubes, beam  
4 ports, rotary specimen rack called a "lazy Susan"  
5 sort of because it -- you put your samples in it  
6 and the rack spins around for you to get even  
7 radiation. So, a lot of different ways of doing  
8 it.

9 The testing facility, I think we talked  
10 about that one earlier to a large extent. So, that  
11 is the reactor at NIST, the 20 megawatts. You can  
12 see it's U308 aluminum clad plates. 93 percent  
13 enriched cladding aluminum. There's some cadmium  
14 there to control peaking.

15 It's our only heavy-water cold reactor  
16 that exists. Heavy-water coolant, moderator,  
17 reflector. That's another reason why you want to  
18 have a tank reactor if you're using heavy water  
19 that you want to keep your very expensive heavy  
20 water from picking up moisture from the atmosphere.

21 CHAIRMAN POWERS: This is one of the  
22 few reactors that uses the thermodynamically  
23 unstable fuel.

24 MR. ADAMS: I'm sorry.

25 CHAIRMAN POWERS: Thermodynamically

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1 unstable fuel.

2 MR. ADAMS: What do you mean by that?

3 CHAIRMAN POWERS: Well, were I to take  
4 that fuel and warm it up a little bit, it would  
5 turn into aluminum oxide and probably uranium  
6 dioxide, I would guess, but don't know that for a  
7 fact. And that would be a very exothermic reaction  
8 when it turned into aluminum oxide.

9 (Off mic comments.)

10 CHAIRMAN POWERS: Well, it is a  
11 permitted compound that they have created here.

12 MR. ADAMS: And sitting here I can't  
13 respond to that in any detail, you know. My guess,  
14 that was an issue that was looked at, you know,  
15 during re-licensing and probably looked at by the -  
16 -

17 CHAIRMAN POWERS: I doubt it was looked  
18 at. It's universally ignored. But nevertheless it  
19 exists as an issue and I wonder why it is  
20 universally ignored.

21 MR. ADAMS: I can't answer that  
22 question sitting here.

23 The high-performance reactors, NIST,  
24 MIT, Missouri, are in the queue to undergo  
25 conversion to LEU. And, you know, at that point

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1 the fuel form is, you know, will end up changing  
2 significantly in these reactors.

3 Nothing new there. It's, you know,  
4 things we touched upon as we went through it. NIST  
5 is unique in that they're the only facility that  
6 does have a significant cold neutron source that if  
7 you get out there, there's an entire neutron guide.

8 Medical radioisotope facilities, you  
9 know, that's what we're looking at, at the moment.  
10 That's the future. And I'm not going to say much  
11 about that because, you know, the Committee, you  
12 know, spent a lot of time looking at the SHINE  
13 design for the construction permit and will, you  
14 know, will be back in front of the Committee when  
15 we get to the point where -- on the Northwest  
16 review where we, you know, we need to come to you  
17 and SHINE and Northwest will be back for operating  
18 licenses.

19 MR. HARDESTY: The one thing I do want  
20 to bring out here is that they are Class 103. So,  
21 they are not eligible for a non-expiring license.  
22 They will have to do license renewal under Class  
23 103 licensing.

24 MR. ADAMS: So, talk about the  
25 inspection program and then talk about some of the

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1 findings we've seen.

2 So, the inspection program, it's a  
3 graded program given the safety significance of the  
4 facility, safety inspections Class I, Class II, and  
5 it's based on power level.

6 Through two megawatts and up you're a  
7 Class I facility. If you're less than two  
8 megawatts, you're a Class II facility. There's  
9 also a Class III facility, which our facilities are  
10 permanently shut down and waiting for  
11 decommissioning.

12 Those inspections are over at NMSS that  
13 once a reactor shuts down and we get the tech  
14 specs, at a certain point the facility is  
15 transferred over to NMSS.

16 So, the difference between these,  
17 there's different inspection procedures. They  
18 basically cover the same material. You'll see the  
19 Class I procedures are -- have more detail in them  
20 in the various areas.

21 The amount of time the inspectors spend  
22 on site at the Class I is greater than the Class  
23 II. So, normally on Class I the -- for safety  
24 inspection the inspector will be on site two weeks  
25 a year. For a Class II the inspector will be on

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1 site one week a year.

2 The difference is the Class I  
3 inspection program is -- the inspection program  
4 cycles annually. The Class II inspection programs  
5 cycle every two years.

6 There are security inspections that are  
7 based on SNM possession limits. Basically, you  
8 know, what Cat you are. And, again, the inspection  
9 program is based on your categories. You can see  
10 your -- the Cat, the three testing facilities get a  
11 one-week security inspection over two years. The  
12 Cat III is a one-week inspection over three years.

13 So, that's sort of the nuts and bolts  
14 of the program. There are also --

15 MEMBER SKILLMAN: And, Al, before you  
16 go on --

17 MR. ADAMS: Yes.

18 MEMBER SKILLMAN: -- let's go back to  
19 50 for a second.

20 MR. ADAMS: Yes.

21 MEMBER SKILLMAN: Should the licensees  
22 of the Class I and Class II reactors anticipate  
23 that there will be drop-in visits by the  
24 inspectors, or are the two one weeks for the Class  
25 I and the two one-weeks over two years for Class II

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1 the only inspections that are applied to these  
2 licensees?

3 MR. ADAMS: So, those are the normal  
4 scheduled inspections. And indeed a lot of the  
5 time the inspector will call up and, you know,  
6 arrange when the inspection will occur with the  
7 facility to, you know, to make sure that they can,  
8 you know, that their impact on facility operations,  
9 teaching them that will be minimized, you know.  
10 Normally, you know, don't try to show up during  
11 final exams week or something like that.

12 However, we do have the, you know, the  
13 authority, you know, just like at any NRC facility  
14 we can show up, you know, whenever we want. And  
15 the regulations require unfeathered access.

16 And indeed, you know, at the 20, you  
17 know, like University of Missouri, that's a  
18 seven-day-a-week 24-hour day operation, you know.  
19 Our inspectors have dropped in unannounced at 2:00  
20 in the morning and knocked on the door.

21 So, you know, so we do -- we do, you  
22 know, we do exercise, you know, the right to come  
23 in and inspect whenever we want.

24 If there's an event or we see something  
25 that would justify more inspection time or special

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1 inspections, they do occur.

2 So, you know, a lot of these, you know,  
3 if a licensee calls in with an event, we'll look at  
4 that event, you know, run it through the processes.  
5 And if, you know, if a special inspection needs to  
6 occur, you know, we go through that process.

7 So, it basically follows the same  
8 processes, inspection, enforcement processes as any  
9 other facility.

10 MEMBER SKILLMAN: Okay. Thank you.

11 MEMBER REMPE: So, how does your -- or  
12 how do your inspections interface with like OSHA  
13 inspections for a reactor facility? Because I've  
14 been in some of them and I'm just wondering  
15 especially with the next slide, do you -- is there  
16 overlap or do you say, ah, that's their issue and -  
17 -

18 MR. ADAMS: Well, OSHA does not -- this  
19 is my understanding, because I'm not an expert in  
20 this. My understanding is OSHA does not actively  
21 inspect NRC facilities.

22 Is there someone from the inspection  
23 branch out there?

24 Mike, could you come to the microphone  
25 and --

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1 MR. MORLANG: Sure.

2 (Pause.)

3 MR. MORLANG: My name is Mike Morlang  
4 with the NRR/PROB Oversight Branch, inspector for  
5 research and test reactors.

6 We routinely share information with  
7 OSHA. We'll look at their reports if they've done  
8 an inspection at the facility. And ours are  
9 obviously public information, the safety report.  
10 So, if there's something identified, we do share  
11 that information.

12 We have a fairly good working  
13 relationship, I guess would be the way to put it.

14 MEMBER REMPE: How often -- so, they do  
15 actually inspect facilities, is what I'm hearing  
16 from you.

17 MR. MORLANG: Some.

18 MEMBER REMPE: And how often do they  
19 come in?

20 MR. MORLANG: They -- OSHA just started  
21 doing that a few years ago. So, it's fairly new  
22 that they started doing that.

23 The universities weren't under OSHA at  
24 some time, and now they are.

25 MEMBER REMPE: Okay. Thank you.

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1 MR. ADAMS: I think as an inspector if  
2 you -- if there's an event that is obviously, you  
3 know, it's not nuclear safety, but it is industrial  
4 safety and, you know, we're aware of it, we will  
5 pass that information on.

6 MR. MORLANG: Exactly. We'll identify  
7 it on the spot to the facility individuals.

8 MR. ADAMS: Yeah, and they'll look at  
9 it to see if there's any nexus to nuclear safety,  
10 you know. If something occurs and it's, you know,  
11 poor safety culture or, you know, some other issue  
12 that can find its way back to, you know, to nuclear  
13 safety, then we will look at that.

14 MS. GAVRILAS: This is Mirela Gavrilas.  
15 Just a small anecdote. I remember many years ago  
16 when I was at the University of Maryland somebody  
17 slipped on the stairs in the reactor and OSHA  
18 became involved after there was an incident in the  
19 reactor.

20 So, their involvement with research  
21 reactors is not new, but it used to be, as far as I  
22 know, incidental in the past.

23 MEMBER BALLINGER: Do I recall that  
24 when the SHINE people came in, I thought there was  
25 a much clearer distinction between the NRC

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1 inspection regime and the non-NRC safety chemical -  
2 - do you recall, Dana?

3 CHAIRMAN POWERS: Well, we have, I  
4 mean, there's a memo of understanding on this that  
5 they don't look at the nuclear --

6 MEMBER BALLINGER: Yes.

7 CHAIRMAN POWERS: -- aspects of  
8 facilities.

9 MEMBER BALLINGER: Yes.

10 MR. ADAMS: There it's, you know,  
11 because the other part of SHINE was the production  
12 facility. And there, you know, we're looking at  
13 licensed material commingled with chemicals and can  
14 that create a problem.

15 So, we looked -- so --

16 MEMBER STETKAR: And my recollection  
17 was NRC inspected anything that contained nuclear  
18 material. OSHA was everything else in the process  
19 --

20 CHAIRMAN POWERS: Yes.

21 MEMBER STETKAR: -- on a production  
22 facility.

23 CHAIRMAN POWERS: Right.

24 MR. ADAMS: So, we looked at violations  
25 from 2010 to 2016 and binned them and here's what

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1 we came up with: We identified 28 violations. And  
2 as you can see, 20 are what we consider  
3 operational. Operator error, tech spec, procedure  
4 violations.

5 Eight of them were what we call  
6 administrative, you know, you didn't fill out the  
7 form, posting and signage. We saw none related to,  
8 as you see, material deficiencies, inoperative  
9 equipment.

10 MR. HARDESTY: Yeah, I just wanted to  
11 add in the binning of these there were material  
12 failures, but the material failures in and of  
13 themselves did not cause a violation. It was the  
14 operator failing to recognize what the material  
15 deficiency was and then doing something afterwards  
16 that ended up being a violation.

17 So, there was some material failures,  
18 but they actually got analyzed and binned in as  
19 operational, because ultimately the violation was  
20 related to the operator not doing the right thing  
21 after material failure happened. And there was a  
22 couple of those.

23 MEMBER SKILLMAN: How did you come to  
24 be aware of these 28 violations?

25 MR. HARDESTY: A good number of them

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1 are self-identified and -- but there are also a  
2 good number of them that are found during our  
3 routine inspection program. And Mike could speak  
4 at great length about that.

5 MEMBER SKILLMAN: Let me ask a deeper  
6 question. What formal process makes sure that the  
7 licensees are reporting when there is a deficiency?

8 MR. ADAMS: Well, yes. So, it -- so,  
9 reporting requirements come from several places.  
10 Some of them are in the regulations. For example,  
11 in the back of Part 20 if you have an incident  
12 that, you know, creates an overexposure or, you  
13 know, or large amount of contamination, there's  
14 requirements in the regulations to report events.

15 Every set of tech specs has a  
16 definition, a standard definition of reportable  
17 events that the licensee within a certain period of  
18 time, and mostly that case is the next working day,  
19 has to pick up the phone and tell us about it. So,  
20 it's a requirement of the regulations and the  
21 license technical specifications.

22 You know, the regulations require that,  
23 you know, that the licensees be truthful with us,  
24 that everything they tell us is truthful and  
25 accurate. So, you know, that's part of it, too.

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1 Am I answering your question?

2 MEMBER SKILLMAN: Well, actually you're  
3 providing very good bait for more questions.

4 MR. ADAMS: Well, that's fine.

5 MEMBER SKILLMAN: Let me ask a  
6 question. It seems to me that part of what started  
7 this activity was the recognition that licensees  
8 were either tardy in reporting or having difficulty  
9 in assembling their licensing basis.

10 That caused a backlog after  
11 approximately 2001. That led to activities for  
12 streamlining that brings us to today's meeting.

13 And so, from my somewhat jaded point of  
14 view, this whole thing begins with some  
15 difficulties by the licensees to assemble the  
16 resources that are necessary to keep their licenses  
17 updated.

18 And hiding in that culture, hiding in  
19 that culture can be either a reluctance or an  
20 inability to report issues that are safety  
21 significant. And that's why I'm really asking the  
22 question.

23 How do we know that the information you  
24 provided here is all there is, or could there be a  
25 pot of information that is very significant and you

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1 are also not aware of it?

2 MEMBER CORRADINI: Can I ask a side  
3 question? So, that's a potential motivator, but my  
4 memory is since I've been involved in this with all  
5 the re-licensing, a lot of this just -- there was a  
6 big backlog because everything came -- all the  
7 initial -- a lot of the research reactors all got  
8 licensed in the late '50s and '60s and you guys got  
9 inundated by a large group of them simultaneously.

10 MR. ADAMS: Right. I mean, the backlog  
11 came from a couple of things. One was timing that  
12 in the early 2000s the 20-year license renewals  
13 that were done on these -- so, mostly, as you can  
14 see from the earlier slide, most of these  
15 facilities were licensed in the '60s.

16 And we licensed them for -- you pick a  
17 number. We handed that out as a term. Three  
18 years, seven years, ten years, 20 years, 30 years,  
19 40 years. We handed them all out.

20 And what happened is the 20-year  
21 licenses came up for renewal in the '80s. TMI  
22 basically stopped regulation of research reactors  
23 for several years. I was a licensee. I didn't see  
24 an inspector for like three or four years. There  
25 was a backlog there.

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1           The staff, you know, streamlined and  
2 renewed a number of licenses in a short period of  
3 time that -- licenses from the '80s came due in the  
4 early 2000s, and the 40-year licenses that were  
5 granted in the 1960s came due in the early 2000s.

6           So, all these renewals came in, 9/11  
7 occurred. And for two, three years after 9/11, I  
8 did, and all the other senior project managers, was  
9 security assessment, security work. All this was  
10 set on the side.

11           So, those two things, and these were  
12 the first license renewals that the staff was  
13 reviewing with the benefit of NUREG-1537. There  
14 was, yeah, these renewals have generated a lot of  
15 RAIs. And that's basically to bring that yardstick  
16 we're using to be the same yardstick across the  
17 plate. So, all those things occurred, you know.

18           Reporting events, you know, could a  
19 licensee decide that they're going to be purposely,  
20 you know, hide things from us. I mean, you know, a  
21 licensee can do that. I mean, sooner or later  
22 we're going to find that out.

23           The worst thing you can do is be  
24 deliberate and willful. And, you know, you've seen  
25 that through how the NRC has handled enforcement

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1 cases in the past.

2 So, you know, there's an assumption  
3 there that, you know, it's trust, but verify. So,  
4 we expect licensees to report their problems to us,  
5 and they do and there's some advantage, you know.

6 If you discover it yourself, report it  
7 to us and take aggressive action. The enforcement  
8 program gives you credit for doing that versus, you  
9 know, we found it and, you know, that there wasn't  
10 corrective action. And the NRC will do what it  
11 takes.

12 Early in my career when I came here, we  
13 got -- I got involved with Georgia Tech who had  
14 issues that those issues could not be, you know,  
15 the licensee was not addressing those issues. We  
16 ordered that licensee to stop doing experiments.  
17 The problems continued. We ordered that licensee  
18 shut down until they fixed their, you know, cleaned  
19 their house.

20 So, you know, the NRC has all the  
21 normal enforcement and regulatory tools to maintain  
22 safety, you know, as anybody else. And it's back  
23 to that question, you know, looking at a license  
24 renewal every 20 years, will that, you know, would  
25 that have prevented what we've seen in the area of

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1 enforcement? And we don't think so.

2 And the next slide we'll talk about,  
3 you know, some of the, you know, some of the  
4 categories these have fallen into.

5 MEMBER SKILLMAN: And let me just  
6 follow up. What I hear you saying, Al, is, hey, we  
7 think this 28 is a pretty good number from 2010 to  
8 2016. And we also think that prior to 2010 there  
9 were not at least purposeful violations, and we  
10 really don't think anything significant happened  
11 back in those earlier years.

12 Is that an accurate interpretation? It  
13 gets to the idea of not having to renew these  
14 licenses, because not renewing licenses can be a  
15 golden pathway to take no action in a lot of  
16 activities.

17 And if take no action in a lot of  
18 activities means I don't have to report at least as  
19 strenuously as I did before, then granting a  
20 no-cessation license is almost a license to do  
21 nothing unless the behavior has been demonstrating  
22 that the licensees really are reporting.

23 MR. ADAMS: And the license renewal  
24 process doesn't look at that beyond, you know, do  
25 they have the standard tech specs that define what

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1 a reportable event is and when they have to report  
2 it.

3 When those actions are carried out as  
4 mainly the inspection program, we do the license  
5 renewal, we go back and look at inspection reports  
6 as part of the license renewal, but the project  
7 managers, you know, if I'm a project manager for a  
8 facility every time the section report is issued,  
9 you know, not only do we have close communications  
10 with the inspectors because, you know, we're two  
11 different branches joined at the hip, but, you  
12 know, we read the inspection reports, we talk to  
13 the inspectors before they go out, we talk to the  
14 inspectors when they come back. So, you know, the  
15 inspection program watches what's going on.

16 We believe that the licensees report  
17 the problems that occur and, you know, the problems  
18 have different safety significance, you know.

19 Although it's not very common, there is  
20 the occasional severity Level 3 problem. We have  
21 written over the history of the research reactor  
22 program, we have issued several civil penalties.

23 Normally they end up being in the area  
24 of discrimination, but we have issued civil  
25 penalties for safety issues before.

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1 MS. GAVRILAS: So, this is Mirela  
2 Gavrilas. I want to piggyback on what Al just  
3 said. We actually issued a civil penalty very  
4 recently and it was for a situation where we had  
5 some questions about the safety culture.

6 And that facility went through what we  
7 all thought collectively were extraordinary  
8 compensatory measures, yet we still issued the  
9 civil penalty because the buck stops there, you  
10 know. We have to set a line. And that's a very  
11 recent experience.

12 MR. ADAMS: Some measures they took,  
13 you know, new facility director. They brought in  
14 an external committee from the TRTR community to  
15 look at, you know, to look at the facility with  
16 outside eyes and basically do an out of the  
17 facility and, you know, and tell, you know, the  
18 licensee, the university what they saw, you know.

19 In addition to the inspection program,  
20 the required, you know, the requirement for  
21 reportable events, there's also requirements for  
22 safety committees that not only the safety  
23 committees have a set number of items they, you  
24 know, review as part of their actions, but there's  
25 also an audit requirement that the safety committee

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1 is periodically auditing the operations, looking  
2 for problems that maybe the operations folks have  
3 missed or looking for trends that maybe they're not  
4 seeing.

5 So, there's a lot of processes that are  
6 in place that license renewal or lack of license --  
7 that process of going through a license renewal are  
8 not -- we believe are not going to affect.

9 MEMBER SKILLMAN: Okay Thank you.

10 MR. HARDESTY: I wanted to add to that,  
11 too, because you mentioned safety culture  
12 specifically. We as an organization have went  
13 through several phases where we've, you know, tried  
14 to impart on the licensees the importance of the  
15 safety culture. And that's no different in our  
16 organization.

17 We have met -- we traditionally go to  
18 the annual test research and training reactor  
19 annual meeting and we give presentations. They  
20 call it NRC Day. And we bring representatives from  
21 the safety culture branches with us to talk  
22 specifically about it.

23 We have interchanges with our licensees  
24 about safety culture. So, we're very much trying  
25 to instill that in them.

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1           And at the same time in my own personal  
2 experience, these reactors aren't driven by a  
3 commercial or profit focus. They're doing  
4 research.

5           And so, they are more -- they tend to  
6 be more sensitive to having a problem, an outsider,  
7 you know, observing something wrong so that I think  
8 that there is a very strong self-reporting culture  
9 that we experience in our, you know, organization  
10 in terms of the research and test reactors.

11           MEMBER SKILLMAN: Thank you.

12           MR. ADAMS: Well, next slide. So,  
13 here's, you know, what I would say the more  
14 significant events that we've seen and  
15 characterized them. And you'll see they tend to  
16 end up in a couple of bins.

17           Exposure events, this is a person  
18 getting a higher exposure than was expected for  
19 what they were doing. And when you pull the string  
20 on these, they end up being a person that, you  
21 know, has, you know, there's a radiation protection  
22 program, you know. Regulations in Part 20 require  
23 a radiation protection program. That, you know, we  
24 look at that program, you know, both as part of the  
25 license renewal and there's a module in radiation

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1 protection that the inspectors do.

2 So, at least once that inspection cycle  
3 the inspectors have an inspection finding that the  
4 radiation protection program and the ALARA program  
5 meets the requirements of the regulations.

6 Despite that, despite, you know,  
7 requirements if you're a radiation worker yet you  
8 have to have training, you have to show the ability  
9 to do the job, despite all that it's basically a  
10 person that has not -- has either not followed the  
11 procedures, not followed their training, you know,  
12 that they basically removed the sample from the  
13 reactor without doing the proper surveys before  
14 they removed it, you know.

15 Then all of a sudden, you know,  
16 radiation monitors are going off and things like  
17 that and, you know, they have to do something in a  
18 big hurry or, you know, proper surveys wasn't --  
19 were not done and a sample created contamination,  
20 or someone despite training, despite interlocks,  
21 you know, by, you know, goes through, you know, goes  
22 through a gate and despite signs blinking and bells  
23 dingding, you know, keeps walking on.

24 That's the kind of violations we've  
25 seen under exposure events versus the radiation

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1 protection program has systematically broken down.

2 And it shows that what we've said that  
3 we, you know, that the risk from these facilities  
4 are internal to the facility, you know, given the  
5 uniqueness and, you know, the difference in power  
6 reactors is the purpose of these reactors is to get  
7 the radiation out of the core, is to make samples  
8 radioactive, is to have beam tubes.

9 So, you know, this is an area we see.  
10 And when we see these type of events, they, you  
11 know, normally end up, I'd say, more than half the  
12 time resulting in a special inspection that occurs  
13 to focus on it, because one of the things we're  
14 concerned about is what we call significant  
15 potential for overexposure that these events did  
16 not result in overexposure, but we want to make  
17 sure that there is not a systematic breakdown and  
18 to understand why these events occurred and what  
19 the licensee has, you know, has done to prevent  
20 these events in the future.

21 The other one, operator absence, and  
22 this is, you know, an operator walks past the  
23 control room door, you know. Could be for five  
24 minutes, it could be for five seconds. Once you  
25 walk past the door, you've walked past the door and

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1 it's a -- it's a violation.

2 And the licensees that have done this  
3 have, you know, done all sorts of things to, you  
4 know, to address it with, you know, closed doors,  
5 sign on the doors, formal, you know, formal  
6 pointing at a person that they are in charge of the  
7 console and they're the console operator until they  
8 turn over to the next person, you know.

9 What we've seen, it's just, you know, a  
10 five-second lapse of concentration or, you know,  
11 one guy goes in this direction, the other guy goes  
12 in that direction. Both of them assume that the  
13 other guys was going to stay in the control room  
14 while, you know, he took -- or the other person  
15 took care of something.

16 The good news is, is that the places  
17 that experience this, we normally don't see repeat  
18 versions. And this is an area where we, you know,  
19 where we talk to the licensees because it's, you  
20 know, that, you know, despite all of the  
21 electronics and the system, you know, the operator  
22 is there for a reason.

23 System failure, Aerotest is down there.  
24 So, the technical specifications have requirements  
25 for doing surveillances on fuel and they define

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1 what is what we call damaged fuel.

2 Obviously if a fuel element is  
3 releasing fission products, that's the highest  
4 level of damage. We see TRIGA pin failures made,  
5 you know. It's been a while since we've seen one.  
6 Maybe every four or five years we'll see something.

7 Plate Fuel, I -- in the last 30 years  
8 we have not seen any plate fuel fail at all. And  
9 probably even goes back even further. In the '60s  
10 there were some issues, but apparently those issues  
11 were solved by increased quality control and a --  
12 sort of a consolidation of the industry who was  
13 making these plates.

14 Aerotest had a number of fuel failures  
15 not indicated by the release of fission products.  
16 Although I -- although in hindsight they went and  
17 took some demineralizer resins and, you know,  
18 analyzed them to very low levels and did see some  
19 indication, but it was just the physical appearance  
20 of the fuel. And I think they took over 20 fuel  
21 elements out of service.

22 These were the old aluminum clad fuel  
23 elements. We still don't fully understand what  
24 we've seen there. However, these aluminum clad  
25 elements had an operating history unlike any other

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1 aluminum element we've seen. These were sort of  
2 the lead as far as how many hours they had, how  
3 many pulses they had.

4 These fuel elements went to India, came  
5 back from India, were at GA for a long period of  
6 time in the pulse development program and then  
7 ended up at Aerotest.

8 My theory is that they've reached the,  
9 you know, that they've reached the end of their  
10 life. That, you know, after 40, 50 years of a lot  
11 of operation that they've reached a point where,  
12 you know, they're at the end of their lives.

13 Again, Aerotest is, as we mentioned,  
14 shut down because of foreign control and  
15 domination, you know. If that issue is solved and  
16 they head back into operation, the status of their  
17 fuel is, you know, one of the things that the staff  
18 will focus on as we move forward.

19 Then there were stainless steel fuels.  
20 We haven't, you know, we haven't seen any patterns  
21 of, you know, issues with that fuel.

22 So, you know, aging -- the aging things  
23 we look at are fuel, that fuel either comes in two  
24 situations. It's facilities that consume fuel  
25 regularly, you know, that fuel isn't -- goes into

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1 the fuel cycle and, you know, is not in there very  
2 long.

3 And then the other end of the spectrum  
4 are these lifetime cores. And indeed some of these  
5 cores have been in operation 40, 50 years. And  
6 that's something, you know, that's something that  
7 we do look at. Fuel failure is one of those things  
8 that is reportable to us, you know, in a short time  
9 period.

10 MEMBER SKILLMAN: What is a short time  
11 period?

12 MR. ADAMS: Next working day to the  
13 headquarters operations officer. That's in the  
14 tech specs.

15 Now, if something happens that is a  
16 reportable requirement via the regulations, then  
17 the regulations tell you how quickly you have to  
18 pick up the phone. A one-hour notification,  
19 two-hour notification, but the reportable event  
20 notifications are normally reported in 24 hours.

21 If events occur, you know, the reactor  
22 has to be shut down, put into a safe configuration.  
23 And there has to be an analysis done and approval  
24 to restart by normally the facility director, in  
25 some cases the safety committee, before the reactor

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1 goes back into operation.

2 MEMBER SKILLMAN: Thank you.

3 MR. ADAMS: So, I'm at the end of what  
4 I wanted to talk about.

5 MEMBER STETKAR: What was the pool  
6 leak, Al, in North Carolina? Was it just a leak  
7 that --

8 MR. HARDESTY: Pool leak?

9 MEMBER STETKAR: Pool leak.

10 MR. HARDESTY: So, they --

11 MEMBER STETKAR: Corrosion or --

12 MR. HARDESTY: Say again?

13 MEMBER STETKAR: Corrosion, or somebody  
14 left a valve open, or somebody --

15 MR. HARDESTY: No, they actually  
16 installed a higher flow rate secondary cooling  
17 system that they were -- when they come back in for  
18 license renewal in 2017, they want to go to two  
19 megawatts. And so, they have been doing a lot of  
20 5059 changes and other associated changes to the  
21 facility to get ready for that.

22 And one of the things they did is they  
23 put in this secondary cooling system and upped the  
24 flow rate. And when they did that, they are  
25 normally supposed to turn it off even before they

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1 upgraded it. But when they upgraded it, it had a  
2 significant more cooling capacity and they actually  
3 left it on overnight. Did not secure it like they  
4 were supposed to by procedure and it aggravated a  
5 known crack, I believe it was already known, in the  
6 lining.

7 And so, they experienced a much higher  
8 loss of water than they normally would trend. And  
9 so, then that --

10 The ultimate root cause was this higher  
11 flow rate cooling system that took the temperature  
12 of the pool way below what the tech spec value was  
13 supposed to be.

14 MR. ADAMS: We found that, you know,  
15 thermally cycling these pools that have the  
16 stainless steel or aluminum liners is not good for  
17 the pool.

18 The majority of the failures we've seen  
19 have been corrosion, but not corrosion from the  
20 inside of the pool. Corrosion from the outside of  
21 the pool.

22 What we've discovered is one of the  
23 worst things you can do is overflow your pool and  
24 get water down between the pool liner and the  
25 concrete structure that the pool lives in. That

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1 water in the concrete turns into a corrosive soup  
2 which basically corrodes the pool liner from the  
3 outside in, you know.

4 When we gained that knowledge, a couple  
5 of things that, for example, the new reactor at the  
6 University of Texas that there is a seal that if  
7 the pool does overflow, it doesn't go down in that  
8 space. And also actually before it gets to the top  
9 of the pool there is a -- basically a pathway that  
10 the pool will overflow onto the floor of the  
11 facility versus down in that spot between the pool  
12 liner and the concrete biological shield.

13 The facility that, for example, USGS  
14 replaced their liner in their entirety because of  
15 this issue. The new liner had a larger setoff from  
16 the concrete biological shield and they had a way  
17 to make -- to check to make sure that there was not  
18 moisture down in between that space.

19 So, lessons learned, we feed into how  
20 we license these things and move those lessons  
21 forward.

22 CHAIRMAN POWERS: I note that in your  
23 list of operator absence errors that you do not  
24 include an error committed at MIT.

25 MR. ADAMS: And I know that you're

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1 talking about and that's because it was outside the  
2 time period that we're talking about. Yes, sir.

3 Probably the more significance -- and  
4 it wasn't operator absence. It was, you know, at  
5 the end of the day we believe the operator  
6 basically fell asleep at the console.

7 And the second operator was -- left the  
8 facility and couldn't, you know, couldn't get back  
9 in, because permission to get back in is given by  
10 the operator. So, that was -- we took a number of  
11 actions and that was a violation that rose to a  
12 higher level.

13 And MIT did, you know, a lot of  
14 training, a lot of staffing requirements and there  
15 is a system there that the operator has to prove to  
16 the electronics periodically, you know, alertness.  
17 So, yeah.

18 So, licensing oversight is with NRR.  
19 It's, you know, our motto is different that the  
20 regions are not inspecting our research reactors.  
21 That it's NRR and it's basically our sister branch  
22 that -- and that allows us close interactions.

23 We have stability in staff, you know.  
24 The folks tend to stay in the research reactor area  
25 for a while. I think our senior inspector has been

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1 inspecting research reactors from probably the late  
2 1980s.

3 We now have NPUFs. They're neutron  
4 sources that thermal power -- it isn't thermal  
5 power that makes you a NPUF. It's that your  
6 utilization or production facility is not a power  
7 reactor.

8 CHAIRMAN POWERS: Seems to me that more  
9 so than -- or as much so as any branch you have a  
10 problem of knowledge preservation and passing on.  
11 We're not going to be here forever.

12 MR. ADAMS: Yeah, and, you know, part  
13 of that is there's, you know, that we do have  
14 knowledge transfer programs where, you know, I pass  
15 on my knowledge to the inspectors, you know. The  
16 inspectors pass on their knowledge as part of the  
17 qualification program, you know.

18 I think it's an issue that, you know,  
19 that NRC as an agency is concerned about. And we,  
20 you know, the folks that work in these areas, you  
21 know, we have the newer folks, but we also, you  
22 know, we also have some gray beards. So, that is  
23 an area that we are aware of and concerned about  
24 and, you know, actively work to pass the knowledge  
25 on.

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1           To me, a great improvement in knowledge  
2 was, you know, writing 1537. That basically, you  
3 know, the project managers and, you know,  
4 contractors who were the real gray beards, you  
5 know, wrote down everything that was in their  
6 heads.

7           And we did have a -- we did have a  
8 chance -- there's some interim staff guidance to  
9 NUREG 1537. One of those was for liquid  
10 homogeneous reactors, because at one point we  
11 thought a licensee was going to come in with -- BMW  
12 was going to come in with liquid homogeneous  
13 reactors for medical isotope production and  
14 Research did that work for us.

15           And what they did is they assembled an  
16 international team of not only, you know, research  
17 reactor knowledge, but liquid homogeneous reactor  
18 knowledgeable people. And not only did they write  
19 an ISG for liquid homogeneous reactors that sits on  
20 top of NUREG-1537, but that group looked at 1537  
21 from front to back and really didn't, you know,  
22 really didn't have very, you know, much to say  
23 about 1537.

24           So, it's, you know, it stood the test  
25 of time, you know. It was developed through the

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1 process where it went out for public comment. And,  
2 you know, we do have, you know, we do get, you  
3 know, indications that it is a, you know, it is a  
4 pretty good document through these things that have  
5 happened over the years of having it looked at.

6 So, that, I think that's important to  
7 knowledge transfer, too, that we have, you know, we  
8 do have things written down versus, you know, when  
9 I got to NRC, it was truly, you know, knowledge  
10 transfer. The old-timers, you know, talked to you.

11 MS. GAVRILAS: This is Mirela Gavrilas.  
12 Again, I'd like to add something on with regard to  
13 knowledge management, you know. That's a problem  
14 throughout the agency and definitely throughout the  
15 industry, but the Research and Test Reactor Group  
16 is fortunate in some regard and perhaps better at  
17 doing it than other parts of the organization,  
18 because they've operated for a long time as a  
19 center of excellence.

20 So, effectively they have the licensing  
21 people together with the oversight people, together  
22 with the security people and they cross-pollinate a  
23 lot and have dialog.

24 So, for those of us who are in the room  
25 with Al, we've heard most of the things that he's

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1 saying over and over. So, while we recognize that  
2 he is going to be -- when he leaves, he takes 30  
3 years of RTR knowledge with him.

4 He's been very effective at  
5 transferring that knowledge in the past, I would  
6 say, three years as long as I've known him, for  
7 sure, to the staff that he is working with.

8 CHAIRMAN POWERS: Well, as an external  
9 observer, it's not clear to me that this is the  
10 vast organization that I'm seeing acknowledge  
11 transfer. Okay. I just pass that off.

12 MR. ADAMS: You mean the Research  
13 Reactor Group, or just NRC as an agency?

14 CHAIRMAN POWERS: No, this Research  
15 Reactor Group. That I have seen other  
16 organizations appear in front of my subcommittees  
17 and the committee itself that seem to have a more  
18 aggressive program.

19 My job is not to manage the Agency. I  
20 just pass on my observation.

21 MR. ADAMS: I appreciate that. And  
22 that's, you know, I think that's something we can  
23 look into, because I think that's important. That  
24 is important to us.

25 So, you know, what we said is that, you

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1 know, five watts, 20 megawatts, we can bin them,  
2 but there's a lot of uniqueness, you know.

3 There's a lot of different applications  
4 and that, you know, the future at the moment is the  
5 medical isotope facilities. But, however, the  
6 medical isotope facilities will still be subject to  
7 license renewal. Am I correct there?

8 So, medical facilities are still going  
9 to be subject to license renewal, and so are the  
10 test reactors. So, right now it's only the  
11 research reactor that we are, you know, that we are  
12 applying this methodology to.

13 Although as you'll find out, for  
14 example, the requirement to keep your SAR up to  
15 date will also be applied to these facilities that  
16 will, you know, still go through formal license  
17 renewal.

18 CHAIRMAN POWERS: We're concluding this  
19 -- this is a background session for this that I had  
20 specifically asked that it be included, because  
21 many of us are not familiar with all the diversity  
22 of the research reactor.

23 So, I'll ask if there are any  
24 questions, because our next intent, I believe, is  
25 to go in and look at the specific proposal that's

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1 coming up. So, we'll get more into -- less into  
2 history and one item more into what's coming up  
3 after lunch.

4 So, are there any questions on this  
5 particular aspect?

6 MEMBER SKILLMAN: I do. Alex, let me  
7 come to you on this question, please. You  
8 identified 28 findings in the timespan between 2010  
9 and 2016. And Dr. Powers said, hey, how about that  
10 issue at MIT? And you said, oh, that was before  
11 the cutoff time.

12 What I had asked about a half an hour  
13 ago was, are there any substantive issues prior to  
14 2010? I believe your answer was no.

15 I'd like to ask you to think about that  
16 if there are some other issues that bear on how we  
17 will consider the importance of license renewal and  
18 activities for changes, I, for one, would like to  
19 know about those.

20 Did we have other significant  
21 exposures? Did we have other failures in  
22 operations? Did we have any facility breakdowns  
23 where the actual design of the facility failed  
24 indicating material conditions that hadn't been  
25 attended to either because of negligence, or

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1 because of error and oversight?

2 Is there other information that we  
3 should know about as we ponder change to the  
4 regulation?

5 MR. ADAMS: Sure. I mean, we, you  
6 know, based on your request for, you know, several  
7 years of information we decided, you know, 2010 to  
8 the present.

9 As you go back in history there is, you  
10 know, there is occasional severity Level 3 events  
11 that have happened. And, you know, we -- if you  
12 want, we can go back as far as you want and sort of  
13 pull those out.

14 We do have places where we gather, you  
15 know, we gather the more significant events and we  
16 have them documented that we use that as a teaching  
17 tool and also to look at things, you know.

18 These, you know, I can't remember an  
19 overexposure occurring, you know. That doesn't  
20 mean that it hasn't happened.

21 When I answered your question, I guess  
22 maybe I didn't understand what you were asking, you  
23 know. If you're asking, you know, have there been  
24 events prior to 2010 that, say, if I took my list  
25 back to 2000 or 1990, would this, you know, would

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1 this list of things we would point out to you be  
2 larger? The answer is yes that, you know, that  
3 there's always -- over the years there's always  
4 been issues with licenses.

5 MR. HARDESTY: And I will add that Mike  
6 and I did the data mining for this. And that even  
7 though we did go back further, what we had in 2010  
8 to '16 is very representative of that larger time  
9 frame.

10 So, it's more of the same kind of  
11 things is what we observed. And the one list that  
12 we were using, that went back to 2000.

13 MR. MORLANG: I believe 2000.

14 MR. HARDESTY: So, I do have a tabular  
15 list that goes back that far if you'd like to see  
16 that, Mr. Skillman.

17 MR. MORLANG: I think it's important to  
18 note that the 28 --

19 (Off mic comments.)

20 MR. MORLAND: Of the 28 instances that  
21 we have listed, only one of those was a willful  
22 misconduct type of item. All the others were  
23 either identified during inspections or identified  
24 by the licensees and reported to us and looked at  
25 on the subsequent inspection.

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1                   MEMBER SKILLMAN:    No.    Thank you.    I  
2    don't need to exhume the bodies or the skeletons.  
3    I'm just curious about what the data show.    And if  
4    you're saying it's basically more of the same and  
5    that the pulse, the current cadence is  
6    self-reporting based on fidelity to the -- if what  
7    we're seeing is faithfulness to the tech specs, if  
8    the licensees are really doing that, then that's  
9    probably as good as it's going to get.    So, I  
10   really don't need more.

11                   MR. ADAMS:        You know, most of the  
12    issues are reported, but the inspectors -- the  
13    inspectors still find things.    It's always amazing  
14    that, you know, our inspectors can go out and they  
15    can, you know, go through the materials and, you  
16    know, find things that, you know, maybe the  
17    licensee wasn't fully aware of.    So, you know, we  
18    do that.

19                   You know, I think of, you know, all the  
20    events that happened over the years I've been at  
21    NRC.    Like I said, the most significant ones were,  
22    you know, we shut, you know, for example, we shut  
23    Georgia Tech down because we lost confidence in  
24    their ability to run the reactor because of some  
25    events that occurred.

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1 I can tell you an instance where most  
2 of the scram circuitry was disabled in one reactor  
3 and, you know, after we pulled that string, it was  
4 because an electronics tech switched out a module  
5 and assumed the new module was the same internally  
6 as the old module. And for some reason it had been  
7 modified and didn't do post-maintenance testing,  
8 which I think created a generic communications to  
9 the licensee, you know.

10 The significant events have resulted in  
11 generic communications and discussions at, you  
12 know, at the various meetings. And that licensee  
13 reported, too, when they went to shut down the  
14 reactor, you know, normally you run the control  
15 rods into 20 percent, you know, put a scram signal  
16 in.

17 Well, they put the scram signal in and  
18 the reactor didn't scram. That was a --- at least  
19 a severity Level 3 with a civil penalty.

20 And, you know, here's an example that  
21 this happened because they didn't recognize  
22 switching out a module as maintenance. And the  
23 tech specs required, you know, you do maintenance,  
24 you test.

25 MR. HARDESTY: And we talked about

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1 special and reactive inspections when something  
2 goes wrong and of course the routine inspection  
3 program.

4 One thing that didn't get mentioned  
5 that I think is perhaps somewhat unique to us,  
6 because we are such a close-knit group and have a  
7 lot of synergy between the two branches, as well as  
8 a management that's right there with us, is that  
9 there have been cases where the licensee will call  
10 us up and they'll say, this isn't reportable, but  
11 we want you to know about it.

12 And so, that's a good side of the  
13 culture, but what happens on our side is we also  
14 look at it. And there have been a number of cases  
15 both where they didn't say it was a violation, but  
16 we thought it was maybe something that had to do  
17 with their op tempo and their culture where the  
18 director or the deputy director would go on site  
19 with the inspector and the PM for a visit to the  
20 facility just to kind of get a little feeling for  
21 what the --- what's going on at the facility to see  
22 if there's any, you know, possibility for a  
23 chilling effect.

24 I don't think we've ever really had  
25 anything like that, but we ---

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1           So, we have, but in general it's --- we  
2           have --- our management is very supportive of us in  
3           going out to the facilities and talking directly to  
4           the directors.

5           In the case of TAMU when they had their  
6           one incident, which generated a lot of activities  
7           on our side, we actually asked to meet all the way  
8           up to the Level 1 and talk about them, what their  
9           corrective actions would be.

10          And our deputy -- or rather our  
11          director went with us to that visit and we had a  
12          very productive meeting in which they outlined  
13          their corrective actions and we followed up with  
14          them.

15          And of course they took independent  
16          action, as Al said, to have the TRTR have a  
17          separate audit group.

18          And so, they are very responsive and to  
19          trying to correct any deficiencies that might be  
20          either perceived or actual.

21          CHAIRMAN POWERS: One of the issues  
22          with these facilities, of course, is that they're  
23          older facilities. And so, you get kind of a  
24          churning of an operational and control systems that  
25          are operating and then we move more and more to

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1 digital systems.

2 Many of them are located on  
3 universities where you have lots of people  
4 unassociated with the reactor anxious to explore  
5 digital systems.

6 Do we have a potential issue here?

7 MR. HARDESTY: That's actually  
8 something we've been very proactive about. The --  
9 our Research and Reactor Test -- the Licensing  
10 Branch has partnered with the power reactors on the  
11 digital I&C working groups on the embedded digital  
12 devices RIS, the counterfeit part RIS. All of  
13 those activities that are going on, they actually  
14 involve me. I'm actually the representative that  
15 typically goes with that.

16 And we also independently took a  
17 contract out with Oakridge National Lab through  
18 Research to, for lack of a better way to express  
19 it, distill the plethora of power reactor  
20 requirements down into a subset that would be more  
21 applicable for the research and test reactors  
22 community or the NPUF community.

23 And that ISG has actually just ended a  
24 75-day public comment period yesterday. And so,  
25 we're getting -- we got a number of comments from

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1 the organization, but it's not new to them. They  
2 have seen this over the years as we went through  
3 and we said, here's a bit of requirements that we  
4 think are applicable to your community, and gave  
5 them the opportunity to feed that back.

6 And then along with that using this new  
7 interim staff guidance, we have started using a lot  
8 of the same processes that power reactors are  
9 using. It's called a Phase Zero review in which  
10 they will come into us with a design and talk about  
11 what their application should contain and the kinds  
12 of things that the ISG is telling them, because  
13 it's -- a lot of it is it's not new because the old  
14 -- I say "old," because the existing standard  
15 review plan has sections on digital -- or rather  
16 instrumentation control and some information on  
17 digital systems, but it's references to these power  
18 reactor standards.

19 So, what we did is we went to those  
20 same standards that were referenced and we  
21 extracted those clauses and put them into the ISG.  
22 So, they're learning a little bit with us in terms  
23 of what we expect for an application.

24 And we've been doing that with we  
25 started with the University of Florida. They had

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1 some other issues unrelated to licensing where they  
2 ended up withdrawing their application.

3 MIT is currently in with an amendment  
4 which we're reviewing. And Purdue University is  
5 going through the Phase Zero process right now to  
6 upgrade their digital I&C. So, there is a lot of  
7 interest because they're having problems getting  
8 replacement parts and we are proactively trying to  
9 address any issues they may have.

10 MR. ADAMS: And I'll change what I said  
11 before that. That is one area in NUREG-1537 where  
12 we are active. ISG is basically an update of  
13 Chapter 7, the ISC chapter in the NUREG, but, yeah,  
14 I mean, we do face a challenge that, you know, it's  
15 universities with electrical engineering  
16 departments and Ph.D.s and, you know, we see a lot  
17 of I've got the answer here on this breadboard and  
18 I use lab view to program it and let's, you know,  
19 let's bolt it onto the reactor.

20 So, you know, the inspectors are  
21 looking for that and there's been, you know,  
22 there's been several places where we told the  
23 licensee, you know, sorry, you know, you can't do  
24 that until you go through a full review.

25 MEMBER BROWN: Has that included as you

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1 -- as they get into this area of applications of  
2 the new systems, have you incorporated not just  
3 like the controls and monitors and protection  
4 devices and that stuff, but the control of access  
5 in terms of where the information -- we've covered  
6 that extensively during the new design, new reactor  
7 design stuff with some agreements/disagreements  
8 relative to the cybersecurity and we're not allowed  
9 to talk about it, and, no, we can't look at the  
10 design, because that's somebody else's, and we  
11 don't have one-way devices, we're going to have  
12 two-way devices so that all of our data can be  
13 spread throughout the electrical engineering  
14 community, that's what I'm envisioning now, or the  
15 computer labs where they can process and see and  
16 send information back, or download software from  
17 some other part of the university, et cetera, et  
18 cetera, via network so that somebody can't take  
19 control of those control systems?

20 MR. HARDESTY: Absolutely we are  
21 considering that. Unlike the larger power reactor  
22 community where they decided to take the  
23 cybersecurity out and put it in NSIR and they kept  
24 the instrumentation control in NRR --

25 MEMBER BROWN: Don't get me started on

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1 that.

2 MR. HARDESTY: I know. So, we  
3 maintained our center of excellence and we brought  
4 our security specialists not only for the  
5 facilities themselves, but also in relationship to  
6 cybersecurity, into our organization. So, we have  
7 a staff of three, right, security specialists that  
8 are helping us deal with that.

9 Now, that doesn't mean we don't  
10 leverage NSIR, because we do, but we've  
11 independently developed our own cybersecurity best  
12 practices document.

13 There are so many different things that  
14 the universities, bright minds say, hey, what if we  
15 could do that, what if we could do that. So, we  
16 were very concerned that they understood that there  
17 were limitations exactly like you have said.

18 You can't have your reactor system on  
19 the university network. Not allowed. Not going to  
20 happen. We're not going to permit it.

21 You have to have these firewalls. You  
22 have to have these access controls. Things have to  
23 be only accessible by authorized personnel and that  
24 has to be very well controlled.

25 And so, that's all in the best

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1 practices document, and it's also included in the  
2 NUREG-1537 ISG at Chapter 7 what those requirements  
3 would be. It's guidance, so I use the term  
4 "requirements" nicely, but what our expectations  
5 are in terms of what their system should have.

6 So, yes, we have been proactively  
7 addressing that as well.

8 MEMBER BROWN: Well, the single point  
9 you ought to take away is the physical access of  
10 somebody coming in and do something to the  
11 equipment. That's largely administrative. That's  
12 paperwork. That's people have to sign in. You  
13 have only certain people have access and there's a  
14 way to get into equipment or not get into it and  
15 somebody's got to know they're doing it and what  
16 they're doing it with. So, but that's inside the  
17 plan.

18 The really key information is that  
19 there should be no external communications into the  
20 facility for the reactor -- or research reactor  
21 test equipment. And any information that goes out  
22 should go out through nothing but a hardware-type  
23 -- where there is no physical way to get any -- you  
24 can really fire your cyber guys, because the  
25 physical access can be controlled. I'm saying that

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1 with a little bit of tongue in cheek.

2 MR. HARDESTY: I completely understand.

3 MEMBER BROWN: So, I mean, it's real  
4 easy. I mean, you just don't allow anybody to  
5 connect in. A firewall that has bidirectional  
6 software -- has software that controls its  
7 directional capability, is fundamentally easily  
8 compromised by a 12-year-old today.

9 I mean, I'm saying that maybe with a  
10 little tongue in cheek, but not totally. These  
11 kids are learning to do stuff these days that every  
12 time you read the papers you'll find some group of  
13 teenagers at some high school has now broken into  
14 something locally and they're very skilled. They  
15 understand the stuff.

16 MR. HARDESTY: Well, when I alluded to  
17 firewalls, it was only internal. There is no  
18 external access to any of our networks.

19 We did do a -- I don't want to call it  
20 an audit. We went out and visited a number of the  
21 facilities as part of this project to develop this  
22 best practices and we did a cybersecurity audit to  
23 identify any critical digital assets. And the  
24 findings were -- the research and test reactors  
25 currently as they exist do not have any critical

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1 digital assets.

2 MEMBER BROWN: I'm not saying within  
3 the facility itself. You're going to want to have  
4 information going out so people can process it and  
5 do with it --

6 (Simultaneous speaking.)

7 MEMBER BROWN: And for that there ought  
8 to be literally an unbreakable wall to go outside.  
9 If you've got to carry it out, you put it on  
10 something, new hardware to take it out and --

11 MR. ADAMS: I mean, we've had to deal  
12 with, you know, remote education and the desire to,  
13 you know, have someone in another country see what  
14 the reactor is doing for, you know, a number of  
15 years now.

16 This is a bridge that we've crossed,  
17 you know, in the past, you know, to make sure that,  
18 you know, no one can get to the reactor from the  
19 outside.

20 MEMBER BROWN: Okay. Thank you.

21 CHAIRMAN POWERS: At this point, I  
22 think we will break for lunch and come back at --  
23 what is that? 1:20.

24 (Whereupon, the above-entitled matter  
25 went off the record at 12:20 p.m. and resumed at

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1 1:20 p.m.)

2 CHAIRMAN POWERS: Robert Beall is going  
3 to deal into the actual nitty-gritty on what's  
4 being proposed here.

5 MR. BEALL: Yes.

6 CHAIRMAN POWERS: So, I'll turn the  
7 floor over to you.

8 MR. BEALL: Okay, thank you, Dr.  
9 Powers.

10 Good afternoon. I'm going to be  
11 continuing on with the presentation this afternoon.  
12 Now that everybody on the Subcommittee is experts  
13 on NPUF courtesy of Duane and Al, this will go  
14 pretty quickly I guess, right? I can always hope.

15 I'd like to start out with what the  
16 purpose of the rule is going to be.

17 As lot of this will be familiar from  
18 the presentation we had this morning, but we talked  
19 a little bit this morning about the license renewal  
20 backlog, so streamlining the process should help  
21 reduce that backlog and eliminate it, and  
22 especially going forward with new license renewal  
23 applications that may come in.

24 Also, hoping to streamline the actual  
25 license renewal process.

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1           And, also, we have some direction from  
2 the Commission via a number of SECY papers and SRMs  
3 that we've sent up over the years. They've asked  
4 to address, both in the short-term, the backlog in  
5 which Al and Duane have generated an ISG that  
6 they're currently using for the current license  
7 renewal applications they have in house.

8           And then, for the long-term, to enhance  
9 the process, and that's what we're doing here with  
10 the rulemaking that we'll be talking about in a  
11 minute.

12           The objective of the rulemaking was to  
13 try to establish a more effective and focused  
14 regulatory framework.

15           So, to do that, there are three  
16 regulations that we're looking at to modify. The  
17 first one is 10 CFR 2.109 which has to do with  
18 effective and timely renewal on application.

19           The second one is 10 CFR 50.71 which is  
20 maintenance of records and making of reports.

21           And, the third one is 10 CFR 50.51,  
22 continuation of a license.

23           But, before we got into the start of  
24 the formal proposed rulemaking, we did do a  
25 regulatory basis. This was completed, the final

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1 regulatory basis was issued in August of 2012.

2 From that regulatory basis, the staff  
3 concluded that the rulemaking should continue or  
4 was justified.

5 We did identify some constraints and  
6 limitations on what the rulemaking should contain.  
7 We also evaluated the feasibility of segregating  
8 the NPUF regulation, which means like setting up  
9 the regulations in its own sections in the 10 CFRs.

10 We also studied some benchmarking of  
11 looking at different methodologies. This  
12 benchmarking, Quynh, you can correct me if I'm  
13 wrong, I think we talked like DOE and people like  
14 that and to see how they did license renewal for  
15 their facilities.

16 So, we looked outside out little window  
17 to see what other people are doing. And, we also  
18 conducted a number of public meetings to get the  
19 stakeholders' feedback on the regulatory basis to  
20 see what they thought about what our proposed  
21 activities would be. And so, we actually had three  
22 public meetings on that.

23 Let me see, oops, I'm a little bit  
24 ahead of myself in my slides here.

25 Okay, so, thank you.

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1           As we talked about this morning, the  
2 rulemaking affects all types of NPUFs. So, we  
3 talked about the earlier, the research reactors or  
4 the Class 104a's and c's, testing facilities are  
5 Class 104c's and the medical isotope facilities and  
6 processings are Class 103s. So, that's what you  
7 all are familiar with, everybody from this  
8 morning's conversation.

9           Next slide?

10           So, as Mirela said this morning, we are  
11 changing -- the proposed rule had nine activities  
12 or things that we were going to be changing. So,  
13 I'm going to go through each one of them now and  
14 discuss what things are being changed and what  
15 we're trying to do.

16           So, the first one is, and this is kind  
17 of a holdover, again, from this morning, is  
18 creating a new definition for the NPUFs. Okay? It  
19 does address -- it affects all the NPUF Class 104's  
20 and 103's. Okay?

21           We're trying to do that because, as we  
22 said this morning, there's no single definition  
23 that covers all the non-power facilities. Okay?  
24 So, we're adding the definition to Section 10 CFR  
25 50.2. And, we wanted to do this so that we can

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1 have a flexible term that can capture all these  
2 different types of licensed facilities under 50.22  
3 and 51.21(a) and 8.

4 Also, because of the different terms  
5 that's out there right now, we feel that this would  
6 add clarification and consistency to the way we can  
7 apply the regulations going forward.

8 Okay, next slide?

9 Another activity we're going to do is  
10 limiting the license terms for the facilities other  
11 than for testing facilities.

12 And, we talked about this this morning  
13 that it affects Class 104a and c, other than  
14 testing facilities. We talked about why testing  
15 facilities are a little different from the other  
16 NPUFs this morning.

17 The proposed rule would exempt Class  
18 104a's and c's, NPUFs and from the requirements of  
19 having a 40-year fixed license term.

20 Basically, you would have a  
21 non-expiring license for these facilities going  
22 forward. Okay?

23 As we talked about this morning, again,  
24 it's the AEA has no licensing term for Class 104.  
25 It's also consistent with the minimum requirements

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1 standard that says, from the AEA for these type of  
2 facilities and with a non-expiring license, that  
3 also reduces the burdens on the licensees and the  
4 NRC.

5 But, we also feel because, and we'll  
6 talk about this is a second, it does -- we can  
7 still maintain the public health and safety.

8 MEMBER BLEY: Is a non-expiring license  
9 something that's common in the materials area or is  
10 this something new for us?

11 MR. HARDESTY: You mean is there one  
12 that exists now?

13 MEMBER BLEY: Yes, not for machines,  
14 but for materials. I'm guessing some of those are  
15 non-expiring.

16 MR. HARDESTY: To my knowledge, we're  
17 the --

18 MEMBER BLEY: The first?

19 MR. HARDESTY: -- only ones to attempt  
20 this. There are upwards of 80-year terms that  
21 they've applied in some of the materials areas, but  
22 we are the only one that is decided to go to a  
23 non-expiring license.

24 MEMBER BLEY: There's nothing in  
25 legislation that prohibits it?

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1 MR. HARDESTY: No, and that  
2 specifically, what brought this up is that when we  
3 reviewed 104 and the Atomic Energy Act, the a and c  
4 specifically talk about what they're for and to  
5 minimally regulate them. But, there's nothing  
6 about license terms.

7 Whereas, under 103, it specifically  
8 says maximum of 40 years.

9 MEMBER BLEY: Okay. Thanks.

10 MR. ADAMS: There's some foreign  
11 countries that employ non-expiring licenses, but  
12 they have something called a periodic safety review  
13 instead.

14 MEMBER BLEY: Okay.

15 MR. BEALL: Okay, next slide?

16 Some of the areas that we looked at to  
17 validate what we're trying to do here is aging  
18 management. When you have a non-expiring license,  
19 are there any issues on the -- say, aging  
20 management that we have to address that would have  
21 been addressed, per se, when you have a license  
22 renewal process?

23 So, but, NPUFs have a very simple  
24 design. We went through all the -- well, they have  
25 a very -- they have a much -- they have varied

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1 designs all over the place, but their designs are  
2 very simple.

3 They're also, we talked about this  
4 morning, again, the low power and temperature that  
5 they operate under. Okay?

6 And, they do have surveillance  
7 requirements in their tech specs. So, they have to  
8 go in and do annual, daily, whatever, you know, for  
9 operation surveillances or whatever they have to do  
10 and before they can operate.

11 It also we said, okay, when you have a  
12 license renewal, there is opportunity there for the  
13 public involvement. Where can we maintain that?

14 So, if you look at the ways the public  
15 can still be involved in the operation of the  
16 facility. And so, if there's a licensing action in  
17 that facility, they can always request a hearing.

18 There's also the process of the 10 CFR  
19 2.206 Petitions. And, also, of course, through the  
20 allegation of process. Those are the three  
21 vehicles that the public can still have an input on  
22 the operation of the facility.

23 MEMBER CORRADINI: What's an example of  
24 a typical licensing action for a research reactor?  
25 I'm not --

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1 MR. HARDESTY: An amendment request.

2 MEMBER CORRADINI: An amendment  
3 request? Okay.

4 MR. HARDESTY: And also, I would point  
5 out that the five-year updates for their FSARs,  
6 although the one they submit may not actually be  
7 released, we will do redacted versions of each one,  
8 so they will be publically available for review.

9 MEMBER CORRADINI: And, that would be  
10 another venue?

11 MR. HARDESTY: Correct.

12 MEMBER BROWN: If you have a  
13 non-expiring license, how can an opportunity for  
14 public involvement be involved with the licensing  
15 action if you're not going to have any licensing?

16 MR. HARDESTY: So, the licensing action  
17 would be like a license amendment request. They  
18 still have to come in with an application and get  
19 it reviewed and approved by the NRC if they're  
20 going to amend their license.

21 MEMBER BROWN: Let me finish.

22 If they're not amending their license?

23 MR. HARDESTY: Oh, how would they if  
24 they're not amending their -- there's no licensing  
25 action?

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1                   MEMBER BROWN: Well, the other -- the  
2                   2.206 Petitions for the allegation process is  
3                   regardless of licensing?

4                   MR. HARDESTY: Right.

5                   MEMBER BROWN: Before, we can do that  
6                   any time?

7                   MR. HARDESTY: Correct.

8                   MEMBER BROWN: And, that's a  
9                   requirement 40 years, at least, there was another  
10                  for license renewal, that's the opportunity today.  
11                  Isn't that correct? For public involvement?

12                  MR. HARDESTY: Yes.

13                  MEMBER BROWN: We're going banish that?  
14                  You're taking that away and the only vehicle then,  
15                  if they do something to their facility that  
16                  requires them to do an LAR?

17                  MR. HARDESTY: Or the ones that exist  
18                  that always, the 2.206 type stuff and then they --  
19                  like, if they review --

20                  MEMBER BROWN: Yes, and those were  
21                  already there?

22                  I was just questioning, you used the  
23                  word licensing actions, they're out of it if they  
24                  have a non-expiring license?

25                  MR. HARDESTY: And they don't have any

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1 licensing actions.

2 MEMBER BROWN: And, they have no other  
3 reason to submit an LAR?

4 MR. ADAMS: And, can tell you from a  
5 statistical point of view, over the last 30 years,  
6 there's been only one license renewal that went to  
7 hearing. So, it's relatively rare in our realm.

8 MEMBER BROWN: I don't know what that  
9 means, one license amendment request or --

10 MR. ADAMS: No, one license renewal in  
11 the '90s went to hearing. So, in the past 30  
12 years, where we have given opportunity for hearing,  
13 we've only had one license renewal in the past 30  
14 years that have gone to hearing.

15 So, it's not --

16 MEMBER BROWN: But, what if they don't  
17 go to hearing? I mean, do they get to -- they  
18 submit the license renewal and nobody does anything  
19 with it or what?

20 MR. ADAMS: No.

21 MEMBER BROWN: I don't understand the  
22 difference, what you're talking about.

23 MR. ADAMS: Well so, okay, their 40  
24 years expired, right? So, there's a difference  
25 here in licensing path.

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1           For example, in the case of SHINE for  
2 the construction permit, the hearing was mandatory.  
3 That, you know, there was a hearing to grant that  
4 licensing action.

5           For a research reactor, initial  
6 licensing and license renewal, a hearing is not  
7 mandatory. The only time you have a hearing is if  
8 you give opportunity for hearing and a person can  
9 come along and get standing and have a contention  
10 that gets admitted.

11           MEMBER BROWN: Okay. But, you all  
12 would grant the -- you granted the license  
13 initially without a hearing?

14           MR. ADAMS: May have, may not.

15           MEMBER BROWN: Well, yes.

16           MEMBER BLEY: Just take it at what he  
17 said, okay?

18           MEMBER BROWN: Well, he said there's no  
19 hearing unless somebody demands one.

20           MR. ADAMS: Unless they demand it.

21           MEMBER BROWN: So, you could have had  
22 30 people come in to have a research reactor, they  
23 requested a license to do that. You granted it.  
24 And, if there was no hearing requested or demanded  
25 for some other reason, you didn't have -- you just

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1 granted the license.

2 MR. ADAMS: But, the only point I'm  
3 trying to --

4 MEMBER BROWN: But, that's what I'm  
5 talking about.

6 MR. ADAMS: Yes, the only point I'm  
7 trying to make is, historically, on license  
8 renewals, hearings have been very rare.

9 MEMBER BROWN: Yes, as opposed to --

10 MR. ADAMS: As opposed to other classes  
11 of licenses.

12 MEMBER BROWN: They come for a license  
13 renewal, there was no other reason to have a  
14 hearing, so 29 out of 30, I'm using my 30 as the  
15 number, got granted again or renewed by NRC without  
16 a hearing because there wasn't a petition or a  
17 demand or some other --

18 MR. ADAMS: But, there was still an  
19 opportunity.

20 MEMBER BROWN: I got that.

21 No, you've answered my question now.

22 MR. ADAMS: Okay.

23 MEMBER BROWN: I think.

24 MR. BEALL: Okay. Oversight and  
25 inspection activities, we talked about the -- right

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1 before lunch, we talked a lot about the inspection  
2 activities that Al and his staff or the other folks  
3 in our division do on the NPUF facilities, that  
4 will continue on.

5 We talked about also the very low  
6 number of design changes. They talked to something  
7 like five changes per year from all the facilities.  
8 So, that's also a very low number.

9 Also, one of the design changes or the  
10 regulatory changes we're putting in here is that  
11 Duane just talked about was the increased FSAR  
12 updates. So, that will help us and also help the  
13 licensees to keep the design basis up to date in a  
14 more frequent manner.

15 Because, one of the things that we  
16 talked about this morning is that the licensees  
17 were not always keeping their FSARs updated with  
18 design changes they may have done over the 20 or 40  
19 year time period.

20 CHAIRMAN POWERS: How did you come up  
21 with the number five years?

22 MR. HARDESTY: Quite honestly, the  
23 number came from the original basis of what we were  
24 going to do for rulemaking that had a -- what we  
25 were calling an enhanced inspection at the time but

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1 that became later became referred to a licensing  
2 basis assessment. And, we decided on ten years for  
3 that.

4 But, very quickly, in the early stages  
5 of the proposed rule, we realized that all we were  
6 doing was going from a 20-year license renewal to a  
7 10-year license renewal.

8 And so, we started thinking a little  
9 bit out of the box, decided that the ultimate  
10 streamlining was to do away with license renewal  
11 all together. So, why would we want this extra  
12 process that we're going to add in if we're not  
13 having issues anyway?

14 And so, the five years came before that  
15 decision was made which was half. We wanted one  
16 every -- to occur with every cycle and halfway in  
17 between. That's, quite honestly, where it came  
18 from.

19 But, when I went to substantiate that  
20 number later, I looked at the Statement of  
21 Considerations for why they do it at two years in  
22 the power reactor license and, originally, they had  
23 suggested five years. And, I thought that -- I  
24 felt, after looking at all the Statement of  
25 Considerations that two years was way too frequent

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1 for us to require these small facilities to do it,  
2 but five years seems like a reasonable number in  
3 which we could maintain continuity and basis  
4 without -- yes, overly burdening them. It was kind  
5 of a good balance.

6 CHAIRMAN POWERS: Did you ask the  
7 licensees about it?

8 MR. HARDESTY: We did. We presented it  
9 to them several -- we've had four -- three public  
10 meetings and --

11 MEMBER CORRADINI: I'm sure they're all  
12 listening as we speak.

13 MR. HARDESTY: Well, Mark's right  
14 behind you. He was at all three.

15 CHAIRMAN POWERS: Well, I mean, what  
16 motivates is the question, may have read into  
17 Mark's wheelhouse here, is that five years is  
18 greater than the average lifetime of the graduate  
19 student working in the facility, his tenure in  
20 office.

21 And so, you could easily have someone  
22 come in, the expert and the existing FSAR  
23 disappear. A new guy may appear and there's been a  
24 complete knowledge lost.

25 MR. HARDESTY: Right.

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1 CHAIRMAN POWERS: And, by having it  
2 five years, whereas, four might not. At major  
3 public, we don't let them graduate unless they  
4 succeed.

5 MEMBER REMPE: At MIT, the students who  
6 went to the reactor had to stay there longer.  
7 There's a long history of names we could list that  
8 stay there longer because they're working at the  
9 reactor. But, I had never questioned.

10 What is the review going to be on the  
11 FSAR? Are you just going to look at the changes?  
12 Are you going to do a thorough review? Have you  
13 thought through what your review process will be  
14 for this?

15 MR. HARDESTY: We've generated a draft  
16 regulatory guide that deals with the guidance for  
17 the licensees and what they're supposed to do for  
18 the FSAR updates. And, it also includes staff  
19 guidance of what should be done.

20 But, we also have, of course, bonding  
21 nonpublic project managers handbook which has  
22 guidance on what the staff is supposed to do.

23 And so, we've used this term called a  
24 delta review and it's exactly what you're talking  
25 about.

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1           If there is no changes at all, they're  
2 still required to submit something to us. But,  
3 there wouldn't be -- if you look at 50.71, they're  
4 required to submit a change page. So, if there's  
5 no changes, then they can simply say that there's  
6 no changes and that would greatly simplify the  
7 process.

8           But, whatever changes they provide,  
9 we've kind of encouraged them or have been trying  
10 to encourage them to submit an entire update that,  
11 you know, a complete FSAR and include the change  
12 pages.

13           But, they do have the option of  
14 submitting just the change pages, in which case,  
15 the staff would have to go in and collate it into  
16 where the existing document is and we put it into  
17 ADAMS so that we maintain our documentation.

18           But, yes, as part of that, we're going  
19 to do a full review. I mean, because it's always  
20 good for the staff as well to review the entire  
21 FSAR. But, we'd be focused on the changes to make  
22 sure there's not something that we need to follow  
23 up on.

24           MEMBER REMPE: I saw the guide, but  
25 it's good to know there's an internal one.

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1 I also was wondering, will there be an  
2 inspection as part of that? Before you say, we're  
3 going to stamp it? You won't change your  
4 inspection schedule? You're just going to do --  
5 look at the paper basically?

6 MR. HARDESTY: Right. And, you brought  
7 up a very important point. That review is not an  
8 approval. Because, if it was an approval, it would  
9 become a licensing action and we can't -- there  
10 would have to be other changes reflected in the  
11 rule to make it a licensing action.

12 So, the NRC is not going to approve  
13 their FSAR updates. We'll just review them and  
14 follow up on them if there's something we have to  
15 follow up on. But, we will not go back to the  
16 licensees and say we've approved this.

17 And, Howard can speak to that better.

18 MEMBER CORRADINI: So, just from a  
19 continuity standpoint, what most of the research  
20 reactors just did in terms of their renewals is  
21 they're -- and they redid the FSAR, is the redoing  
22 of the FSAR five years similar to what they would  
23 have done in their most recent licensing actions or  
24 is there going to be totally different again than  
25 for 1537?

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1 MR. HARDESTY: I think that there is an  
2 important nuance --

3 MEMBER CORRADINI: Do you know what I'm  
4 asking?

5 MR. HARDESTY: I do, I think so.

6 I think there's an important nuance  
7 that you have to caveat all that with is that  
8 50.59, the regulations under 10 CFR 50.59 require  
9 that the licensee already make updates to their  
10 FSAR if they make changes to the facility that  
11 impact that. So, they're already supposed to be  
12 doing this documentation.

13 The only additional requirement we're  
14 putting on them is to submit it to us so that we  
15 also have all those changes into the FSAR.

16 Because, currently, the only way we get  
17 them is at the 20-year point.

18 MR. BEALL: Right, so we try to  
19 increase the timely review internally when we get  
20 those documents in.

21 MEMBER CORRADINI: But, the only reason  
22 I ask is, since, as you had noted, that 1537 was  
23 new to them in the sense that they now built up a  
24 nominal approach to how things are relicensed and  
25 now information is kept.

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1 I was hoping that what they did there  
2 is similar to what they have to do here so that  
3 it's not like another step.

4 MR. ADAMS: No, yes, you're absolutely  
5 correct. So, in the round of license renewals  
6 we're doing now is where we're bringing them up to  
7 the standard yardstick, so to speak.

8 So, we have a licensing basis that  
9 matches up with the format and the content in 1537  
10 in the standard review plan.

11 As we move forward, we expect license  
12 amendments that would come in that would use the  
13 applicable part of the format and content in the  
14 standard review plan.

15 So, if I get an FSAR update in, what I  
16 should expect to see is license amendments that I  
17 issued that I know what they talk about. 50.59 is  
18 that the licensee has done which reported as part  
19 of the annual report and are looked at by the  
20 inspection program.

21 So, theoretically, as I read this  
22 updated FSAR every five years, I should be getting  
23 surprised. And, you know, if I do --

24 MEMBER CORRADINI: You are in the  
25 preparation?

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1 MR. ADAMS: Yes. Or if I -- yes, if I  
2 do end up getting surprised, you know, then I need  
3 to, you know, I need to pull that string. But, the  
4 important part was, it's not a licensing action.

5 I don't -- on the power reactor side,  
6 are those FSAR reviews licensing actions? People  
7 are nodding their head no. So, it's similar.

8 But, you know, again, we're interested  
9 in safety. If we read something and we go, where  
10 did that come from? You know, and it's safety  
11 significant, you know, we're going to follow it.

12 MR. HARDESTY: And, in fact, we do that  
13 already when we get their annual reports, if they  
14 summarize their 50.59 changes and we don't  
15 understand them or the inspector goes out and has a  
16 question they do inspector qualified and then come  
17 back and talk to the PM, we do that.

18 So, we have an existing framework to  
19 accomplish that.

20 MEMBER CORRADINI: Thank you.

21 MR. BEALL: Next slide?

22 So, as we talked about this morning,  
23 the Atomic Energy Act doesn't really establish a  
24 licensing term for these class of facilities.

25 So, right now, the regulations talks

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1 about limiting to about less than 40 years. And,  
2 what we currently do now is give them a license for  
3 about 20 years for the term. Okay?

4 So, not having a non-expiring license,  
5 we feel -- the staff feels that is it consistent  
6 with Section 104 to impose only the minimum amount  
7 of regulations under the act.

8 And, also with the aging management  
9 systems and the oversight and the checks we do and  
10 the surveillance requirements, we feel that we can  
11 still maintain the public health and safety by  
12 making this change.

13 So, I'll also note that the Class 103  
14 facilities like SHINE will still have to have the,  
15 you know, will not be part of this. So, they'll  
16 come back and have a normal licensing term and the  
17 same thing with test reactors. Okay?

18 Well, speaking of which, that's what  
19 this slide is all about.

20 A good segue, right.

21 So, it affects all Class 103's and  
22 existing facilities will still have a licensing  
23 term of some sort.

24 They have to come in and when they want  
25 to have a license renewal, they have a possible

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1 hearing and all that good stuff. So, the proposed  
2 rule will consolidate the license renewal  
3 requirements under a very new section in the 10  
4 CFRs, 50.135, that's a brand new one that we're  
5 creating for this.

6 And so, we're hoping to use this to  
7 clarify license renewal reprocess and also to help  
8 with the efficiency of how we do the license  
9 renewal process for these types of facilities.

10 MR. ADAMS: Can I add something here?

11 So, I was surprised that someone didn't  
12 say 20 years when the regulations say you can go up  
13 to 40 years?

14 Twenty years was an administrative  
15 decision that we made because we felt that was, you  
16 know, a long enough period of time to go between  
17 not seeing any FSAR updates.

18 You know, given this five-year rule  
19 with these licensees, that would be a reason to,  
20 you know, to consider renewing licenses for more  
21 than 20 years because now we would have that FSAR  
22 update on both sides of the fence.

23 MR. BEALL: Okay. So, this -- the  
24 before requirement is what we just finished talking  
25 about a little bit is about the five-year update

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1 for the FSARs. This does affect all new NPUFs  
2 Class 104's and 103's.

3 So, the proposed rule would extend it  
4 to all the new NPUFs. During the license renewal  
5 some licensees are unable to provide the  
6 documentation that we talked about this morning is  
7 that, you know, one of the reasons we're doing this  
8 is to try to have more frequent FSAR updates  
9 instead of having it just when the license renewal  
10 process starts.

11 So, this also benefits, we talked about  
12 -- a little bit about knowledge transfer. Also,  
13 for the inspections programs so that the inspectors  
14 don't have to go through a ton of paperwork when  
15 they go through there. They have something to look  
16 at here at the facility, at the NRC Headquarters,  
17 before they go out to the facility.

18 MEMBER BLEY: Has there been any push  
19 back on this idea when you've talked to the  
20 facilities?

21 MR. HARDESTY: Push back from the  
22 licensees?

23 MEMBER BLEY: Yes.

24 MR. HARDESTY: No, we did not get any  
25 push back from the licensees. The -- I guess the

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1 one comment that would even come closest to this is  
2 that I did have a couple offline, not during the  
3 public meeting, that said that this was a very  
4 major paradigm shift and they did not think that we  
5 would be successful.

6 But, no, they all embrace this idea.  
7 In fact, and we've had other licensees that have  
8 come in and even to the Commission and said so much  
9 as, you know, why do we even regulate? There's no  
10 consequence to us, why regulate us?

11 So, I think that they embrace the idea  
12 that we're trying to move to this more of a minimum  
13 regulations standpoint.

14 MEMBER STETKAR: Explore -- and I don't  
15 know if you've thought about this, and I'm  
16 personally not even completely clear in terms of  
17 power reactor requirements.

18 I've been told, on good faith, that  
19 when power reactors update their FSARs and submit  
20 them, they do not update things like their  
21 environmental information, weather related  
22 information, nearby hazardous facilities, any site  
23 related stuff. That's the -- I've been told they  
24 don't do that.

25 So, for example, if somebody builds a

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1 weapons manufacturing facility next door to your  
2 nuclear plant, you don't update that information in  
3 your FSAR because you weren't licensed to that.

4 MR. HARDESTY: So, the regulations only  
5 talk about changes that affect the FSAR. So, if it  
6 affects what's in the FSAR, then it should be  
7 updated.

8 Our guidance documents are more  
9 specific in which they adhere to the 1537 guidance  
10 that we provide. So, essentially, if it affects  
11 one of the 18 chapters or so, I guess it was  
12 actually only 16 because of this other information,  
13 but anyway, if it affects one of the chapters that  
14 are part of the NUREG-1537 guidance, our guidance  
15 basically says that we expect to see that updated  
16 in the FSAR.

17 MR. ADAMS: Yes, but we can't comment  
18 on what the power reactors do.

19 MEMBER STETKAR: No, and I don't  
20 particularly care. I was using that as a lead in.

21 So, for example, if you had an updated  
22 seismic hazard assessment in your local area or  
23 around your facility within the last five years  
24 that indicated that you're seismic hazard had  
25 increased, would that need to be information that's

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1 included in the updated FSAR for one of these  
2 facilities?

3 Or, if somebody changed the amount of  
4 air traffic at a local airport that's across the  
5 street from your facility, for example?

6 MR. HARDESTY: It would certainly be  
7 the expectation that --

8 MEMBER STETKAR: That's just an  
9 example.

10 MR. HARDESTY: It would certainly be  
11 the expectation that that would be evaluated.  
12 However, if it didn't constitute in a change of the  
13 analyzed condition in the FSAR, then it probably  
14 wouldn't be updated.

15 Because they don't speak the -- not a  
16 lot of them, you know, have, quote, the data  
17 specifically saying this particular data about this  
18 many airplanes or, you know, air traffic, in your  
19 example.

20 That kind of level of detail isn't in  
21 their current FSARs, so you wouldn't expect that --  
22 there wouldn't be a needed update just because that  
23 traffic was changed numerically.

24 However, if the overall analysis of the  
25 consequences and probability changed then, yes, we

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1 would expect that to be updated.

2 And, the interesting side of that is  
3 that, if we know about it and they didn't make the  
4 change, then obviously, we'll question it and force  
5 an update. If they know about it, then we would  
6 expect them to change it.

7 MEMBER STETKAR: Well, that's -- I'm  
8 not going to comment on the power reactors. The  
9 power reactors people have known about things and  
10 yet, have not been updated in the FSAR because  
11 there's no legal requirement to update them in the  
12 FSAR.

13 MR. HARDESTY: Right. You have to  
14 remember, there are --

15 MEMBER STETKAR: So, I'm trying to  
16 pulse you in terms of looking now forward over many  
17 possible years of incremental updates to an FSAR  
18 whether the surroundings of the facility could  
19 change substantially where the licensee wouldn't  
20 need to inform you about it.

21 Where's the --

22 MR. HARDESTY: You wouldn't need to.

23 MEMBER STETKAR: Would be required to?

24 MR. HARDESTY: So, that kind of  
25 information would be in Chapter 2 of NUREG-1537 and

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1 we would expect that a corresponding update would  
2 occur if it affected their FSAR in that section  
3 when they went to -- when these new things were  
4 identified so that they would be reflected in their  
5 FSAR. That's basically what the guidance says.

6 MEMBER CORRADINI: So, can I say it  
7 back to you so I understand?

8 You're saying the spirit of this is,  
9 with whatever chapter it is, the spirit of this is  
10 if something changes around their site, they ought  
11 to inform you as part of an update of the FSAR?  
12 That's what I -- the spirit of this? Am I  
13 understanding you?

14 MR. HARDESTY: With the caveat that it  
15 changes the analysis.

16 MEMBER CORRADINI: Right.

17 MR. ADAMS: Yes, the example of if  
18 someone builds an explosive, you know, factory  
19 across the street, you probably want to know about  
20 that.

21 Or, the example with MIT of the --

22 MEMBER CORRADINI: Well, I was going to  
23 say that would be --

24 MR. ADAMS: Yes, yes, there was a  
25 change that had a safety implication, you know,

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1 that changes and have safety implications then  
2 there's, you know, changes that don't.

3 MR. FOLK: I would add with respect to  
4 power reactors, you're correct, that environmental  
5 information would not, you know, demographic  
6 information that was part of the original FSAR  
7 would not be updated.

8 But, where information relevant to a  
9 tech spec change and environmental information that  
10 relates to that, that would be updated. For  
11 example, something --

12 MEMBER STETKAR: Tech specs, like an  
13 environmental discharged one -- I'm talking about  
14 it's not clear that somebody would need to report  
15 the fact that somebody built a munitions plant  
16 immediately adjacent to my fence provided that  
17 there weren't a bizillion people housed there  
18 during the day that could be possibly exposed to a  
19 release that would change my licensing basis.

20 Because it's more, you know, it's not  
21 --

22 MR. ADAMS: And, that's, you know, part  
23 of the interesting fact that, you know, 50.59 is  
24 changes to the facility, procedures and that. And,  
25 you know, across the street is not the facility,

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1 but it still is the FSAR.

2 MEMBER STETKAR: But, again, I don't  
3 want to argue. I wanted to use it because we've  
4 run into this in the past with the power reactors  
5 and people have argued that, at least at the  
6 license renewal stage, there's some attention paid  
7 to that because of the environmental review.

8 MR. HARDESTY: Certainly, that's part  
9 of our standard review plan. And, they do report  
10 that, at least the environmental impact in their  
11 annual report as far as that's what it relates to  
12 and things.

13 But, you know, you mentioned moving  
14 something hazardous adjacent to the reactor, we  
15 would also consider the converse of that is that if  
16 they decided to build a casino or if they decided  
17 to build a new dorm room or a new student center  
18 that was within, you know, a proximity that was of  
19 concern, then we would expect them to update for  
20 that as well.

21 MEMBER STETKAR: That's what I said.  
22 Well, if, you know, if this munitions factory were  
23 going to employ 500,000 people that obviously would  
24 change the demographics in terms of your licensing  
25 basis for releases. But -- okay.

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1 MR. BEALL: Another proposed change is  
2 to the timely renewal provisions of the  
3 regulations.

4 This does affect all NPUFs, but not the  
5 104a's and c's because they don't have a -- they  
6 don't have to worry about timely renewal for them  
7 because they have a non-expiring license.

8 Also, it also exempts the -- and so, it  
9 really affects just the Class 103 facilities.

10 So, the issue we're having here right  
11 now is that the current regulations in 10 CFR 2.109  
12 talks about that if you submit your license  
13 application within 30 days of your license  
14 expiring, you can continue on with your operations  
15 on your timely renewal provisions, similar to  
16 what's going on with Indian Point.

17 And so, but the 30-day time period  
18 doesn't allow Al and his staff to perform a  
19 sufficient review of the applications. Because,  
20 all of a sudden, you're into timely renewal  
21 operation very quickly.

22 And so, what we're going to here is  
23 change the regulations to allow licensees to submit  
24 within two years of their current license to  
25 expire. And, that would give Al and his folks more

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1 breathing room to do the review of the applications  
2 for the current license expires.

3 MR. ADAMS: With the 30 days, there's  
4 no way you can do an acceptance review of a license  
5 renewal application. So, basically, whatever, you  
6 know, whatever was in the envelop is what we, you  
7 know, went with from there.

8 And so, you know, the, you know the REI  
9 process became a substitute for an acceptance  
10 review. So, we, you know, we'd like to have some  
11 more time for that, you know, if there are serious  
12 shortcomings in the application, we can basically  
13 return the application to be, you know, to be  
14 worked on and the license is still in place.

15 Because after the -- if you're in 31  
16 days before you expire and that 31 days is up, then  
17 you continue on the fact that you're on timely  
18 renewal, which doesn't allow us to reject the  
19 application.

20 MEMBER REMPE: So, even though you  
21 never accept the application, you can't reject it?

22 MR. ADAMS: We accept the application  
23 through lack of rejection.

24 MR. BEALL: Okay.

25 Number six is going to be talked about

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1 by Rich Clement.

2 MR. CLEMENT: Thank you, Bob.

3 The staff is proposing a new regulation  
4 to provide an accident dose criteria of 1 rem total  
5 effective dose equivalent for NPUFs other than  
6 testing facilities.

7 TEDE is defined in Part 20, it means  
8 the sum of the internal and external radiation  
9 exposures.

10 Testing facilities and power reactors  
11 are subject to the reactor site criteria in Part  
12 100.

13 Currently, results from the accident  
14 analyses for NPUFs, other than testing facilities,  
15 are compared with the standards in Part 20 for  
16 protection against ionizing radiation.

17 The standards in Part 20 provide a  
18 limit on the maximum yearly dose a member of the  
19 public can receive from operation of any NRC  
20 licensed facility.

21 The annual public dose limit of .1 rem  
22 applies to normal operating conditions.

23 In addition to the dose limits in Part  
24 20, accident dose criteria are also applied to  
25 determine the acceptability of a licensed facility.

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1           The accident dose criteria are not dose  
2 limits, but provide defense-in-depth so that in the  
3 unlikely event of an accident, no acute radiation  
4 related harm will result to any member of the  
5 public.

6           And, the NRC Atomic Safety and  
7 Licensing Appeals Board suggested that the  
8 standards in Part 20 are unduly restrictive as  
9 accident dose criteria for research reactors. This  
10 was a ruling in 1972.

11           Previously, the NRC had generally found  
12 accident doses of .5 rem whole body and 3 rem  
13 thyroid from iodine exposures for members of the  
14 public to be acceptable.

15           However, in January of 1994, the NRC  
16 implemented a change in Part 20 that reduced the  
17 public dose limit from .5 rem to .1 rem.

18           Because of NPUFs low potential  
19 radiological risks to the environment and the  
20 public, the .1 rem public dose limit is restrictive  
21 as applied to accident consequences such as the  
22 maximum hypothetical accidents considered in NPUF  
23 license renewal applications.

24           Also, the staff considers the accident  
25 dose criterion Part 100, which is 25 rem whole body

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1 and 300 rem thyroid to be too high for NPUFs other  
2 than testing facilities.

3 In 1992, the Environmental Protection  
4 Agency published Protective Action Guides, or PAGs,  
5 and the Manual Protective Action Guides and  
6 Protective Actions for Nuclear Incidents.

7 In 2013, the EPA made revisions to the  
8 PAG Manual which is currently in draft interim.

9 The PAGs are dose guidelines to support  
10 decisions that trigger protective actions such as  
11 staying indoors or evacuation to protect the public  
12 during a radiological incident.

13 In the early phase, that's the  
14 beginning of the incident that may last a few hours  
15 or two days.

16 The PAG that recommends the protective  
17 action of sheltering in place or evacuation of the  
18 public to avoid inhalation of gases or particulates  
19 in an atmospheric plume and to minimize external  
20 radiation exposure ranges from 1 rem to 5 rem.

21 The proposed accident dose criterion of  
22 1 rem total effective dose equivalent for NPUFs  
23 other than testing facilities is consistent with  
24 the early phase PAG and provides adequate  
25 protection for public from unnecessary exposure to

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1 radiation.

2 MEMBER CORRADINI: So, given your  
3 explanation, I want to make sure, so you said, I  
4 can't remember the date, somewhere in your  
5 explanation, '94 you said EPA went from X to Y?

6 MR. CLEMENT: It was the NRC, it  
7 changed Part 20.

8 MEMBER CORRADINI: Okay.

9 MR. CLEMENT: In 1991, there was a rule  
10 change. There was a two or three years  
11 implementation period. So --

12 MEMBER CORRADINI: Where EPA started  
13 setting the -- go ahead, I'm sorry.

14 MR. CLEMENT: The NRC public dose limit  
15 prior to 1991 was .5 rem to a member of the public.  
16 And, in 1991 when there was a rule change, the  
17 public dose limit was reduced by a factor of 5 from  
18 .5 rem to .1 rem.

19 MEMBER CORRADINI: For normal  
20 operations?

21 MR. CLEMENT: For normal operations,  
22 that's correct.

23 There is no accident dose criteria in  
24 Part 20. It's in Part 100 applies to testing  
25 facilities and power reactors.

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1           So, we are proposing new regulations  
2 for accident dose criteria for NPUFs other than  
3 testing facilities.

4           MEMBER CORRADINI: Okay.

5           MR. CLEMENT: Based on the EPA PAG  
6 which has some precedence.

7           MEMBER CORRADINI: Okay. So, that's  
8 the short answer I was looking for. I got you.

9           MR. ADAMS: So, up until now, we've had  
10 no accident limits for research reactors. We, by  
11 default, use the regulations in Part 20 for normal  
12 operations.

13          MEMBER CORRADINI: Okay, I got you.

14          CHAIRMAN POWERS: And, there the  
15 problem.

16                I mean, you said, okay, .1 is too low  
17 and .5 seems too high. I don't quite understand  
18 that, but I really don't understand why, you know,  
19 one's too hot and one's too cold, but one is just  
20 right.

21          MEMBER STETKAR: What are you,  
22 Goldilocks or something?

23          CHAIRMAN POWERS: Yes, this is the  
24 Goldilocks approach to picking a number. I mean,  
25 it's between point -- I will agree it's been .1 and

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1 25.

2 And, I agree .1 seems too low and 25  
3 seems too high, but I don't know what one -- why  
4 one?

5 MR. CLEMENT: Well, that's a really  
6 good question.

7 We have asked in the Federal Register  
8 Notice that will be published whether or not the  
9 proposed accident dose criteria of 1 rem total  
10 effective dose equivalent is a reasonable number.

11 And, we've asked for feedback to say  
12 that, if there is another number that you would  
13 like to propose, please provide the rational basis.

14 But, there is precedence for using PAGs  
15 for radiological terrorist events, for example, EPA  
16 PAG is used. So, there is a precedence and there  
17 is a basis and we figured 1 rem TEDE, if there is  
18 -- in the unlikely event of an accident, there  
19 would be shelter in place.

20 CHAIRMAN POWERS: So it belonged to  
21 somebody else?

22 MR. CLEMENT: We haven't picked that  
23 PAG.

24 MEMBER CORRADINI: So, I know we're not  
25 supposed to go there, but since you brought it up,

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1 how is the original PAG justified because I'm not  
2 even clear why that's a good number.

3 I know it's a number that you can  
4 anchor yourself to, but why is 1 rem appropriate?  
5 Why not 2? Why not 3?

6 Because the Health Physics Society says  
7 they don't know anything below 1 or I was going to  
8 say 10 rem.

9 MR. CLEMENT: Maybe you're right.

10 MEMBER CORRADINI: They don't know  
11 anything below 10 rem for a health effect, so why  
12 1?

13 MR. CLEMENT: There is some technical  
14 basis. So, it has been adopted. There is some  
15 precedence established with that. And, you know, 1  
16 rem is --

17 MEMBER CORRADINI: Have you had  
18 history?

19 MR. CLEMENT: -- 1 rem is as good as  
20 any number -- any other number right now.

21 MEMBER REMPE: So, I worked at another  
22 organization years ago where they applied the PAG  
23 to the exclusionary boundary around a plant because  
24 it was a gas reactor.

25 And, this 1 rem you're going to apply

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1 is at the unrestricted area which, I assume, is --

2 CHAIRMAN POWERS: The door.

3 MEMBER REMPE: The door.

4 But, anyhow, this is -- they weren't  
5 doing the door. It reminded about what is actually  
6 in the PAG document. Is it supposed to be the door  
7 or is it supposed to be at the exclusion area  
8 boundary?

9 MR. CLEMENT: The PAG is defined at the  
10 exclusion area and it's following the onset of a  
11 fission product release.

12 So, it's at the exclusion area, at the  
13 low population zone or it's at the population  
14 center.

15 So, the criteria that we're proposing  
16 will be a member of the public and the nearest  
17 unrestricted area.

18 Now, from the accident analyses that I  
19 have seen and I'm sure Al's group has reviewed, the  
20 100 millirem is restrictive because, from my  
21 calculations, a member of the public could exceed  
22 100 millirem.

23 There is a provision in Part 20,  
24 1301(d) that a licensee or applicant may apply for  
25 a prior authorization to operate up to that annual

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1 dose limit of .5 rem to a member of the public.

2 But, I think this might --

3 MR. ADAMS: Yes, and there's a couple  
4 instances where we had to use that to move, you  
5 know, to find the accident scenarios to be  
6 acceptable.

7 But, it's the unrestricted area and,  
8 for a lot of these facilities, it's what Dr.  
9 Corradini said, it's the door or it's, you know,  
10 it's the fence. It's the fence, you know, five  
11 feet away from the facility.

12 And, that's the same with the, you  
13 know, the EPZs for these facilities of most are  
14 the, you know, inner boundary of the confinement or  
15 containment.

16 MEMBER REMPE: So, the person walking  
17 down the street is further out and so, in a way,  
18 you're applying the PAG in a very conservative  
19 manner if I'm interpreting this correctly.

20 MR. ADAMS: Well, what we do when we do  
21 this analysis is we, you know, we have the source  
22 term from the MHA and we look for the maximally  
23 exposed individual where ever that person might be.

24 Sometimes they're at the fence,  
25 sometimes we found that it's not the guy at the

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1 fence because the plume goes over his head and it's  
2 the guy that's, you know, 200 feet in that  
3 direction.

4 Or, sometimes we find the plume goes  
5 over the guy's head but the shine from this -- from  
6 the radiological cloud in the building creates the  
7 build.

8 So, if, you know, we look for that  
9 maximally exposed individual where ever they are  
10 and figure out, you know, figure out what the dose  
11 is in that person.

12 We also, because we, you know, how  
13 we've done this, we also look at the nearest  
14 permanent residents and then we also look for any  
15 special situations. For example, on one campus,  
16 there is a dorm which, you know, the ninth floor of  
17 the dorm lines up with the top fo the stack.

18 MR. CLEMENT: Which could be exposed to  
19 shine or anything like that.

20 MR. ADAMS: Yes, so --

21 CHAIRMAN POWERS: Actually, it's the  
22 air intake because of the stack, it's the air  
23 intake in the dorm and where it feeds into the  
24 ninth floor on the building that will be your  
25 maximally exposed individual and it'll be the

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1 krypton that gets them.

2 MR. ADAMS: Yes, so you know, so we  
3 look for that person in the unrestricted area.

4 MEMBER REMPE: Okay. So anywhere  
5 beyond is where you're -- when I'm reading the text  
6 here, it's not just at that boundary of the  
7 unrestricted area, it's anywhere?

8 MR. CLEMENT: It's the nearest  
9 unrestricted area.

10 MEMBER REMPE: Okay, thank you.

11 MR. CLEMENT: So, it is conservative.

12 MEMBER CORRADINI: So, I'll just  
13 register my -- I understand your logic. You logic  
14 is you're connecting to the EPA number, which I  
15 get.

16 But, I'm still not clear as to what  
17 that -- why that number is the right number from a  
18 health standpoint. But that's in some sense  
19 immaterial, but that's your logic, is it connects  
20 to the EPA number.

21 MR. CLEMENT: Correct.

22 MEMBER CORRADINI: Okay.

23 MEMBER BROWN: Well, on that line, can  
24 I ask, I want to try to increase my understanding  
25 of your all's argument that you all have been going

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1 through.

2           Isn't this a reduction? I mean, I went  
3 back and looked at your -- it says in there that  
4 they considered the -- if I can find it -- the  
5 staff considers the accident dose criteria in Part  
6 100 25 rem and 300 rem to the thyroid to be too  
7 high.

8           Therefore, they're proposing to amend  
9 it to reduce it.

10           MR. CLEMENT: For research reactors --

11           MEMBER BROWN: Yes, for NPUFs?

12           MR. CLEMENT: Right.

13           MEMBER BROWN: Okay. And so, I'm  
14 trying -- that --

15           MR. ADAMS: So, you're reading the --  
16 what the Board suggested to the staff. Part 100  
17 has that 25 rem number in it but Part 100 only  
18 applies to test reactors, power plants, not  
19 research reactors.

20           So, what the Board was telling the  
21 staff was --

22           MEMBER BROWN: What applies to research  
23 reactors now? What's the existing requirements?

24           MR. CLEMENT: There isn't any.

25           MR. ADAMS: So, by default, we sure the

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1 normal operational radiation dose limits.

2 MR. CLEMENT: Which is not necessarily  
3 the --

4 MR. ADAMS: Which are the 1 rem -- 100  
5 millirem and, in some cases, we can go up to 500.

6 CHAIRMAN POWERS: What you're saying is  
7 that the individual that walks by Seabrook during  
8 an accident is going to be less protected than the  
9 individual who walks by MIT during an accident even  
10 if it's the same individual?

11 MR. ADAMS: I don't want to put it that  
12 way.

13 CHAIRMAN POWERS: Well, you didn't, I  
14 did.

15 MR. ADAMS: Okay. But so, you know,  
16 but what the difference is, is that along with Part  
17 100 comes all the siting criteria with Part 100  
18 what Rich was saying, you know, low population,  
19 distance to population centers.

20 You don't get the 25 but you also, you  
21 know, you also don't have to, you know, you don't  
22 have that constraint. The lower number recognizes  
23 the fact that these reactors are on the base of an  
24 engineering --

25 CHAIRMAN POWERS: Perfect, perfect.

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1 Now I understand. Yes, good. That is the right  
2 answer for me anyway. Yes, I mean it makes sense.

3 He's saying my data about outrageous  
4 circumstances, there's a lower population zone,  
5 whereas, MIT has lots of inhabitants loosely  
6 classified as people.

7 MEMBER BALLINGER: The dorm is right  
8 across the tracks. The new one's going to have 500  
9 students in it.

10 CHAIRMAN POWERS: Yes, and so he's  
11 saying, therefore, we lower the number down because  
12 nearly all of these fit, not all of them but nearly  
13 all of them have a large population in the area  
14 affected.

15 MR. ADAMS: Right.

16 MR. BEALL: Okay.

17 CHAIRMAN POWERS: I understand and it's  
18 a good clarification.

19 MR. BEALL: Okay. Another proposed  
20 change we're looking at is to 10 CFR 50.59. This  
21 is for when the NPUFs start to move into  
22 decommissioning.

23 Currently, if a NPUF is decommissioning  
24 and the fuel has been moved offsite, they cannot  
25 make any other changes to the facilities using a

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1 50.59 process. They have to come in to us and ask  
2 for a license condition to allow them to make  
3 changes.

4 So, what we do here is we're going to  
5 make a slight change to 50.59 to allow that process  
6 to be applicable to NPUFs when the fuel is moved  
7 offsite and they want to continue with the  
8 decommissioning process at their facility. Okay?

9 MEMBER SKILLMAN: Was there support for  
10 this proposed change from license holders?

11 MR. ADAMS: There wasn't -- there was  
12 no sort of objection to it. This was an area that  
13 was introduced in the 50.59 when some changes were  
14 made in the past related to how you transition from  
15 operating status to decommissioning status, you  
16 know, 50.82 stuff.

17 And, what had happened was the way it  
18 was written that if you were a research -- if you  
19 are research reactor and you shutdown and you moved  
20 your fuel offsite, then for some reason, 50.59  
21 didn't apply anymore.

22 And, what we had to do as the staff  
23 working on decommissioning plans is we basically  
24 had to put a license condition in the license which  
25 was 50.59 verbatim put in the license or else, for

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1 example, if you wanted to make a change to a -- if  
2 you had a procedure that says, I'm going to use  
3 disposable PCs and you said, you know what, I want  
4 to use a nuclear laundry instead. That would have  
5 to come in as a license amendment because you  
6 couldn't make that change in the procedure under  
7 50.59.

8 So this corrects an inadvertent error  
9 that was introduced in the past.

10 MEMBER SKILLMAN: Alex, as you've  
11 explained this, you've triggered a concern that I  
12 have and that is, one of the real problems in  
13 industry is that some licensees were using 50.59 as  
14 a change process when, in reality, 50.59 is a  
15 screening process to determine whether or not you  
16 need to seek a license amendment.

17 Those are two very different things.

18 MR. ADAMS: Yes, I agree. It's the,  
19 you know, it's the screening process.

20 MEMBER SKILLMAN: It's the screening  
21 process.

22 MR. ADAMS: Yes.

23 MEMBER SKILLMAN: So, in the  
24 explanation that you just provided, it sounded as  
25 though you would have a licensee using 50.59 as

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1 method to change from a laundry to a --

2 MR. ADAMS: Well, it was -- it would be  
3 -- you would have to go through the screening  
4 process to see if you can make that change.

5 MEMBER SKILLMAN: Well, that would  
6 suggest then that, having a laundry or not a  
7 laundry was part of the original license.

8 MR. ADAMS: It would be a procedure  
9 that was in the license, yes.

10 MEMBER SKILLMAN: Okay.

11 MR. ADAMS: It was -- and, what the  
12 staff was doing is, we were basically reproducing  
13 50.59 verbatim as a license condition for that --  
14 we were getting license amendments requests, you  
15 know, to change things that had no safety  
16 significance and would have sailed through the  
17 50.59 screening.

18 MEMBER SKILLMAN: Okay, so by adding  
19 this to this proposed change, what you're simply  
20 doing is applying the 50.59 to a defueled NPUF and  
21 making it necessary for the licensee to determine  
22 whether or not a license amendment is required.

23 MR. ADAMS: Right. And, it's where we  
24 were before a change was made to 50.59 a number of  
25 years back related to facilities and it was that,

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1 that all those questions that came up about power  
2 reactors transitioning that, you know, is it still  
3 an operating license once you, you know, you submit  
4 your certification of, you know, defueling and your  
5 certification of permanent shutdown, was it still  
6 an operating license?

7 That the words in the regulation that  
8 said, you know, operating license apply to those  
9 reactors.

10 Part of the, you know, part of the  
11 rulemaking to fix that inadvertently fixed it for  
12 power reactors but didn't recognize the fact that  
13 research -- most research reactors, the fuel is  
14 owned by DOE and leaves site rapidly.

15 MEMBER SKILLMAN: Okay, thank you. Now  
16 I understand.

17 MR. BEALL: Okay. The proposed change  
18 number eight is going to be discussed by Kevin  
19 Folk.

20 MR. FOLK: Thanks, Bob, Members of the  
21 Subcommittee.

22 I'm going to break from our Part 50  
23 discussion here for a minute and talk about the  
24 Part 51, our environmental protection regulation.

25 Just by a little way of background,

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1 NRC's environmental protection regulations under  
2 Part 51 implement the National Environmental Policy  
3 Act.

4 These regulations require the staff to  
5 do an environmental review for the Agency's  
6 licensing and related regulatory actions.

7 So, specifically, NPUFs, you know, to  
8 enable the staff to conduct its independent  
9 analysis of the environmental impacts of a  
10 licensing action that we may take and to prepare  
11 environmental documentation that's required under  
12 the National Environmental Policy Act and our  
13 regulations, we require environmental information  
14 from the applicant normally in the form of an  
15 Environmental Report, which I think we mentioned in  
16 some of our earlier discussions.

17 So, the requirement for this  
18 environmental information in the form of a formal  
19 Environmental Report specific to NPUFs is not  
20 currently contained in Part 51.45 or Section 51.45  
21 of our regulations as it is for power reactors.

22 So, that brings us to the purpose of  
23 this change and sort of delving into Part 51 that  
24 to provide consistency in the form and quality of  
25 environmental documentation that we receive from

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1 our applicants, we are proposing adding the  
2 provision that they come in with a, at license  
3 renewal, with an Environmental Report for the  
4 staff's independent review.

5 MEMBER CORRADINI: So, maybe I don't  
6 appreciate that, but since we're not -- since we're  
7 now -- we don't have license renewal or we have  
8 ongoing, I don't understand.

9 MR. FOLK: Well, we would continue to  
10 have license renewal for the Class 103 facilities.

11 MEMBER CORRADINI: Oh, I'm sorry.

12 MR. FOLK: SHINE, Northwest, those  
13 types of facilities.

14 MEMBER CORRADINI: Okay.

15 MR. FOLK: And for testing facilities.

16 MEMBER CORRADINI: I misunderstood.  
17 So, it's for those?

18 MR. FOLK: That's correct.

19 MEMBER CORRADINI: Okay.

20 MR. FOLK: It's part of the broader  
21 license renewal framework that we're proposing,  
22 correct.

23 MEMBER BROWN: So, it's not going to  
24 change? That's going to be the -- that's going to  
25 remain the same? I'm trying to have a takeaway.

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1           You haven't added this, this is what  
2 exists today?

3           MR. FOLK: At the moment, there is not  
4 a specific requirement for an Environmental Report  
5 under 51.45.

6           MEMBER BROWN: For the test reactors?

7           MR. FOLK: That is correct. We are  
8 proposing to add that requirement similar as to  
9 what exists for power reactors.

10          MEMBER CORRADINI: And, just to repeat  
11 for --

12          MEMBER BROWN: Why? I'm sorry.

13          MEMBER CORRADINI: Go ahead.

14          MEMBER BROWN: I was just asking why  
15 are you upping the ante on the test reactors now  
16 after 70 years, 60 years of experience with test  
17 reactors?

18          MR. FOLK: Sure, sure. They provide  
19 environmental documentation but as regulatory  
20 requirements have evolved and the scrutiny of  
21 environmental issues has evolved and increased, we  
22 find ourselves needing to compare more and more  
23 apples to apples, if you will.

24                 On the power side, our licensees have  
25 become very custom to understand what information

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1 we need to be able to meet our NEPA requirements.

2 You know they work together very  
3 proactively to see what information we need and  
4 what types of questions we have in the terms of  
5 RAIs.

6 We continue to do environment reviews  
7 for, you know, license amendments and so forth.  
8 But, there are sometimes differences in the quality  
9 of that information that we get from particular  
10 licensees.

11 So, the overarching purpose here is to  
12 provide a clear technical direction to licensees to  
13 facilitate them providing us information such that  
14 we're not in the situation, perhaps, of  
15 unnecessarily issuing RAIs.

16 MR. ADAMS: I think there was a way to  
17 get there, but it was kind of convoluted.

18 MR. FOLK: Well, I'll give a specific  
19 answer or a specific example.

20 When SHINE came in for their  
21 construction permit application, they looked at our  
22 regulations as certainly they should and said,  
23 well, there's no requirement for us to provide an  
24 Environmental Report. And, there is no specific  
25 requirement.

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1                   We've relied on 51.41 of our  
2 regulations which says that the Commission may  
3 request environmental information. And so, well,  
4 what's the form of that environmental information  
5 that we would provide?

6                   Well, the staff undertook an initiative  
7 to develop an ISG for the medical radioisotope  
8 production facilities, and ISG to 1537 which  
9 prescribes the type of information for that  
10 Environmental Report. It also includes guidance to  
11 staff on how to -- as part of the review process of  
12 that environmental report.

13                   MR. ADAMS: I mean, that's what I was  
14 looking for.

15                   MR. FOLK: Yes.

16                   MR. ADAMS: 51.41.

17                   MR. FOLK: 51.41.

18                   MR. ADAMS: You know, we would get the  
19 question, you know, the license renewal, when we --  
20 about a year before a license expires, you would  
21 send out a standard letter that says, here's what  
22 we expect to see in your application. And we would  
23 get, well, why do I need an Environmental Report?

24                   And, we basically would have to go back  
25 to 51.41 saying, you know, that we need it for we

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1 can meet our requirements under NEPA because the  
2 Commission may require an applicant blah, blah,  
3 blah, blah.

4 So, what we're doing is we're  
5 clarifying and making a more direct tie to what,  
6 you know, we've been doing sort of the long way  
7 over the years.

8 MEMBER BROWN: Okay, I lost the bubble  
9 a little bit on the other stuff.

10 SHINE is a test reactor then?

11 MR. ADAMS: SHINE is a special case.

12 MEMBER BROWN: It's a --

13 MR. ADAMS: 103.

14 MEMBER BROWN: 103.

15 MR. ADAMS: Right.

16 MEMBER BROWN: So, I'm still talking  
17 about test reactors. SHINE, you people keep  
18 beckerling into SHINE and I'm -- you keep changing  
19 which tree I'm working on here. Okay?

20 I've got research reactors, test  
21 reactors and SHINE and W-whoever they are for --

22 MEMBER CORRADINI: He needs a VIN  
23 diagram.

24 MEMBER BROWN: So, why impose this on  
25 -- I understand SHINE a little bit more, I think, I

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1 guess, even though there's no requirement, right?  
2 But the test reactors, I still can't connect the  
3 dots as to why you're upping the ante on the test  
4 reactors.

5 MR. HARDESTY: No, they've always had  
6 the requirement.

7 MEMBER BROWN: That's --

8 MR. HARDESTY: They've always had the  
9 requirement, the testing facilities, because  
10 they're actually required to do an Environmental  
11 Impact Statement. Well, we're required to do it.

12 MEMBER BROWN: Were?

13 MR. HARDESTY: The federal agencies.

14 MEMBER BROWN: I thought you said they  
15 weren't before, that's why I'm confused. Neither  
16 the research reactors nor the test reactors and you  
17 were now -- you just said you were adding this as a  
18 requirement.

19 MR. HARDESTY: I think adding is a  
20 misnomer, it's more of a clarification because we  
21 have always solicited the information. We have to  
22 do an environmental analysis anytime we do a  
23 licensing action.

24 So, whether it be an amendment or a  
25 license renewal or anything else, a license

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1 transfer, et cetera, we have to do an environmental  
2 -- determine whether an Environmental Impact  
3 Statement is necessary or an Environmental Analysis  
4 or -- and there's other things, finding a no  
5 significant impact for that.

6 But, in order to facilitate that, we've  
7 always requested from the licensee environmental  
8 information typically by RAI because of the 50.41  
9 clause allowing us to do that.

10 This is just meant to clarify that to  
11 the licensees that, as part of license renewal in  
12 that new -- we're coming to that or, actually, I  
13 guess we talked about it, the new section that  
14 talks about license renewal for 103s and testing  
15 facilities, they are required to provide that  
16 Environmental Report.

17 The reason why the NPUFs, the other  
18 NPUFs fall off is because they're not doing license  
19 renewal, but it would still apply to them for  
20 licensing actions like amendments.

21 MS. GAVRILAS: This is Mirela Gavrilas.

22 If I can add something for clarity  
23 because test facilities come up over and over and  
24 we think NIST. When the staff thinks test  
25 facility, we think of potential 500 megawatt test

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1 facility that is now being proposed, for example,  
2 in certain circles at DOE.

3 So, while the threshold between  
4 research reactors and test reactors is the 10  
5 megawatts. There's no upper limit on test  
6 reactors, so people are talking about large in  
7 terms of power rating test reactors and we want to  
8 make sure that what ever we do covers those  
9 facilities as well.

10 MR. FOLK: If I might -- may add,  
11 Mirela, under 51.20 by regulations, a license  
12 renewal of testing facilities of which there is  
13 one, as we mentioned, NIST, requires the staff to  
14 prepare and Environmental Impact Statement. So,  
15 they are already required to come in with a formal  
16 Environmental Report.

17 Clear as mud?

18 MEMBER BROWN: It just sounded to me  
19 like we were embarking on a full-blown NEPA  
20 exploding requirement for these and, depending on  
21 what the size of the, quote, test reactor is and  
22 how many people work there, that's -- power plants  
23 is one thing. I mean, they've got hundreds of  
24 hundreds of folks that work on this between the  
25 corporate offices and the other stuff.

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1           Whereas, you have two or three people  
2           or four or five, whatever here it is. And so, I'm  
3           trying to sort out a lot rocks to get the  
4           information you wanted to do the full-blown NEPA  
5           approach.

6           Issuing an RAI saying we want this,  
7           this, this and this, that's kind of a different  
8           thing.

9           MR. FOLK:     NEPA only applies where  
10          there's a licensing action to take. So, for the  
11          facilities that would be converted or may be  
12          converted to non-expiring licenses and, therefore,  
13          would not be required to come in for license  
14          renewal, there's no regulatory action to take.

15          MEMBER BROWN: I understand that part,  
16          it's the research reactors you're talking about. I  
17          got that. I know which tree I'm working on now.

18          MR. ADAMS:    And, I think the test  
19          reactor, because we're required to do an EIS, they  
20          have to come in with an Environmental Report.

21          MR. FOLK:    That's correct.

22          MR. ADAMS:    Okay? So, it would be the,  
23          you know, the only folks left are these medical  
24          facilities that are under 103, they're not test  
25          reactors, they're not a type of facility that we're

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1 required to an EIS for, however, the way we get an  
2 Environmental Report from them is not the 51.45 but  
3 it's the --

4 MEMBER BROWN: It's under there,  
5 though, right?

6 MR. ADAMS: Yes, we get there but it's  
7 a long road and now we're just -- we're clarifying  
8 to make the explanation to regulation more direct  
9 and clearer.

10 MR. FOLK: And, this rule for those 103  
11 facilities, this rule would not reinvent the wheel  
12 for them. They would be required to come in with  
13 an Environmental Report, but it could be a  
14 supplement to their original Environmental Report.  
15 And that's -- but that's specified in the proposed  
16 language as well.

17 MR. BEALL: Okay. And our final  
18 proposed change has to do with financial  
19 qualifications and Kos Lois will be taking -- will  
20 discuss this slide.

21 MR. LOIS: Thank you.

22 My name is Kos Lois and I'm a Financial  
23 Analyst in NRR. I appreciate the opportunity to  
24 speak about eliminating the requirements for the  
25 NPUFs to submit financial qualification information

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1 with their license renewal application.

2 As it first of all states, this  
3 proposed rule impact Class 103 NPUFs and testing  
4 facilities. There are 31 NPUF facilities, as we  
5 discussed earlier this morning, 25 of which are  
6 academia, 3 are private industry and 3 are federal  
7 government.

8 The second bullet, 10 CFR 50.33(f)(2)  
9 requires financial qualification information at  
10 license renewal.

11 The current financial qualification  
12 regulations at 10 CFR 50.33 require the licensees  
13 to provide evidence that they have a reasonable  
14 assurance of obtaining the funds necessary to cover  
15 the estimated operation costs for the first five  
16 years of their operations.

17 Currently, this requires licensees at  
18 the time of initial licensing and on license  
19 renewal to provide financial statements and  
20 forecasts the future operational costs.

21 MEMBER REMPE: So -- go ahead, finish  
22 your slide.

23 MR. LOIS: Third bullet, this proposed  
24 rule would eliminate the financial qualification  
25 requirements at license renewal stage only. So,

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1 the licensees would still need to provide the  
2 financial statements and forecasts of their  
3 operational costs at the initial licensing stage.

4 There is -- and, I'd like to just add  
5 to this point, there is another rulemaking ongoing  
6 that is reassessing the financial qualification  
7 requirements for all the 10 CFR Part 50 licensees,  
8 including the NPUFs, and the Commission provided  
9 staff direction to pursue that rulemaking. And, if  
10 anyone's interested, that's SRM SECY-14-0089.

11 CHAIRMAN POWERS: Since there is this  
12 other activity going on, why shouldn't you remain  
13 mute on this subject until that is completed?

14 You don't know where it's going and  
15 don't know what they're going to come up with, why  
16 is this -- why add this into your activity?

17 MR. HARDESTY: So, we included them in  
18 our working group and we had several discussions  
19 with the people that are working on that rule and  
20 the people that were working on our rule. And this  
21 was the division of labor, as it were, that we  
22 decided on in order to keep it the most clean.

23 They really hadn't addressed the  
24 non-power facilities in what they were working on,  
25 but they knew they needed to and we were already

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1 working on addressing it because we wanted to get  
2 --

3 CHAIRMAN POWERS: So, you really --  
4 you're part of it, you're just ahead of it?

5 MR. HARDESTY: That's correct.

6 CHAIRMAN POWERS: And they're not going  
7 to do anything that's going to undo what you're  
8 doing?

9 MR. HARDESTY: They were counting on us  
10 getting this through. If we don't, then obviously,  
11 they'd have to address it.

12 CHAIRMAN POWERS: Okay.

13 I mean, clearly, what I'm concerned  
14 about is they come up with something that's working  
15 on to this.

16 MR. ADAMS: We're coordinating with  
17 them closely and what this does is --

18 CHAIRMAN POWERS: What you're telling  
19 me is that you're actually doing the NPUF part of  
20 their job?

21 MR. ADAMS: Their rule, that's correct.

22 CHAIRMAN POWERS: And so, we don't --  
23 there is no possibilities that they will come up --

24 MR. BEALL: They are aware of what  
25 we're doing. So, we've sent them copies of our

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1 proposed rule language and all this good stuff.

2 CHAIRMAN POWERS: And, they're not  
3 going to do anything to undo you on their on  
4 volition, I'd say?

5 MEMBER BROWN: Say no, say no out loud.

6 MR. HARDESTY: Kos is actually on both  
7 rulemaking groups. So, he's our middleman.

8 CHAIRMAN POWERS: You can't preclude  
9 somebody external to the group might impose  
10 something on them, but on their own volition,  
11 they're not addressing your topic, they're counting  
12 on you doing that?

13 MR. HARDESTY: That is correct.

14 MEMBER SKILLMAN: Why is this a good  
15 idea?

16 MR. HARDESTY: Why is this a good idea?

17 MEMBER SKILLMAN: Yes.

18 MR. HARDESTY: Because this is one of  
19 the most burdensome things that the licensees have  
20 complained to the Commission about.

21 MEMBER SKILLMAN: So?

22 MR. HARDESTY: And so, the Commission  
23 directed the staff to look into this. And, when  
24 the staff looked into it, there was basically no  
25 connection found between financial surety and

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1 safety.

2 MR. ADAMS: For licensing. My  
3 understanding is this is consistent with what's  
4 required of the power reactors. So, basically,  
5 we're making alignment with the power reactors that  
6 do not have to submit this information.

7 And, the question is --

8 MEMBER SKILLMAN: At license renewal?

9 MR. ADAMS: At license renewal, right.

10 So, why do I, the little research  
11 reactor, have to prove that, you know, questions  
12 like, you know, prove you're the State of  
13 Wisconsin? I believe those are questions we have  
14 to ask.

15 So, I mean --

16 CHAIRMAN POWERS: That's a legitimate  
17 question in the case of the State of Wisconsin.

18 MR. ADAMS: So, you know, driving force  
19 was that we had a requirement that, for research  
20 reactors, that was much more onerous than the  
21 mirror requirement for power reactors.

22 MEMBER SKILLMAN: It almost seems  
23 counterintuitive. It strikes me that if you're a  
24 very small operation, there may be value in  
25 demonstrating that you do have financial capability

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1 even thought it's burdensome.

2 MR. ADAMS: And so, we're only looking  
3 at license renewal for initial licensing that, you  
4 know, you still would have to show it. But, you  
5 have to step back, they're small operations but,  
6 the majority of them are the State of, you know,  
7 State of Fill-in-the-Blank.

8 MEMBER SKILLMAN: But, here I am, I'm  
9 out 22 years. I expect to run for another 22. I'm  
10 somewhere between almost dead broke and certainly  
11 dead broke but I'm just about there, but I'm  
12 hanging on. And, I know I have equipment that I  
13 need to repair. But, now I'm not going to have to  
14 disclose that.

15 MEMBER STETKAR: And, you only need to  
16 have one of them have an accident.

17 MR. ADAMS: Well, so and it's financial  
18 information as, where am I going to get my money  
19 from? And, the answer is, the State of  
20 Fill-in-the-Blank through appropriations will give  
21 me, you know, and we let, you know, give us the  
22 information.

23 MEMBER SKILLMAN: Except that you have  
24 something like 50.9 which says that you've got to  
25 be accurate and truthful. And so, you can't go in

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1 smoking the books saying, you know, I can get this  
2 money when I need it when, in fact, you can't.

3 MR. ADAMS: Well, just like anything  
4 else, if the licensee is lying to us, and  
5 especially a State licensee, you know, if we see  
6 the material condition of a facility start to  
7 deteriorate through the inspection program rapidly,  
8 we're going to start to ask questions.

9 And, I'll be honest with you, the  
10 licensee will come and say, hey --

11 MEMBER SKILLMAN: But, the financial  
12 conditions can be vastly different than what is  
13 apparent in the physical condition. You can have  
14 an entity that's on the verge of bankruptcy or  
15 that's in some legal activities that really do  
16 prevent it from being solvent six months from now  
17 and it needs that money to run the operation.

18 MR. ADAMS: But those inspections are  
19 still ongoing even though our financial --

20 MEMBER REMPE: Let's --

21 MEMBER CORRADINI: So, I ask a  
22 different question?

23 So, I interpreted -- the Members are  
24 going to ask you a bunch of stuff, but what I guess  
25 I'm curious about is, one of the answers you said

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1 is you're making it consistent with what power  
2 reactors required to do for their license renewal.

3 MR. ADAMS: Yes.

4 MEMBER CORRADINI: Isn't that it in a  
5 nutshell? Why should this be more onerous for the  
6 research reactor than for the power reactor?

7 MEMBER REMPE: Okay. Let's take --  
8 this is for Class 103 NPUFs and testing facilities.  
9 Mirela said on the prior slide, I'm thinking about  
10 the new 500 megawatt thermal reactor that's going  
11 to be put at a DOE site from Joe Blow and his  
12 financial venture capitalists.

13 And, five years after it's operated,  
14 Joe Blow and his venture capitalists are saying,  
15 well, we didn't really market these to other  
16 facilities.

17 And then I'm wondering maybe we should  
18 look at their finances.

19 MR. ADAMS: Well, we still look at  
20 financial for initial licensing.

21 MEMBER REMPE: Yes, but after five  
22 years when you can't market it to across the world  
23 --

24 MEMBER STETKAR: A 1000 megawatt  
25 electric merchant plant in the Northeast of the

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1 United States.

2 MEMBER REMPE: But he has a  
3 decommissioning fund.

4 MR. ADAMS: Well, not necessarily.

5 MEMBER STETKAR: Yes, but that's  
6 decommissioning doesn't help you in terms of day to  
7 day operations.

8 MEMBER REMPE: I'm wondering what's  
9 going to happen with the facility on the DOE side.

10 MR. ADAMS: Well, that facility, you  
11 know, the next time we would look at the financial  
12 condition is license renewal which might be 20, 30,  
13 40 years down the road.

14 So, we look at, you know, we look at it  
15 for initial licensing and it's back to, you know,  
16 our licensees are mostly governments, state  
17 governments or federal governments and there are  
18 the three facilities that are private companies.

19 And, sort of the parallel to this is,  
20 you know, in decommissioning funding, state  
21 governments can give us the basically the assurance  
22 that, you know, that they're a government entity  
23 and that's it. They don't have to put, you know,  
24 any of the financial tools that, you know, that the  
25 private companies have to put up.

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1 MEMBER REMPE: But, this is the 104s.  
2 The slide is for the 103s and the testing  
3 facilities, right?

4 MR. ADAMS: Because they're the only  
5 ones that will have license renewals.

6 MEMBER REMPE: Right. And so, you're  
7 going to eliminate the financial qualifications for  
8 them?

9 MR. ADAMS: At license renewal.

10 MEMBER REMPE: At license renewal?

11 MR. ADAMS: Right.

12 MEMBER REMPE: They're not going to be  
13 state governments like you were saying --

14 MR. ADAMS: Well, that's --

15 MEMBER REMPE: -- in your last  
16 sentence.

17 MR. ADAMS: Well, that's true. I mean  
18 that would be, you know, NIST would be --

19 MEMBER REMPE: NIST and --

20 MR. ADAMS: -- and the private --

21 MEMBER REMPE: -- SHINE which is  
22 depending on NSA money and something we don't know  
23 about that may or may not happen.

24 MEMBER CORRADINI: I'm not sure what  
25 you're worried about. They're not even built yet

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1 and they haven't been qualified yet.

2 Once they get an operating license,  
3 they have to go through this qualification, this  
4 financial qualification and then, I don't know what  
5 the SHINE's license would be to pick SHINE.

6 Well, let's say it's 20 years, then  
7 they would have to go through a similar to a power  
8 reactor in 20 years. That's what I --

9 MEMBER REMPE: They won't have to do  
10 financial qualification.

11 MEMBER CORRADINI: That's what I  
12 thought Al was telling us.

13 MR. ADAMS: Right, but in the lead up  
14 to that license renewal, we have an inspection  
15 program. We're, you know, obviously, if we walk  
16 into the place and half of the staff is not there  
17 anymore from last time and staffing is one of the  
18 things we look at.

19 And, you know, and we see the equipment  
20 falling apart --

21 MR. LOIS: Al, can I add one more  
22 thing, too? Aside from initial licensing and at  
23 license renewal, there is a provision in 10 CFR  
24 50.33(f)(5) that does say the Commission may  
25 request an established entity to submit additional

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1 or more detailed information respecting its  
2 financial arrangements and status of funds if the  
3 Commission considered information appropriate.

4 So, that's always --

5 MEMBER REMPE: It may. Yes, I just --  
6 it doesn't seem like such a bad thing to be asking  
7 for their financial assurances through the years.

8 CHAIRMAN POWERS: Well, I think the  
9 argument here is that it's redundant, that they get  
10 alerted to degradation in their finances by other  
11 ways. And so, they don't need that information.  
12 That's the sense I'm getting here.

13 MEMBER BROWN: Well, they can also,  
14 based on a comment over there, I mean, if you're  
15 doing your inspections or whatever it is, you geez,  
16 things are looking a little shoddy. You can come  
17 in and ask for the information to see if there's a  
18 driver for the thing.

19 I mean, there are a lot of ways to get  
20 there as opposed to requiring some formal 500 pages  
21 worth of stuff. I don't know.

22 MR. LOIS: And, actually, to my next  
23 bullet over there, I know some of this is  
24 repetitive from what Al and Duane mentioned this  
25 morning, but the NRC's primary means to ensure the

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1 safe operation is through the inspection and  
2 enforcement programs that are in place.

3 They were discussed this morning, but  
4 we do perform routine safety inspections,  
5 inspections of physical security and safeguard  
6 programs and reactor inspections when necessary.

7 We also -- NRC also has a training  
8 qualification program in place for the NPUF  
9 inspectors and the examiners.

10 And, the NRC also manages the review of  
11 the emergency and security plans and develops and  
12 implements policy and guidance concerning the NPUF  
13 licensing program.

14 So, we have the ability to look more to  
15 the financial, you know, integrity if we need.  
16 However, we do have all these other programs in  
17 place to ensure that these facilities are operating  
18 safely.

19 MR. ADAMS: And, could you say -- could  
20 you tell us briefly what kind of information that  
21 they submit to us?

22 MR. LOIS: Sure. They submit their  
23 operating costs. Yes, they submit their operating  
24 costs and sources of funds to cover those costs.  
25 All the things that come in in the report.

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1 I mean, they have things -- salaries,  
2 benefits, I mean they have all sorts of the  
3 breakdown associated with the facility that we  
4 evaluate. And they do it --

5 MR. ADAMS: And, that's for the first  
6 five years?

7 MR. LOIS: That's for the first five  
8 years. And, the way it currently is, obviously,  
9 when we do have license renewal, they provide it  
10 for the next five years.

11 MEMBER SKILLMAN: I would like to  
12 respond to Mike Corradini's challenge. What are  
13 you afraid of?

14 The answer is nothing, in all candor.  
15 This is the business of the entity that has the  
16 license.

17 But, my experience is, the  
18 organizations that have to account financially  
19 have, in addition to the discipline of owning the  
20 plant, operating the plant, maintaining the plant,  
21 protecting the public, protecting the -- now coming  
22 through emergency planning, taking the appropriate  
23 actions with their radiological protection program.

24 They also have a fiscal discipline of  
25 being able to understand what are the revenues?

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1           What are the costs?   What are the projected costs  
2           for the next several calendar quarters and the next  
3           two or three years?   What are the capital outlays  
4           that are necessary to maintain the facility?

5                       And, at least my experience over all  
6           these years is the financial discipline runs  
7           parallel to the operational discipline.   They are  
8           literally locked at the hip.

9                       And so, this, in my mind, severs that  
10          very important connection.   And it is immaterial to  
11          me   whether   the   financial   qualification   is  
12          indicating an abundance of funds or a very slim  
13          amount of funds, but that, to me, is important.

14                      MEMBER CORRADINI:   But the -- so, I  
15          want to make sure I understand that.

16                      So, your point is that you don't think  
17          nine makes sense.   So, that means you would rather  
18          require nine for all 100 operating reactors because  
19          it's not required of the 100 operating reactors.

20                      MEMBER SKILLMAN:   Well, what you get  
21          with the commercials, no, what you get with the  
22          utilities is a financial report annually, but they  
23          are generally reporting quarterly.

24                      There is a huge amount of attention to  
25          the finances of the big news.

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1                   MEMBER STETKAR:   And, you have resident  
2                   inspectors there.   You have resident inspectors,  
3                   not --

4                   MEMBER CORRADINI:   But the inspectors  
5                   don't inspect the finances.

6                   MEMBER SKILLMAN:   Well, they inspect  
7                   everything but finances.

8                   MEMBER STETKAR:   But they wander around  
9                   the plant and you don't have an inspection once  
10                  every couple of years or so kind of.

11                  MEMBER SKILLMAN:   So, I'm with Mike  
12                  that, to a very large degree, the health of the  
13                  finances at least are a leading indicator of the  
14                  potential health of the facility.

15                  MEMBER CORRADINI:   So, let me --

16                  MEMBER SKILLMAN:   So, it seems to me  
17                  there's a connection there that is worth retaining.

18                  MEMBER CORRADINI:   So, let me make sure  
19                  I understand who this applies to because I thought,  
20                  and maybe I'm off base, so it applies to the NIST  
21                  reactor, it applies to the MIT reactor --

22                  MEMBER REMPE:   No.

23                  MEMBER CORRADINI:   It's a 103 --

24                  MR. ADAMS:   If we get, you know, if we  
25                  go forward with everything in this rulemaking

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1 package, because license renewal will be eliminated  
2 for research reactors, it would only apply to test  
3 reactors and Class 103 facilities.

4 MEMBER CORRADINI: So --

5 MR. ADAMS: So, NIST, SHINE and  
6 Northwest, if they become licensees.

7 MEMBER REMPE: And, something new that  
8 might be built on venture capital.

9 MR. ADAMS: Yes.

10 MEMBER REMPE: Oh, and something new  
11 that's large built on venture capital money,  
12 perhaps.

13 MR. ADAMS: Well, again, the initial --  
14 for the initial construction permit and license,  
15 there is a requirement for financial information.  
16 It's that, you know, it's the renewal for those  
17 facilities that occurs, you know, 20, 30, 40 years  
18 down the road.

19 So, we would have been watching that  
20 facility operate for 20 to 40 years before a  
21 license renewal comes up and we look at that and  
22 potentially, we'd want to look at financial again.

23 MEMBER CORRADINI: So, what you  
24 explained, I just want to make sure I'm -- so, now  
25 I've got who it applies to, but SHINE and Northwest

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1 have yet to even get their operating license. So,  
2 they have yet to even go through this process. Is  
3 that correct?

4 MR. ADAMS: Correct.

5 MEMBER CORRADINI: So, it's really  
6 NIST?

7 MEMBER REMPE: Right.

8 MEMBER CORRADINI: Okay. So, back to  
9 Dick's point then, in the case of that as an  
10 example, which is government owned, you still think  
11 they would need to show financial qualification  
12 upon renewal? That's the only reactor that fits in  
13 this category.

14 CHAIRMAN POWERS: You're asking me?

15 MEMBER CORRADINI: Yes.

16 CHAIRMAN POWERS: The answer's yes,  
17 sir. Yes. Yes, but the answer is fairly simple.  
18 I mean it's a one line statement. It's full faith  
19 and security of the American government. I mean  
20 but it's one line.

21 MEMBER STETKAR: This rulemaking  
22 doesn't say -- this isn't the NIST rulemaking, it's  
23 the rulemaking that will exist 79 years from now.

24 MR. BOWERS: If I could just add --

25 MEMBER STETKAR: Because there isn't

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1 any more money left for anymore rulemaking.

2 MR. BOWERS: If I could add one  
3 statement?

4 My name's Tony Bowers. I'm the Branch  
5 Chief for the Financial Analysis International  
6 Projects Branch in NRR.

7 This is a great, great discussion,  
8 great debate about the importance of finance, or  
9 lack thereof.

10 And, Kos, one important thing as Kos  
11 mentioned, there is an ongoing rulemaking for all  
12 Part 50 licensees. That actually came from  
13 Commission direction in SRM 13-0124, not 14-0089.

14 But, one thing I'd like to clear up is  
15 the assertion that there's any nexus between safety  
16 and money. I'd like to, you know, just go back to  
17 either Duane or Al made the statement that the data  
18 doesn't support that statement.

19 And, that's currently what we're  
20 looking to validate. Currently, there is no data  
21 that we have come across to support the statement  
22 that there is a direct nexus between safety and a  
23 one-time look at a licensees financial condition.

24 That's all I'd like to say.

25 Thank you.

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1 MR. BENOWITZ: I'll support -- just to  
2 continue on that point, partly because I used to  
3 work on that rulemaking.

4 There have been over the last few  
5 decades, NRC staff and Commission determinations  
6 about the lack of a nexus. So, it's not a recent  
7 look at that issue, there is actually historical  
8 lack of a nexus between the financial health of a  
9 licensee and its ability to safely operate its  
10 facility.

11 CHAIRMAN POWERS: I think what you  
12 said, I'm just taking notes here, is that, if I  
13 look at the database, I come to the conclusion that  
14 there is not a course connection between financial  
15 health and the ability to operate a facility  
16 safely.

17 MR. BENOWITZ: That's correct.

18 My name Howard Benowitz, again, from  
19 OGC.

20 CHAIRMAN POWERS: Thank you a lot.

21 MR. BEALL: Continuing on the topic of  
22 money, the -- as part of the proposed rule package,  
23 the staff also did a draft regulatory analysis and  
24 also considered whether or not the backfit rule,  
25 51.09, would apply to this proposed rulemaking.

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1           So, what we have in the top chart is  
2 the cost and cost savings to both the Agency and to  
3 the licensee.       There will be a one-time  
4 implementation cost, \$720,000.00 for the NRC. That  
5 cost is basically the cost it takes to finish up  
6 the rulemaking and internal changes that Al and his  
7 folks have to make to implement the final rule.

8           And, a one-time cost of \$140,000.00 to  
9 the licensees.

10           And then, there's continuing operating  
11 costs. Now, this operating cost you see here --

12           MEMBER BROWN:     I thought you said  
13 licensees, is that individual licensee or total?

14           MR. BEALL:    Total.

15           MEMBER BROWN:    So, 31 into \$140,000.00  
16 is -- it's what, \$22,000.00 -- \$5,000.00, whatever,  
17 I can't even do the math anymore it's so  
18 outrageous.

19           I mean, you're talking, what, 30 times  
20 --

21           MR. BEALL:    Five thousand dollars --

22           MEMBER BROWN:    Five thousand, yes,  
23 something --

24           CHAIRMAN POWERS:   It didn't cost very  
25 much not to do something.

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1                   MEMBER BROWN:       Well, no, that's  
2 implementation costs. I mean, but it sounds like  
3 they're going to have to do something.

4                   CHAIRMAN POWERS:    Yes, they've got to  
5 do --

6                   MEMBER BROWN:       But they've got to  
7 change the procedures. I was looking to the hours  
8 that you program for some of these things. And,  
9 the dollar cost value it seems like that those  
10 numbers are so low that I would have walked out of  
11 the room if I'd been a licensee. I mean that's the  
12 total for all the licensees you said?

13                   MR. BEALL:    Right.

14                   MEMBER BROWN:    Thirty-one licensees?

15                   CHAIRMAN POWERS:    Again, it doesn't  
16 cost much not to do something.

17                   MEMBER BROWN:    But they've got to do  
18 something to get to not do something. That's the  
19 implementation cost.

20                   MR. BEALL:    Right. As well as changing  
21 --

22                   MEMBER BROWN:    But this is not a cost  
23 for not doing anything later, this is a cost just  
24 to not be able to do anything later.

25                   MR. HARDESTY:       But, you have to

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1 remember that one of the things we are requiring is  
2 the update of their FSARs. And, we went in with a  
3 base assumption that they were starting at ground  
4 zero. We don't really expect that, but we're  
5 saying, you know, this is what it's going to take  
6 them to get from what ever they have to what ever  
7 we will accept. Accept's probably not the right  
8 word. What ever we will allow them to submit as  
9 part of 50.71(e) update.

10 So, that is included in that cost.  
11 And, Liz Gormsen can give you a lot more details  
12 behind the numbers if you'd like to have that.

13 MEMBER BROWN: My brain would explode.  
14 The numbers are so small as to be -- I'd just --

15 MR. BEALL: Well, we're hoping to get  
16 bigger numbers from the industry once -- because  
17 this is a draft regulatory basis. And so, this  
18 will be released, this document with the rest of  
19 the rulemaking package.

20 And so, the RTR folks are able to see  
21 this and hopefully give us feedback on what they  
22 really think the implementation cost will be. And  
23 then, we'll update the numbers in the final rule  
24 package.

25 And, the operation costs you see here,

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1 \$1.8 million and \$1.6 million, respectively, is  
2 over a 20-year time period. So, that's -- so it's  
3 not much of a per year basis.

4 So, the average savings we're seeing  
5 here, cost savings around \$12 million and \$5.5  
6 million, respectively.

7 So, the total net benefit we calculated  
8 to be approximately \$13 million. And, of course,  
9 you can see the three and seven percent discount  
10 rates there also as it breaks down.

11 The other thing we look at is backfit.  
12 Backfit 51.09 does not apply to the NPUFs. 51.09  
13 is really written for power reactors. And so,  
14 there have been other documents that have gone up  
15 to the Commission, other rulemakings that apply to  
16 NPUFs, or RTRs at the time, that had not -- that  
17 stated that backfit was not applicable.

18 And, since this rulemaking is totally  
19 on RTR/NPUF activities, the backfit considerations  
20 of 51.09 do not apply. And so, it has not been  
21 considered as part of this rulemaking.

22 MEMBER BALLINGER: I've got a question.  
23 What is included in the cost savings?

24 MS. GORMSEN: Good afternoon. Liz  
25 Gormsen from ICF.

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1           Cost savings are largely driven by the  
2 non-expiring license option under the rulemaking so  
3 that, over the 20-year period, there is a  
4 substantial savings from licensees not having to  
5 submit an application, respond to RAIs, for the NRC  
6 staff to not have to review the application and  
7 develop RAIs and interact with the licensees. So,  
8 you get a cost savings from those activities.

9           MEMBER BALLINGER:       So, but that's  
10 effectively a one-time operation for a facility if  
11 it's 20 years.

12           MS. GORMSEN:   Right.

13           MEMBER BALLINGER:   So, it's effectively  
14 a one-time cost?

15           MS. GORMSEN:   Right.   And, it was a  
16 pretty substantial outlay, looked at NRC staff time  
17 keeping data to figure out how much time is spent  
18 on these activities.

19           MEMBER BALLINGER:   Because, I do have  
20 numbers for the licensing renewal effort on the MIT  
21 reactor. And, I can tell you it doesn't match up  
22 with this.

23                           If you divide 30 into this, it ain't  
24 the same number.

25           MS. GORMSEN:   Well, right.   And, we did

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1 have to bend the licensees into different cost  
2 categories or cost saving categories, depending on  
3 -- and we did it by actually power level.

4 The higher level facilities were  
5 actually assigned a higher cost and the lower power  
6 facilities were assigned a lower cost.

7 MEMBER BALLINGER: And what was the  
8 higher cost? What was the higher power facility  
9 cost assigned?

10 MS. GORMSEN: I can look it up for you.  
11 I don't have it right here.

12 MEMBER BALLINGER: I'd like that  
13 because I'd like to compare it with the number,  
14 meaning that yours is less costly.

15 MR. BEALL: Are you kidding?

16 MS. GORMSEN: We also did have --

17 MEMBER BALLINGER: MIT can't do  
18 anything for \$5,000.00.

19 MS. GORMSEN: Yes.

20 MEMBER BALLINGER: They can't build a  
21 commode for that.

22 MS. GORMSEN: But, for a facility like  
23 MIT, it was much higher than that.

24 We talked to licensees at TRTR to get  
25 more information on, you know, what their

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1 experiences were like. They were rough estimates  
2 and we didn't have hard data to back it up. So, we  
3 welcome --

4 MEMBER BALLINGER: Well, MIT, they now  
5 have hard data.

6 MS. GORMSEN: They do?

7 MEMBER BALLINGER: I think so, yes.  
8 Just contact Lynn Winn Yu (phonetic) at MIT.

9 MS. GORMSEN: Yes, that would be great.  
10 Yes, but we can get that data to you on the 12  
11 categories.

12 MR. BEALL: Thank you, Liz.

13 Okay, next?

14 So, the proposed package that's going  
15 out for public comment will consist of a number of  
16 documents and all these documents will be released  
17 at the same time asking for public feedback on  
18 them.

19 It will be a SECY paper which will be  
20 going, of course, to the Commission that summarizes  
21 the proposed rule.

22 There's a Federal Register Notice. And  
23 also, in the Federal Register Notice, there will be  
24 a number of questions that we're asking the public  
25 to give us feedback on. Of course, all the

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1 documents, of course.

2 We also have the regulatory analysis  
3 and backfit discussion that will be going out, the  
4 Environmental Assessment, we have a draft  
5 Regulatory Guide, DG 2006.

6 So, the rulemaking package, will be  
7 going to OGC shortly. And, also, additional  
8 documents for the in public rulemaking will have  
9 congressional letters and, of course, an OMB  
10 statement has to go out for OMB review before  
11 anything happens.

12 Also, while all other stuff is out for  
13 public comment, Al and his folks, or as Duane had  
14 mentioned earlier, is that we're updating the  
15 Project Manager Handbooks, okay, to reflect that  
16 changes of this proposed rule. So, our internal  
17 documents will also be updated.

18 Okay, next one?

19 We plan to come back to the Full  
20 Committee on March 3rd of this year. We'll be  
21 presenting this again. And, right now, we're  
22 currently scheduled to submit the package to the  
23 Commission on April 1st of this year.

24 Right now, the proposed rule will be  
25 going out for a 75-day comment period. Like I said

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1 earlier, all those documents will be submitted to  
2 the public both in ADAMS and on regulations.gov to  
3 get feedback. And, we're also looking at doing a  
4 public -- some type of press release or something  
5 like that also to let everybody know that it's out  
6 there for public comment.

7 And, of course, we also hope -- we will  
8 be holding a public meeting during the public  
9 comment period.

10 And, also, if it doesn't line up, we'll  
11 also have a public meeting during the 2006 RTR --  
12 or excuse me, TRTR conference in August. I think  
13 that's late August, correct? In Albuquerque. I  
14 think it's Albuquerque, yes.

15 MEMBER REMPE: Before you get into the  
16 summary stuff --

17 MR. BEALL: Yes, ma'am?

18 MEMBER REMPE: -- when I was reading  
19 the information that we were provided, it's my  
20 understanding that the 104s have to go through a  
21 renewal before they can ever go to this new  
22 process.

23 And, you're going to start with the  
24 most recent renewal, so like the MIT reactor, who  
25 ever just got through a license renewal are going

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1 to have to be in the first group. You've grouped  
2 them and the ones that haven't gone through it  
3 because they're still trying to find their  
4 licensing basis get a little more time.

5 And, one of the -- and, you had  
6 different options you were talking about for what  
7 you could have done when you were trying to meet  
8 the Commission guidance.

9 And, one of the things that was  
10 suggested was updating this NUREG-1537 with lessons  
11 learned from license renewals.

12 And, since you're going to make the  
13 whole group go through license renewal before they  
14 can live life without license renewal, it seemed  
15 like it would be a good idea to update that NUREG  
16 anyhow.

17 And, I didn't hear anything about that  
18 in the discussion today. And, is your plan to  
19 update 1537?

20 MR. HARDESTY: So, Al kind of alluded  
21 to that a little bit earlier.

22 MEMBER REMPE: I must have missed it,  
23 sorry.

24 MR. HARDESTY: When we did the ISG for  
25 the medical isotope facilities, we had a bunch of

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1 independent organizations outside of us that were  
2 also looking at that documentation and they looked  
3 at the original NUREG-1537 and contrasted that with  
4 the ISG.

5 And so, what we found since that  
6 original statement was that NUREG-1537 is high  
7 level enough that it withstood the test of time and  
8 continues to stand that test of time with regard to  
9 the level of information and our expectations from  
10 a guidance standpoint on the regulations.

11 So, the only things that we've actually  
12 updated have been the ISG, the Interim Staff  
13 Guidance for how we do a streamline license renewal  
14 which was our focused review, the medical isotope  
15 facilities and then the INC stuff.

16 Those were the only three areas where  
17 we've thought we needed augment NUREG-1537.

18 Eventually, we plan to republish  
19 NUREG-1537 to incorporate all the Interim Staff  
20 Guidance. But, that will be at a point where we  
21 think that we can put what really is working.  
22 Because we started going through the ISG process  
23 for license renewal and we're done with probably,  
24 what, 75 percent of them already.

25 So, there's a considerably less number

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1 that still have to go. I forget, what's bucket  
2 3-5? What's the third bucket that we're expecting  
3 to have to do right license renewal?

4 MEMBER REMPE: You have to come to the  
5 mic and say your name. Sorry.

6 MS. GORMSEN: I don't remember it off  
7 the top of my head. This Liz Gormsen for ICF.  
8 But, I think it's around five.

9 MR. HARDESTY: I think it was five.

10 MEMBER REMPE: It's in the information,  
11 I saw it when I reading through this, I just don't  
12 remember.

13 MR. HARDESTY: So, it's a relatively  
14 small number compared to those that have already  
15 been through the process.

16 So, the thought we had as the staff was  
17 that, if you're, for example, Texas A&M TRIGA who  
18 just completed license renewal that you have been  
19 through a review under NUREG-1537.

20 If you're North Carolina State who is  
21 coming in 2017, you have not been through  
22 NUREG-1537 level review.

23 And, that's kind of our new benchmark,  
24 our new yardstick as Al called it, is that if  
25 you've had a review to what the staff considers the

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1 ideal standard review plan, then you'll meet the  
2 entrance criteria for this.

3 MEMBER REMPE: Or you might just have a  
4 one page saying I just did this, can you accept --  
5 but you didn't -- you passed it and so, I don't  
6 need to do much to get through this requirement for  
7 doing another license renewal?

8 MR. ADAMS: Well, if you have a license  
9 renewal under NUREG-1537, then you're done. By the  
10 end of this year, I'm expecting that about 26, 27  
11 of the 31 will be in that condition.

12 MEMBER REMPE: I thought in here it  
13 said that even -- you grouped the plants into  
14 categories and the ones who had already gone  
15 through license renewal will need to do something  
16 before they can go into this new process where you  
17 don't have to have renewal, you'll just submit your  
18 updated FSARs.

19 MR. ADAMS: So, the one --

20 MEMBER REMPE: I'm pretty sure I read  
21 that, did I misunderstand it?

22 MR. HARDESTY: You did. No, I just  
23 want to caveat what those buckets mean.

24 So, the ones that have done recent  
25 license renewal, they have the most updated FSAR

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1 and corresponding safety evaluation from the staff.

2 They will be ordered into a  
3 non-expiring license immediately.

4 MEMBER REMPE: Without submitting  
5 anything new? Because it sounded like they had to  
6 submit something.

7 MR. HARDESTY: They will have to submit  
8 an FSAR update.

9 MEMBER REMPE: Okay.

10 MR. HARDESTY: And so, we're expecting  
11 that they can do it immediately because they're  
12 very current.

13 MEMBER REMPE: And so, they'll say  
14 nothing changed and they'll give you a one-pager?

15 MR. HARDESTY: Correct.

16 MEMBER REMPE: On top of their existing  
17 FSAR.

18 MR. HARDESTY: Correct.

19 MEMBER REMPE: Okay.

20 MR. HARDESTY: Then, there's another  
21 category that has gone through a NUREG-1537 update,  
22 but they were done back in the 2006 to 2010 time  
23 frame. So, it's been, you know, six or ten years  
24 by the time we get this rulemaking in place.

25 So, since there's no requirement for

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1       them to submit an FSAR to us, we made the  
2       assumption that they'll need a little time to do  
3       some work on that FSAR to get it to where it  
4       matches the draft Reg Guide guidance to submit it  
5       to us. So, that's what the thought was there.

6               And then, that last category were the  
7       ones that will be going through or scheduled to go  
8       through license renewal and we don't want to order  
9       them into this process until they complete license  
10      renewal.

11             MEMBER REMPE:     So, if they've had a  
12      license renewal, they just have to submit something  
13      with an updated FSAR, they do not have to go  
14      through license renewal again?

15             MR. HARDESTY:    Correct.

16             MEMBER REMPE:     Okay.    And then, those  
17      who haven't have a lot more time?

18             MR. HARDESTY:    Correct.

19             MEMBER REMPE:     And, you will not issue  
20      an updated 1537 until you feel like you've had  
21      enough lessons learned?

22             MR. HARDESTY:     Well, after we've gone  
23      through the ISG process completely over all the  
24      facilities then I think that's, I mean, obviously,  
25      that's -- my Branch Chief could probably speak

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1 better to that tasking.

2 But, that is the intent is that once  
3 we've completed all of that, then we'll consolidate  
4 all of the findings and lessons learned and  
5 determine what updates are necessary.

6 MEMBER REMPE: Okay, thank you. I was  
7 a bit unclear on some of the details, so thanks.

8 MR. HARDESTY: So, moving forward on  
9 the 103s and the testing facilities, we don't plan  
10 on necessarily doing away with the ISG process.  
11 It's a living document and so, that type of  
12 streamlining is still being considered as the  
13 practice that will go on for even the facilities  
14 that will continue to be in license renewal.

15 In other words, we'll do a focused  
16 review. It won't be exactly the same because the  
17 ISG originally was written to encompass four  
18 specific areas and then, one of the lessons learned  
19 that we did get and that we are already  
20 incorporating is that we realized very quickly that  
21 it was very myopic to look at those only four areas  
22 without saying, you know, hey, we have to look at  
23 the rest of this.

24 So, the staff was already doing it. We  
25 were looking at the entire FSAR and when we found

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1 areas that fell outside of those four categories,  
2 then we also considered them and made those part of  
3 the license renewal.

4 So, that was part of our growth process  
5 in using and adopting the ISG. And, that's what we  
6 intend to continue to do for the future license  
7 renewals.

8 MEMBER REMPE: Thank you.

9 MR. BEALL: So, we're hoping to wrap up  
10 the final NPUF rule sometime in early 2018.

11 So -- oh wait.

12 Okay, actually, we missed one. Thank  
13 you.

14 MR. HARDESTY: That works better.

15 MR. BEALL: That works better. Okay.

16 So, wrapping up the proposed rule, the  
17 proposed rule, like we said earlier, it's only  
18 going to be applied to Class 103s and 104a and c  
19 NPUF facilities.

20 There are nine proposed changes that  
21 we're going to make the regulations. The major  
22 ones are the non-expiring licenses, having the  
23 Class 103 NPUFs and testing facilities submit their  
24 license renewal applications within a two-year  
25 window now instead of a 30-day window. The FSAR

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1 updates every five years and the new accident dose  
2 criteria for the NPUFs.

3 The staff feels that eliminating the  
4 licensing terms will reduce the burden of both the  
5 licensees and staff. It's allowed by the IAEA.  
6 It's the minimum of regulations.

7 CHAIRMAN POWERS: It's not by the IAEA.

8 MR. BEALL: It's the AEA, thank you.

9 CHAIRMAN POWERS: The Atomic Energy  
10 Act.

11 MR. BEALL: Yes, I know, that too.

12 Minimum regulations on licensees.

13 We will be continuing the level of  
14 oversight and inspections by the staff and the  
15 improved FSAR documentation goes along with helping  
16 to justify eliminating the licensing terms.

17 As we saw in the slide earlier, the  
18 quantitative benefits of the proposed rule is  
19 around \$13 million over a 20-year time period. And  
20 so, the staff feels that this proposed rule will  
21 maintain the safety of the public and health --  
22 maintain the health -- public health and safety  
23 while continuing the safe operations of the  
24 facilities.

25 That wraps up our presentation for the

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1 day. Any questions, please?

2 CHAIRMAN POWERS: What I would like to  
3 do is go ahead and have a break and come back in  
4 about 15 minutes and we can interrogate Mr. Beall  
5 to our heart's content, maybe not his content.

6 And then, get public comments.

7 Then, our intention is to have the  
8 staff present this material to the Full Committee  
9 in March. And then so, we need to give them some  
10 guidance on how to put what has been about seven  
11 hours of presentation or so into about an hour.  
12 But, I think you can.

13 By the way, I mean you've fulfilled my  
14 expectations admirably on this. Duane and I had a  
15 chance to talk about this and it did everything I  
16 aspired you to do here and very well.

17 But, we need to also discuss the topics  
18 that we would like to address in a draft letter  
19 that we prepare for the Full Committee's  
20 consideration.

21 And, I would invite the staff to help  
22 us with that because we're really communicating to  
23 the Commission on that letter and the kinds of  
24 things that we need to address in that as we  
25 explore both the upsides and downsides of this

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1 proposed activity.

2 So, that's my intention. And so, I  
3 suggest that we meet back here at 25 after the hour  
4 and pursue those issues.

5 (Whereupon, the above-entitled matter  
6 went off the record at 3:08 p.m.)

7 CHAIRMAN POWERS: What we need to make  
8 sure we understand is what is being proposed and  
9 what is controversial or contentious about what is  
10 being proposed. There are nine elements and I  
11 guess Ms. Beall is the object of our interrogation  
12 here.

13 So, I would ask, do members have any  
14 questions to pose specifically on what is being  
15 proposed?

16 MEMBER CORRADINI: As long as we hear  
17 from TRTR, no.

18 CHAIRMAN POWERS: What is TRTR?

19 MEMBER CORRADINI: The equivalent of the  
20 industry group that is going to be regulated.

21 CHAIRMAN POWERS: We have them not on my  
22 schedule.

23 MEMBER CORRADINI: I'm sure they would  
24 like to say something.

25 CHAIRMAN POWERS: Okay.

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1 MR. HARDESTY: The executive chair of  
2 TRTR, Jerry Jenkins, is actually on the phone and  
3 we can open the lines if you want to hear from him.

4 CHAIRMAN POWERS: We will do that when  
5 the time comes to do that. I first want to make  
6 sure that we've exhausted our scheduled speakers  
7 here and there are no remaining questions to be  
8 asked.

9 MEMBER BLEY: I have one. I sort of  
10 asked it earlier.

11 The license that doesn't expire idea,  
12 have you had conversations with the Commission  
13 about this yet?

14 MR. HARDESTY: The Commission actually  
15 proposed the idea to us in an SRM. We put forth a  
16 SECY that had several options and at the time the  
17 Commissioner or the Chairman, rather, Chairman  
18 Klein, gave us feedback and it's in the voting  
19 record about us considering streamlining and, in  
20 particular, a license that would be -- what were  
21 the exact words? It wasn't non-expiring.

22 MR. ADAMS: Yeah, I forget. We went up  
23 to the Commission with a number of ideas and the  
24 Commission paper for the future of licensing for  
25 non- power reactors and the Commission came back

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1 and said, hey, you know, these are good ideas and  
2 here's one, you know, that, here's something you  
3 should continue to think about and this was one of  
4 the concepts that was, you know, that was on that  
5 list.

6 CHAIRMAN POWERS: It's a licensing under  
7 sufferance kind that has been used in Europe  
8 forever. And I think it's -- I mean, it's not a  
9 break from all precedent but it's certainly  
10 different--

11 MR. ADAMS: It's different and I believe  
12 that --

13 CHAIRMAN POWERS: In this particular  
14 case it has a traction just because of the  
15 peculiarities of the facilities.

16 Now, one thing that is unclear to me in  
17 this is how the operations of these facilities for  
18 protracted periods of time how that interfaces with  
19 Gall.

20 MR. ADAMS: So, well, the answer there  
21 -- let me step back.

22 The other thing that the Commission --  
23 I believe we sent the 2012 reg basis to the  
24 Commission so the fact that this came out of our  
25 reg basis and the Commission also filed it so and

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1 we've talked to the Commission staff about this  
2 over time.

3 So, you're looking at, you know, aging  
4 and what we've done with aging. So, it was  
5 interesting because, you know, back when we finally  
6 got to the point where Pall reactors were starting  
7 to enter license renewal, you know, a lot of  
8 consideration was given to how to go forward there.  
9 And, you know, the answer there was a focus on  
10 aging. At that point we had to decide what to do  
11 with the research reactors and there was two  
12 things. One, by that point we had already done  
13 probably tens and tens of license renewals so we  
14 already had that process established. And I think  
15 it was -- and at that point in time that process  
16 was license renewal was equivalent to initial  
17 licensing. So, you basically look at everything  
18 again from top to bottom.

19 They decided they didn't want to do  
20 that for Pall reactors so, you know, they went in  
21 the way of aging. And then we looked and we looked  
22 at aging and said, wow, if we just focus on aging  
23 we're not sure what's going to be left.

24 Traditionally, if you look at our SERs  
25 that we write, we do talk about aging and aging is

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1 focused in two areas. Fuel cladding and  
2 instrumentation and control systems. And I  
3 mentioned we also have looked at pull failures,  
4 heat exchanger failures. And these areas are based  
5 on what we've observed from watching these  
6 facilities, you know, run from the '50s and not  
7 only the 31 that we have today but the other 110  
8 that are no longer with us. So, you know, is there  
9 something equivalent to the Pall reactor pool  
10 program, the answer is no. but we have seen  
11 components that aging is a consideration for we  
12 have looked at those and there's information that  
13 we get from the licensees ongoing. So, you know,  
14 there's reportable events. And, you know, we can  
15 bring, you know, the standard tech specs and show  
16 you the kind of things they have to tell us about.  
17 But it's basically equipment failures that have  
18 safety significance, failures to fuel cladding,  
19 primary coolant boundary, containment boundaries  
20 that are safety significant, releases that are  
21 safety significant.

22 The other thing they have to tell us is  
23 in their annual reports are the kind of maintenance  
24 things they're doing both routine and non-routine  
25 maintenance. So, you know, we get to see, you

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1 know, this is broke, this is broke, this is broke,  
2 you know, I have a reportable event. Geez, I'm  
3 calling you up because, you know, we discovered  
4 that, you know, that the pool is leaking or a heat  
5 exchanger is doing this. So, we get information,  
6 you know. What we look for is, you know, are we  
7 starting to see a trend. An example that was the  
8 pooling that we had seen enough pools fail that we  
9 said, you know what, there's something here. Like  
10 I say, if you go back to the '80s, you know, we  
11 didn't look at that. Now, that's right in the  
12 NUREG 1537 that the licensee has to tell us about  
13 it for that it becomes a pre-analyzed operational  
14 event rather than a, oh, my God, you know, what are  
15 we going to do?

16 So, I don't know if I'm answering your  
17 question, but that's sort of the approach we took  
18 towards aging.

19 Now, these machines are so simple that  
20 failures, you know, manifest themselves. Failures  
21 in the instrumentation control system, the ones  
22 we've seen basically shut down the reactor, you  
23 know, except for, you know, very unusual  
24 occurrences like the one I talked about where, you  
25 know, someone switched out a component that was

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1 internally modified to do exactly what it did and  
2 didn't test the results. And, you know, as we see  
3 things, you know, we'll pursue them.

4 MR. HARDESTY: I would add to that that  
5 again the big difference between a power reactor  
6 and our impulse is that we don't have to wait for  
7 the next scheduled shutdown period or they don't  
8 have to wait or anything like that. And it's very  
9 common and, in fact, it's happened very recently  
10 where if a facility has something that's broken  
11 they can't fix it, they just remain shut down. You  
12 know, there's no immediate actions that they try to  
13 do to restore operations. That's a very controlled  
14 evolution that they fix whatever it is that's  
15 broken and return to operation. Don't have that  
16 same op tempo driving them for immediate recovery.

17 MS. GAVRILAS: This is Mirela Gavrilas.  
18 If I can add something to this and most of our  
19 rulemaking, have a steering committee that has  
20 management from various organizations that are  
21 interested in that particular rulemaking. And for  
22 this steering committee we had with us the Division  
23 for License Renewal, NRR, and they got very engaged  
24 because they see it as potentially precedent  
25 setting. So, they were very interested in how this

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1 rule is evolving and they wanted us to articulate  
2 very clearly why for RCRs we are thinking of  
3 non-expiring license. And there was three elements  
4 that went into our response.

5 The first one was Al just talked about  
6 the aging mechanism, few and far between and we  
7 handled them in tech specs. The second one is the  
8 low consequences of a failure in one of the  
9 systems. And the third one was the slowly evolving  
10 licensing basis in terms of rulemaking. Rules that  
11 are promulgated usually are safety significant.  
12 RTRs are typically excluded from rulemaking just on  
13 the basis of it doesn't apply to them most  
14 rulemaking.

15 So, the licensing basis for the  
16 community of licensees is very slow moving. Those  
17 are three substantial differences between Pall  
18 reactors and non-Pall reactors.

19 CHAIRMAN POWERS: Let's say the three  
20 points that you make there on your thinking is one  
21 of the items that shouldn't show up for the full  
22 committee and those are good ones to make. They  
23 should understand -- the full committee should  
24 really understand what was in your thinking and  
25 pulling its weight.

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1           Okay. Any other questions proposed at  
2 this point?

3           MEMBER BALLINGER: I have one comment.  
4 Have an actual number for you.

5           The cost to renew the license of the  
6 MIT reactor was \$2 million, for the record.

7           CHAIRMAN POWERS: It's a hell of a  
8 price, for the record.

9           CHAIRMAN POWERS: We should open up the  
10 line and then invite comment from those people that  
11 are electronically connected to it.

12           Okay. If there's anybody connected to  
13 us by the phone bridge that would care to make a  
14 comment then now is the time to do so. In order to  
15 do so, please identify yourself and proceed with  
16 your comment.

17           MR. JENKINS: This is Jerry Jenkins,  
18 Chairman, of the National Organization of Test  
19 Research and Training Reactors or TRTR that you've  
20 been discussing this morning.

21           I'd like to state the position of the  
22 community which is the community of non-power  
23 reactors that this is a very important rulemaking  
24 process for us based exactly on what the staff has  
25 told you.

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1           The licensing process has evolved over  
2 time we now follow NUREG 1537 as most of the  
3 reactors will like Al explained earlier. We have  
4 gotten to the point where our safety analysis  
5 reports look very much like what the power reactor  
6 safety analysis reports look like. It's an easy  
7 document to maintain in its present form as long as  
8 there's no moving target on what the SAR should  
9 look like in 10 years.

10           So, the actual process of going to this  
11 non-expiring license that will be a significant  
12 burden relief for the research and test reactor  
13 community, especially the facilities that just have  
14 one or two people on staff because we were always  
15 working reviewing the safety analysis report every  
16 year anyway or the security plans, tech specs.  
17 They're all being reviewed every year. Now, this  
18 will just formalize that process and it will allow  
19 us to continue to operate in a safe and effective  
20 manner of these facilities that have very, very  
21 large safety envelopes as it is.

22           Most of the reactors as Al has  
23 explained to you are very small in the big scheme  
24 of things. You do have the higher power reactors  
25 but obviously those are under a higher level of

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1 scrutiny than the small reactors are. This is  
2 anticipated on -- I'm sorry?

3 CHAIRMAN POWERS: Please continue.

4 MR. JENKINS: Okay. We don't anticipate  
5 any change in how we are inspected or how we would  
6 handle any license amendment request until even our  
7 5059 reviews going down the road. We try to  
8 maintain best practices.

9 We meet every year as a group but the  
10 National Organizations of Testors there's training  
11 after it's annual meeting. We are always sharing  
12 best practices. We're always trying to do the best  
13 thing. We support each other. So, this is  
14 something we are very interested in seeing happen  
15 and we will do everything we can to support the  
16 process.

17 CHAIRMAN POWERS: Thank you. Are there  
18 any other comments the people would like to make?

19 MR. LEWIS: Martin Lewis for the public.

20 CHAIRMAN POWERS: Marvin? Please make  
21 your comment.

22 MR. LEWIS: Yes. First of all, I'm so  
23 pleased to hear you talk about financials finally.  
24 After many times raising financials in public  
25 meetings the once I didn't hear people dancing

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1 around saying, oh, no, we can't discuss financials  
2 because that's not a safety, you know. Well, thank  
3 you for that.

4 But at the same time I also point out  
5 that there is a nexus to safety. If you can't buy  
6 gas for your fire engine, it is not going to get to  
7 the fire. And maybe in some states it happens that  
8 way that you get to a fire without any gas but I  
9 can honestly tell you in Philadelphia that doesn't  
10 happen. Sometimes the engine doesn't get to the  
11 fire even with gas. But that's Philadelphia  
12 traffic for you.

13 And I just wanted to point that out and  
14 I'm glad to hear that people are finally talking  
15 financials.

16 Thank you.

17 CHAIRMAN POWERS: Are there any other  
18 comments to be made? I hear none and, therefore,  
19 close the line again.

20 And we come to the point where we need  
21 to give the staff some guidance on how they might  
22 truncate this rather nice set of presentations down  
23 to a manageable portion to fit within the time they  
24 will be allowed to have. And I think -- I don't  
25 have guidance on the time right now but in total I

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1 doubt that it will extend beyond two hours. So,  
2 you can anticipate you might at best have an hour.

3 My first suggestion to you is the area  
4 of truncation that's open to you strikes me as it  
5 is just the background section, that is being  
6 proposed was rather succinct and fairly compact.  
7 And I don't think there's much that can be removed  
8 from that because it's nine bullets and nine slides  
9 essentially. There's a little bit of elaboration  
10 in there but there's not much. And so I think we  
11 need to think carefully about what points you need  
12 to make in the background section. And I think I  
13 would adopt the view that if members needed to have  
14 the detailed background you provided us they would  
15 have been here at this meeting -- the subcommittee  
16 meeting. And I would suggest to you that the  
17 points you want to make in that background section  
18 are perhaps three.

19 One is that you have a diverse set of  
20 Inpuffs. You'll have to define Inpuff for them.  
21 They're diverse. They're diverse in design and  
22 they're diverse in ownership. They're small. And  
23 you need to in that background draw the distinction  
24 that you do between the gurus that are going to get  
25 this -- that you're proposing have this continuing

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1 or non-expiring license in those that will not fall  
2 into that category. And those are the only points  
3 you really make in that background section to the  
4 full committee. To us you did a very nice job  
5 telling us what the designs look like and things  
6 like that. I think you have to dispense with that  
7 just to fit into the time period.

8 I presume you could add background  
9 slides available if somebody asks you a question  
10 about what the design was. But I would not make it  
11 a part. That's my suggestion. I'll walk around  
12 and ask the members if they have any suggestions.

13 MEMBER SKILLMAN: Yes, sir, I do. First  
14 of all, thank you very much. This is been a very  
15 beneficial exchange from early this morning. Thank  
16 you. You're thoroughly prepared and the material  
17 is clear. Here is where I would suggest you start.

18 In the Atomic Energy Act it's Sections  
19 103 and 104. That's where you really draw the  
20 roots for what you're proposing. Of the nine  
21 points that you're suggesting for changing the  
22 regulation at least my view is four through nine  
23 are very clear. The machination comes in one, two  
24 and three. Number one, we need a definition. Got  
25 it. Easy to talk about. But two and three begin

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1 to weave this interesting relationship between  
2 what's a test reactor and what's not a test  
3 reactor. And once you introduce that set of  
4 permutation in combinations now you've got 31  
5 targets with a couple of different bins. My view  
6 is, if you can find a way to present that very  
7 clearly then we with the rest of our members will  
8 have no consternation or ambiguity in what you're  
9 proposing. To me that is the area that was  
10 confusing to me actually until Joy began to pull  
11 the pieces one at a time.

12 So, again, I think your items four  
13 through nine are very clear. They may be  
14 controversial to some of the members but they're  
15 clear. But sorting out what you mean by the  
16 exceptions for test reactor for an Inpuff versus a  
17 non-test reactor would benefit from clarification  
18 so all nine of your points flow very smoothly.

19 Thank you.

20 CHAIRMAN POWERS: Ron, did you have a  
21 point to make?

22 MEMBER BALLINGER: Yes, I mean, I think  
23 I agree with what Dick was saying but in the  
24 interest of compassion for those members who  
25 unavoidably could not attend, might we consider the

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1 background as a package which is separate from  
2 anything that gets presented so that members that  
3 want to look at it it will have available to them.

4 CHAIRMAN POWERS: The slides from the  
5 subcommittee are available for the members at all  
6 times.

7 MEMBER BALLINGER: Okay. But I'm not  
8 talking about subcommittee members.

9 CHAIRMAN POWERS: Any member can get --

10 MEMBER BALLINGER: Okay.

11 CHAIRMAN POWERS: -- the slides from  
12 the subcommittee.

13 Sir?

14 MEMBER STETKAR: I have nothing to add  
15 other than this is a great education experience for  
16 me. I came to learn.

17 CHAIRMAN POWERS: Oh, okay. Did you?

18 MEMBER STETKAR: I did.

19 CHAIRMAN POWERS: Oh, my God.

20 MEMBER STETKAR: I now know everything.

21 CHAIRMAN POWERS: And we won't go into  
22 that. Professor Corradini?

23 MEMBER CORRADINI: No, I think -- I  
24 think all you folks have covered it.

25 CHAIRMAN POWERS: Mr. Chairman Bley?

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1                   MEMBER BLEY: I have just a couple  
2 things.

3                   I agree with Dana, the three points  
4 Mirela made on the non-expiring license is crucial  
5 and I would almost start with that.

6                   CHAIRMAN POWERS: Well, I'm not sure I  
7 would start with that but I would certainly  
8 introduce that section that deals with what's  
9 being proposed.

10                  MEMBER BLEY: Fair enough.

11                  CHAIRMAN POWERS: I would put it -- I  
12 would really highlight. Here's what our thinking  
13 was. Here's what led us to think that this was a  
14 good thing to propose.

15                  MEMBER BLEY: This is an okay thing. I  
16 was thinking a little bit about our meeting and  
17 also about the thing you talked about for next year  
18 and about what Ted was talking through and I don't  
19 know if you can do it. I'm visioning a kind of  
20 graphic that puts all these different kind of  
21 definitions of reactors and non-reactors and makes  
22 a picture of it. I think it might get rid of four  
23 slides and be much clearer and maybe --

24                  CHAIRMAN POWERS: I agree with you.

25                  MEMBER BLEY: And most likely if

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1 something in the future ought to be done you'll see  
2 it and oh, yes. Something like a Venn diagram but  
3 some kind of graphic I think could help.

4 And the only negative thing I have to  
5 say, this is one of the two or three absolutely  
6 worst acronyms I've ever run into.

7 MR. HARDESTY: We left that up to the  
8 staff to try to help us come up with a better name  
9 and this was the least of the worst. A minority  
10 view I actually kind of like it.

11 CHAIRMAN POWERS: We call it Inpuff but  
12 the community likes to call it Inpouf. Mr. Brown?

13 MEMBER BROWN: Came to the meeting  
14 because I wanted to learn something since I had no  
15 idea what these things generally look like from the  
16 regulatory standpoint. So, I thought the  
17 presentation and the material we got to prepare for  
18 it was very, very good. And so this has been very  
19 informative for me. I thought you all did a good  
20 job on this from that standpoint. That's not to  
21 say you didn't do it on some other standpoint.  
22 But, I guess, if I was going to simplify this thing  
23 I would take -- I would add on to Dick's thing.  
24 Within your first nine or ten vu-graphs there was  
25 some definitions of what is this, what is that,

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1 things like that that if you don't understand those  
2 you don't understand one through nine. And then  
3 you need Dana's comment about you need -- okay.  
4 This is what we intend to do to try to categorize  
5 this thing. These are all major things we're  
6 trying to accomplish and these are the nine steps  
7 we're going through and then try to walk, you know,  
8 try to categorize those. All those little pictures  
9 of triggers and this that and the other thing you  
10 ought to can and all that kind -- there's a lot of  
11 miscellaneous stuff that you don't need and a  
12 little bit of an attachment to the Atomic Energy  
13 Act where you talk about there are no requirements  
14 in a few of these places, get introduced at the  
15 right place and that you're introducing some  
16 clarifications or however you want to phrase them  
17 to do it. So, I think you could reduce this thing  
18 to 20 or 30 slides if you could probably present  
19 within the hour to hour and a half that you will  
20 probably end up with because I could probably do it  
21 for you but you don't want me to and I'm not going  
22 to.

23 So, you've got some condensations in  
24 there that are very good if you pick out the right  
25 ones and then try to adjust them to meet that

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1 general approach. So, that's all I have.

2 MEMBER REMPE: I would like to share my  
3 appreciation. I really enjoyed the background  
4 section. I went into some of these reactor types  
5 but it's a nice overview and some of the personal  
6 insights from your own experience were worthwhile  
7 hearing and I appreciated it.

8 I also appreciated what the rule is  
9 doing because I did read through it but it helped  
10 to discuss it today. And I think my colleagues  
11 have told you how to simplify it and good luck with  
12 it. But it's worthwhile seeing the staff working  
13 to try and reduce the burden when you see things  
14 that you believe aren't necessary. So, thanks.

15 CHAIRMAN POWERS: I wouldn't again work  
16 very hard to get to the nine points in a logical  
17 fashion because I think those are well expressed  
18 and fairly succinct. There's not much cutting you  
19 can do there.

20 Okay. At this point we move now to the  
21 discussion of formulating a draft letter within the  
22 committee. You can sit here or not as you see fit.

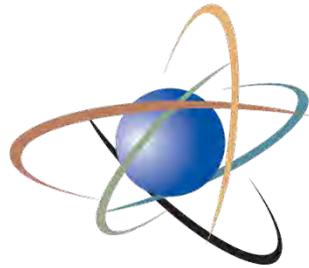
23 I would welcome suggestions -- that's  
24 right. I do want to go off the record too.

25 (Whereupon, the above-entitled matter

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1           went off the record at 3:51 p.m.)  
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**U.S.NRC**

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

# **ACRS Subcommittee Meeting:**

## **Non-power Production or Utilization Facility (NPUF) License Renewal Rulemaking**

February 3, 2016

# NRC Staff Presenters

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- Robert Beall, NRR: Rulemaking PM
- Duane Hardesty, NRR: Technical Lead
- Al Adams, NRR: Branch Chief - Research & Test Reactors Licensing
- Rich Clement, NRO: Radiation Protection & Consequence Branch
- Kevin Folk, NRR: Environmental Review & Guidance Update Branch
- Kosmas Lois, NRR: Financial Analysis & International Projects Branch

# Agenda

---

- Background on NPUFs
- Background on the NPUF proposed rule
- Summary of the NPUF proposed rule
- Rulemaking documents and schedule



# **Introduction to Non-power Production or Utilization Facilities (NPUFs)**

Duane Hardesty

Alexander Adams, Jr.

Research and Test Reactors Licensing Branch

# Regulatory Authority

- Pursuant to Section 101 of the Atomic Energy Act of 1954, as amended (AEA), the NRC licenses production and utilization facilities
- All current power reactors and non-power facilities are licensed as utilization facilities
- Two primary types of licenses:
  - Section 103 Commercial Licenses
  - Section 104 Medical Therapy and Research and Development Licenses

# Power vs. Non-power

## Nuclear power plant objective:

- Make electricity
- Maximum heat/energy output
- Large core volume at maximum power density

## NPP results:

- High power >1000 MW
- High temperature / pressure
- Complex safety systems
- Low peaking factor, low leakage core
- High stored energy

## Non-power production or utilization facility objective:

- Make radiation
  - High flux in beams / traps
  - High irradiation flux positions
- Lowest possible power, fuel consumption, and stored energy

## NPUF results:

- Low power < 20 MW
- Low temperature / atmospheric pressure
- Passive, simple safety systems
- High leakage core (neutron leakage feeds beam tubes)
- High peaking factor in flux trap
- Compact core design

## **Regulatory Authority (cont.)**

- Three subsets of production or utilization facility licenses provided for in Section 104 of AEA
  - 104(a) Medical therapy licenses
  - 104(b) Commercial demonstration licenses
  - 104(c) Research and development licenses
- All NRC-licensed non-power or production facilities are licensed pursuant to 104(c) of the AEA, one facility also holds a 104(a) license

# Regulatory Policy

The policy for regulation of Class 104 NPUFs is described in the Atomic Energy Act of 1954, as amended, Section 104a. and c.

## **Sec. 104. Medical Therapy and Research and Development**

- a. ...the Commission is directed to permit the widest amount of effective medical therapy possible with the amount of special nuclear material available for such purposes and to impose the minimum amount of regulation consistent with its obligations under this Act to promote the common defense and security and to protect the health and safety of the public.
- c. The Commission is directed to impose only such minimum amount of regulation of the licensee as the Commission finds will permit the Commission to fulfill its obligations under this Act to promote the common defense and security and to protect the health and safety of the public and will permit the conduct of widespread and diverse research and development.

# Regulatory Definitions

- Non-power reactor means a research or test reactor licensed under § 50.21(c) or 50.22 of this part for research and development [*10 CFR 50.2 Definitions*].
- Research reactor means a nuclear reactor licensed by the Commission under the authority of subsection 104c of the Act and pursuant to the provisions of § 50.21(c) of this chapter for operation at a thermal power level of 10 megawatts or less, and which is not a testing facility as defined by paragraph (m) of this section [*§ 170.3 Definitions*].



# Regulatory Definitions (cont.)

- Testing facility means a nuclear reactor which is of a type described in § 50.21(c) of this part and for which an application has been filed for a license authorizing operation at:
  - (1) A thermal power level in excess of 10 megawatts; or
  - (2) A thermal power level in excess of 1 megawatt, if the reactor is to contain:
    - (i) A circulating loop through the core in which the applicant proposes to conduct fuel experiments; or
    - (ii) A liquid fuel loading; or
    - (iii) An experimental facility in the core in excess of 16 square inches in cross-section. [ § 170.3 Definitions]

# Proposed Definition

- *Non-power production or utilization facility* means a non-power reactor, testing facility, or other production or utilization facility, licensed under § 50.21(a) or § 50.21(c) or § 50.22, that is not a nuclear power reactor.





# List of Currently Licensed NPUFs

<u>LICENSEE</u>	<u>TYPE</u>	<u>LICENSED</u>	<u>POWER, kW</u>	<u>MISSION</u>
Aerotest	TRIGA	1965	250	Private
AFRRI	TRIGA	1962	1,100	Federal
Dow Chemical	TRIGA	1967	300	Private
General Electric	Nuclear test	1957	100	Private
Idaho State University	AGN	1967	0.005	Academic
Kansas State University	TRIGA	1962	1,250	Academic
Massachusetts Institute of Tech	HWR reflector	1968	6,000	Academic
National Institute of Science & Technology	Nuclear test	1970	20,000	Federal
North Carolina State University	Pulstar	1972	1,000	Academic
Ohio State University	Pool	1961	500	Academic
Oregon State University	TRIGA	1967	1,100	Academic
Penn State University	TRIGA	1955	1,100	Academic
Purdue University	Lockheed	1962	1	Academic
Reed College	TRIGA	1968	250	Academic
Rensselaer Institute of Tech	Critical facility	1964	0.1	Academic



# List of Currently Licensed NPUFs (cont.)

<u>LICENSEE</u>	<u>TYPE</u>	<u>LICENSED</u>	<u>POWER, kW</u>	<u>MISSION</u>
Rhode Island AEC	Pool	1964	2,000	Academic
Texas A&M University	AGN	1957	0.005	Academic
Texas A&M University	TRIGA	1961	1,000	Academic
US Geological Survey	TRIGA	1969	1,000	Federal
University of California - Davis	TRIGA	1998	2,300	Academic
University of California - Irvine	TRIGA	1969	250	Academic
University of Florida	Argonaut	1959	100	Academic
University of Maryland	TRIGA	1960	250	Academic
University of Mass - Lowell	Pool	1974	1,000	Academic
University of Missouri - Columbia	Tank	1966	10,000	Academic
Missouri University of Science & Tech.	Pool	1961	200	Academic
University of New Mexico	AGN	1966	0.005	Academic
University of Texas	TRIGA	1992	1,100	Academic
University of Utah	TRIGA	1975	100	Academic
University of Wisconsin	TRIGA	1960	1,000	Academic
Washington State University	TRIGA	1961	1,000	Academic

# Characterization of Operating NPUFs by Decade Licensed

4	1950s
21	1960s
4	1970s
2	1990s
2	2010s *

\* Shine and Northwest submitted construction permit applications for a Class 103 medical isotope production facility

# Characterization of NPUFs by Power

4 < 1 kW<sub>th</sub>

12 > 1 kW<sub>th</sub> but < 1 MW<sub>th</sub>

10 > 1 MW<sub>th</sub> but < 2 MW<sub>th</sub>

5 > 2 MW<sub>th</sub>

# Characterization of NPUFs by Fuel Type

- 3 AGNs ▶
- 8 Plate-type fuel ▶
- 16 TRIGA ▶
- 4 One-of-a-kind ▶

# Characterization of NPUFs by Mission

25 Academia

3 Private Industry

3 Federal Government

# Primary Mission of NPUFs

- **Private Industry (3)**
  - Service radiograph (Aerotest)
  - Product characterization and research (Dow)
  - Power reactor studies (GE)
- **Federal Government (3)**
  - Radiation effects studies (AFRRI)
  - Materials studies, basic science (NIST)
  - Geological characterizations (USGS)



# Primary Mission of NPUFs (cont.)

## Academia (25)

- Laboratory classes
- Basic nuclear research
- Academic research or outside services
  - Neutron activation analysis ⇨
  - Neutron radiography ⇨
  - Neutron scattering ⇨
  - Material irradiation ⇨
  - Isotope supply ⇨

# NPUF Utilization

Very Low	Few hours/year	Laboratory classes	4
Low	Few hours/week	Classes and limited research/ service work	16
Moderate	20 to 40 hours/week	Classes and extensive research/ service work	7
High	24 hours/day 7 days/week	Substantial research and service	4

# NPUF Staffing

## Small Organization

**Staff of 1 or 2** ▶

~~~~~

Director (SRO, Part time)

### Outside Support

RSO (health and safety)

Clerical

Facility engineering

Physical plant crafts

Administrative services

- 25 facilities

## Large Organization

**Staff of ~10 to 50** ▶

~~~~~

Director, Deputy Director

Administration

Operations

Engineering & maintenance

### Outside Support

RSO/HP technician

Physical plant

Administrative services

- MURR, NIST, MIT, AFRRRI, OSU, TAMU(T)

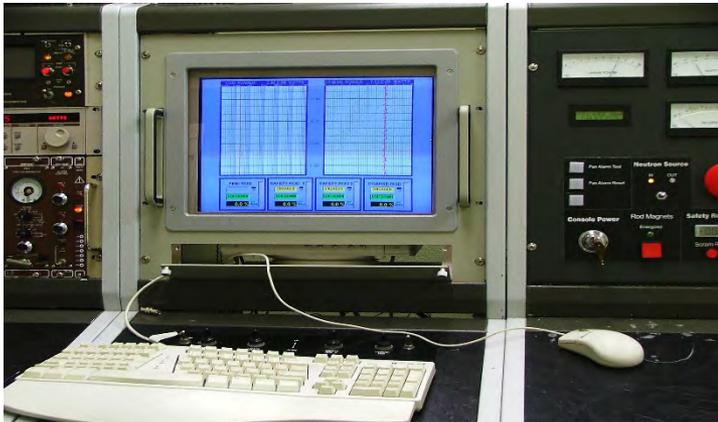
# Description of NPUF Types

- AGN
- Argonaut
- Pulstar
- Pool and Tank
- Critical assemblies
- TRIGA
- Testing facilities
- Medical radioisotope irradiation and processing ( $\text{Mo}_{99}$ )

# AGN Reactor

- **Aerojet General Nucleonics (AGN)**
  - Compact, self-contained (portable) reactor
  - Fuel is a mixture of enriched uranium oxide in a polyethylene moderator
  - 10-inch diameter core has holes for insertion of control rods made of same composition as fuel
  - Center of core is a “fuse” which if melted, drops the lower half of the core
  - A graphite, lead, and water shield surrounds core
  - The core is a vertical water tank surrounded by a concrete shield

- Currently 3 licensed AGN research reactors
  - Texas A&M University (5 watts)
  - Idaho State University (5 watts)
  - University of New Mexico (5 watts)



- Located in campus engineering building
- Class 104c research reactor

# AGN major projects, experiments, and uses of the reactor

- Nuclear engineering laboratories
  - Reactor dynamics
  - Reactor operations
  - Reactivity feedback
  - Subcritical multiplication
- High school science workshops
- Training of power reactor personnel, emergency responders and general public
- Experimental stations:
  - Experimental access ports
  - Allows placement of samples in most intense neutron flux



# Argonaut Reactor

- Heterogeneous core
- Fuel: Material Test Reactor (MTR-type) plate
- Characteristics
  - Coolant: Forced flow demineralized light water
  - Reflector: Graphite
  - Moderator: Demineralized light water and graphite blocks
  - Biological shield: cast-in-place concrete
- Graphite thermal column for irradiations



# Argonaut Cutaway View

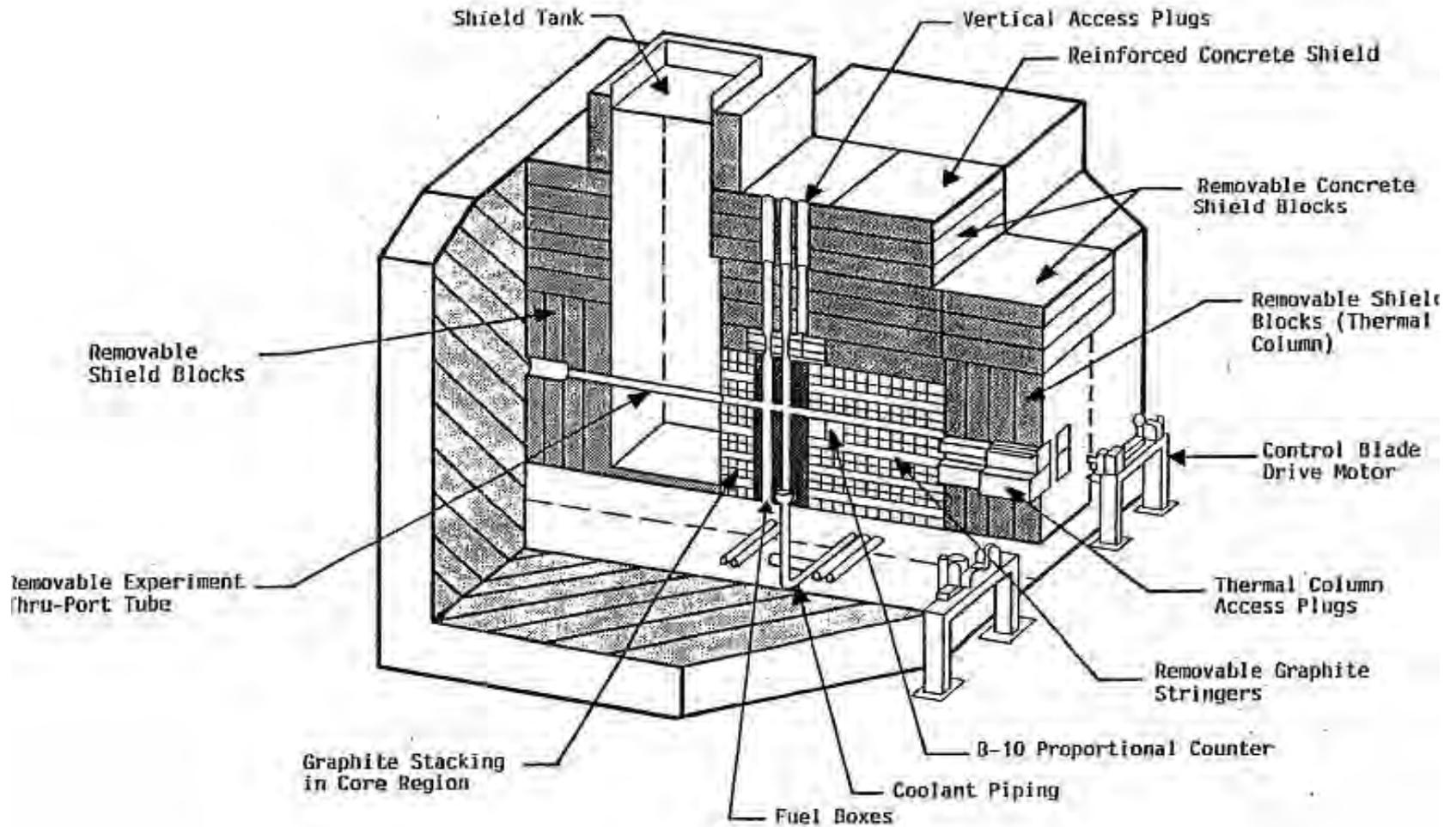


FIGURE 3 CUTAWAY VIEW OF THE UFTR

# Argonaut Research Reactor

- Currently 1 licensed Argonaut reactor
  - University of Florida Training Reactor (100 kWth)



- Located in campus engineering building
- Class 104c research reactor



# **Argonaut major projects, experiments, and uses of the reactor**

- Reactor tours and demonstrations including high school classes
- Research activities including: neutron activation analysis research, basic physics research and plasma physics studies
- Maintenance, surveillance, and testing, plus various extended inspection activities
- College courses, reactor operations laboratory, nuclear engineering laboratory and demonstrations
- UFTR operator training and requalification, and support staff and other training

# PULSTAR Reactor

- Pool-type, light water moderated
- Solid homogeneous core
- Uses 4% enriched, pin-type fuel consisting of uranium dioxide pellets
- Coolant/Moderator: demineralized light water
- Reflector: demineralized light water and beryllium
- Cladding: Zircaloy
- Originally designed for pulse capabilities but no longer authorized





# Pulstar Research Reactor

- Currently 1 licensed Pulstar reactor
  - North Carolina State University (1 MW<sub>th</sub>)
  - Located in campus engineering building
  - Class 104c research reactor



# **Pulstar major projects, experiments, and uses of the reactor**

- Variety of irradiation facilities used for teaching and analytical services.
- Neutron activation analysis (NAA) provided to academic institutions, federal and state agencies, and commercial companies across the country.
- Fixed beam facilities for prompt neutron capture gamma analysis and neutron radiography.
- Experimental Stations:
  - Intense slow positron beam
  - Ultra cold neutron source
  - Powder neutron diffractometer
  - Neutron imaging facility

# Pool Reactors

- Term to describe an NPUF facility where the reactor core is located in a pool of water
  - Sealed or metal-lined concrete structure
  - Purified light water
  - Range of sizes and depths (2,000 to 71,000 gallons)
  - Pool water provides significant radiation shielding



- Core can be mounted from a movable bridge
  - Move to specific experiment locations exposure rooms, etc.
  - Gate isolates the core for maintenance on drained half of the pool



# Pool Research Reactors

- Currently 5 licensed pool reactors
  - Purdue University (1 kW<sub>th</sub>)
  - Missouri University of Science and Technology (200 kW<sub>th</sub>)
  - Ohio State University (500 kW<sub>th</sub>)
  - University of Massachusetts-Lowell (1 MW<sub>th</sub>)
  - Rhode Island AEC (2 MW<sub>th</sub>)



# Pool Reactor major projects, experiments, and uses

- Neutron activation analyses
- Irradiation experiments
- Neutron radiography
- Teaching laboratories
- Experimental stations:
  - Thermalizing column with bulk shielding tank (RIAEC, MUS&T, OSU)
  - Dry irradiation room (RIAEC, UMass-Lowell)
  - Pneumatic transfer tubes
  - Central Thimble
  - Dry Tube

# Tank Reactors

- A term used to differentiate an NPUF with a sealed enclosure
- Prevents exchange of air and water vapor between reactor and ambient atmosphere
- Allows for pressurization (slight), HVAC isolation, offgas collection, etc.
- Used normally for only the highest power NPUFs

# Tank Research Reactors

- Currently 3 licensed tank research reactors
  - General Electric-Vallecitos (100 kW<sub>th</sub>)
    - Located in remote fenced compound
  - Massachusetts Institute of Technology (6 MW<sub>th</sub>)
    - Located on MIT campus
  - University of Missouri-Columbia (10 MW<sub>th</sub>)
    - Located in fenced compound on university
- All are Class 104c
- MIT also Class 104a



# Tank Reactor major projects, experiments, and uses

- Types of Experiments:
  - Radiopharmaceutical production (MURR)
  - Neutron radiography
  - Explosives experiments
  - Neutron activation analyses
  - Teaching laboratories
  - Boron neutron capture theory
  - Research and training
  - Failed fuel rod testing (GE)
- Experimental Stations:
  - Beam ports
  - Radiography film transfer system
  - In-core facilities
  - Pneumatic transfer



# Critical Assembly Facilities

- Very low power level research reactor
- Built to determine and/or verify fuel parameters for new fuel designs
- Licensed for multiple grid plate designs
- When not in use, fuel is frequently placed in a vault



# Critical Assemblies

- Currently 1 licensed Critical Assembly
  - Rensselaer Polytechnic Institute ( $0.1 \text{ kW}_{\text{th}}$ )
    - Rated power: 100 Watts
    - Light water moderator critical facility, core in tank of water
    - $\text{UO}_2$  sintered pellets in stainless steel tubes (4.8% enriched)
    - Coolant/Moderator: light water
    - Reflector: light water
    - Cladding: Stainless steel



# Critical Assembly major projects, experiments, and uses

- Types of Experiments:
  - Neutron activation analyses
  - Neutron powder diffractometry
  - Neutron radiography
  - Teaching laboratories
- Experimental Stations:
  - Central thimble
  - Pneumatic transfer
  - Dry tubes (2)
  - Thermalizing column with bulk shielding tank
  - Thermal column with removable door
  - Beam ports: radial (2), piercing (fast neutron), tangential



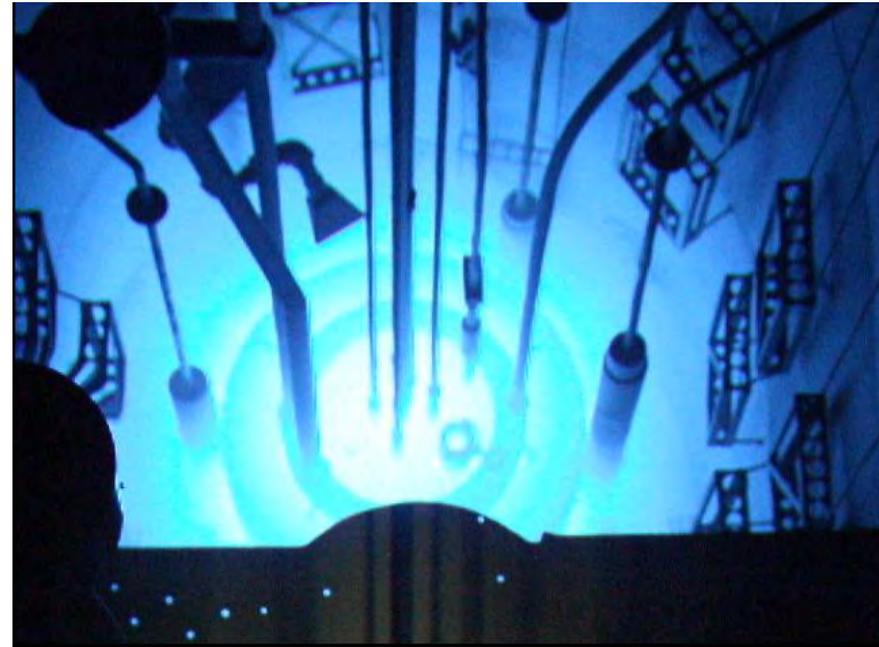
# TRIGA Reactor

- Trainning, Research, Isotope-production, General Atomics
  - Pool-type, light water moderated
  - Solid homogeneous core
  - Pulsing reactor
  - Rated power: 250 kW<sub>th</sub> to 2.3 MW<sub>th</sub>
  - Coolant: Demineralized light water
  - Moderator: Zirconium hydride, demineralized light water, and graphite
  - Reflector: Graphite
  - Cladding: stainless steel or Aluminum



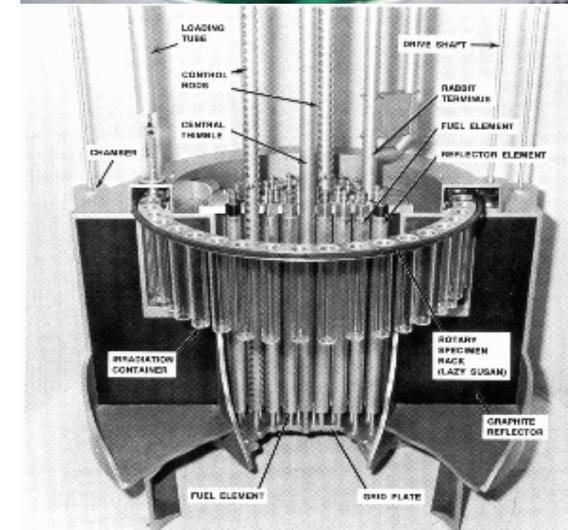
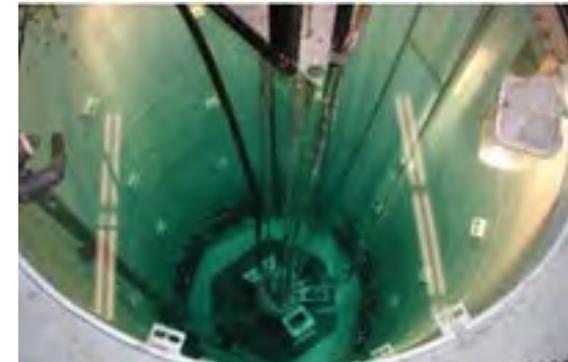
# TRIGA Research Reactor

- Currently 16 licensed TRIGA reactor
  - Training-Research-Isotope-General Atomics
  - Located in engineering or research bldg.
  - All Class 104 c.
- TRIGA Reactors
  - Dow Chemical Company (100 kilowatts)
  - University of Utah (100 kilowatts)
  - Aerotest (250 kilowatts)
  - Kansas State University (1.25 megawatts)
  - Reed College (250 kilowatts)
  - University of California-Irvine (250 kilowatts)
  - University of Maryland (250 kilowatts)
  - Texas A&M University (1.0 megawatts)
  - U.S. Geological Survey (1.0 megawatts)
  - University of Wisconsin (1.0 megawatts)
  - Washington State University (1.0 megawatts)
  - Oregon State University (1.1 megawatts)
  - Pennsylvania State University (1.1 megawatts)
  - Armed Forces Radiobiology Research Institute (1.1 megawatts)
  - University of Texas (1.1 megawatts)
  - University of California-Davis (2.3 megawatts)



# TRIGA major projects, experiments, and uses of the Reactors

- Types of Experiments:
  - Teaching laboratories
  - Neutron activation analyses
  - Radiation hardening of electronic equipment
  - Neutron radiography
  - Radiochemistry
  - Production of radiotracers
- Experimental Stations:
  - Central thimble
  - Pneumatic transfer
  - Dry tubes
  - Thermalizing column with bulk shielding tank
  - Thermal column with removable door
  - Rotating specimen rack (“lazy susan”)
  - In-pool irradiation apparatus



# Testing Facility

- Currently 1 licensed testing facility
  - National Institute of Standards and Technology (20 megawatts)
  - Located on large government complex
  - Class 104c
- Reactor
  - Fuel:  $U_3O_8$ -AL, plates (93% Enrichment)
  - Cladding: cadmium/aluminum
  - Coolant: heavy water ( $D_2O$ )
  - Reflector: heavy water ( $D_2O$ )
  - Moderator: heavy water
  - Maximum Excess Reactivity: 10.0%  $\Delta k/k$
  - Reactor shield: concrete, lead, and iron



# Testing facility major projects, experiments, and uses of the reactor

- Types of Experiments:
  - Thermal and cold neutron research
  - Neutron activation analyses
  - Neutron scattering
  - Neutron imaging
  - Neutron physics
  - Radiochemistry
- Experimental Stations:
  - Pneumatic transfer
  - Multi-axis crystal spectrometer
  - Ultra/small angle neutron scattering
  - Cold and thermal neutron imaging and depth profiling
  - Neutron reflectometers, diffractometers, spectrometers, and interferometer

# Medical Radioisotope Irradiation and Processing

- Currently reviewing two construction permit applications
- SHINE Medical Technologies, Inc. (SHINE)
  - Irradiation facility houses eight accelerator-driven subcritical operating assemblies for the fission of 19.75% enriched aqueous target solution
  - Moderation and reflection provided by light water pool
  - Cooling provided by light water pool and forced convection
  - Radioisotope production facility consists of three hot cells for chemical separation and purification of fission products
- Northwest Medical Isotopes, LLC (NWMI)
  - Proposes to manufacture 19.75% enriched solid targets for irradiation at existing research reactors
  - Radioisotope production facility consists of two hot cells for chemical separation and purification of fission products



# Medical Radioisotope Irradiation and Processing facility major projects and uses

- SHINE and NWMI to be licensed as class 103 commercial facilities
  - Target irradiation performed by *utilization facilities* (SHINE)
    - Each of SHINE's irradiation units will operate at about 100 kW
  - Fission product separation performed by *production facility* (SHINE and NWMI)
- Facilities will be primarily dedicated to the production of molybdenum-99

- Safety Inspections
  - **Class I** (5 - Thermal power  $\geq$  2 MW)
    - MIT, MURR, NIST, RINSC, and UC Davis
    - 2 one-week visits annually. (Safety Inspections)
  - **Class II** (26 - Thermal power  $<$  2 MW)
    - 2 one-week visits over 2 years.
- Security Inspections (Based on licensed possession limits)
  - **Cat II** (3)
    - MIT, MURR, NIST
    - 1 one-week visit over 2 years
  - **Cat III** (28)
    - 1 one-week visit over 3 years:

- For the period of 2010-2016:
  - Operational: 20
    - Operator error, TS or procedure violations, etc.
  - Administrative: 8
    - Record keeping, posting and signage, etc.
  - Material: 0
    - Inoperative equipment
    - Material deficiencies

# NPUF Violation Examples

- For the period of 2010-2016:
  - Exposure events:
    - Kansas State University - 2010
    - University of Maryland – 2011
    - North Carolina State University – 2011
    - Rhode Island Nuclear Science Center – 2012
  - Operator Absence:
    - U Wisconsin - 2011
    - UC Irvine – 2012
    - Reed College – 2013
    - Texas A&M University – 2014
  - System Failure:
    - Aerotest - fuel failures – 2011
    - North Carolina State University – reactor pool leak - 2011

# Summary

- Primary responsibility for licensing and oversight is with NRR
- NPUFs are neutron sources; thermal power is incidental
- NPUFs incorporate numerous design techniques to bring neutrons to experiments or experiments to the neutrons
- The NPUFs operating in the US range from  $5W_{th}$  to  $20 MW_{th}$
- Every NPUF is unique from the others
- NPUFs support multi-disciplinary research, commercial, industrial and educational applications for the benefit of mankind
- Medical radioisotope irradiation and processing facilities are not licensed, but construction permits being reviewed

# QUESTIONS?





# **Proposed Rule for Non-power Production or Utilization Facilities (NPUFs)**

Robert Beall  
Sr. Project Manager  
Rulemaking Branch

# Purpose of the NPUF Proposed Rule

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- Eliminate the NPUF license renewal backlog.
- Streamline the license renewal process.
- Implement Commission directed the staff:
  - Short-term plan: address the backlog with the Interim Staff Guidance (ISG)
  - Long-term plan: enhance license renewal process

# Background on NPUF Proposed Rule

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- Objective: “establish a more efficient, effective and focused regulatory framework”
- The proposed rulemaking will modify:
  - 10 CFR 2.109 “*Effect of timely renewal application*”
  - 10 CFR 50.71 “*Maintenance of records, making of reports*”
  - 10 CFR 50.51 “*Continuation of license*”

- Regulatory Basis completed August 2012
  - Rulemaking justified
  - Identified constraints and limitations
  - Evaluated feasibility for segregation of NPUF regulations
  - Studied benchmarks for alternate methodology
  - Conducted public meetings to solicit stakeholder feedback

# Applicability of the NPUF Proposed Rule

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- Rulemaking affects all NPUFs:
  - Research reactors (Class 104a & c)
  - Testing facilities (Class 104c)
  - Medical radioisotope irradiation and processing facilities (Class 103)

# Summary of the NPUF Proposed Rule

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## 1. Create a definition for NPUF

- Affects all NPUFs
- No single definition exists to cover all non-power facilities
- Proposed rule would revise 10 CFR 50.2, Definitions
- Flexible term is needed to capture all non-power facilities licensed under § 50.22 and § 50.21(a) and (c)
- Ensures clarity and consistency for the applicability of NPUF regulations

# Summary of the NPUF Proposed Rule

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- 2. Eliminate license terms for facilities, other than testing facilities, licensed under 10 CFR 50.21(a) and (c)**
- Affects Class 104a and 104c NPUFs, other than testing facilities
  - Proposed rule would exempt Class 104a and 104c NPUFs, other than testing facilities, from 10 CFR 50.51, which requires 40-year fixed license terms
  - No license term specified in AEA for Class 104 NPUFs
  - Consistent with AEA's minimum regulation standard
  - Reduces burden for licensees and NRC, but maintains public health and safety

# Non-expiring License Questions

- Aging management ▶
  - Simple designs
  - Low operating power and temperatures
  - Surveillance requirements
- Opportunity for hearings & public involvement
  - Licensing actions
  - 10 CFR 2.206 petitions
  - Allegation process
- Oversight and Inspection activity
  - Increased FSAR updates
  - Continuing staff onsite inspections
  - Very low number of design changes each year
- The above actions help ensure the public health and safety

# Non-expiring License Rationale

- AEA does not establish a license term for Class 104a. or 104c.
  - Limited only by 10 CFR 50.51(a) to  $\leq$  40 years
  - Staff currently licensing NPUFs for 20 year terms
- Non-expiring license is consistent with AEA Sec. 104 to “...impose only such minimum amount of regulation...under this act to promote the common defense and security and to protect health and safety of the public...”

# Summary of the NPUF Proposed Rule

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## **3. Define the license renewal process for testing facilities and NPUFs licensed under 10 CFR 50.22**

- Affects Class 103 NPUFs and testing facilities
- NPUF license renewal regulatory requirements default to initial licensing requirements
- Proposed rule would consolidate license renewal requirements under 10 CFR 50.135
- Clarifies license renewal process
- Enhances regulatory efficiency

# Summary of the NPUF Proposed Rule

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## **4. Require all NPUF licensees to submit routine FSAR updates to the NRC every five years**

- Affects all NPUFs
- 10 CFR 50.71(e) only requires FSAR updates by power reactor licensees
- Proposed rule would extend applicability to NPUFs
- During license renewal, some licensees unable to provide documentation on licensing basis
- Benefits knowledge management, NRC's inspection program, and licensee operator training and exams

# Summary of the NPUF Proposed Rule

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## 5. Amend current timely renewal provision

- Affects all NPUFs
- 10 CFR 2.109, Effect of timely renewal application, provides 30-day timely renewal
- Proposed rule would:
  - Create two-year timely renewal for Class 103 and testing facilities and
  - Exempt Class 104a and 104c NPUFs, other than testing facilities
- Thirty days is not a sufficient period of time for adequate assessment of license renewal application
- Two years would provide sufficient time and allow facility to operate under current license terms

# Summary of the NPUF Proposed Rule

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## **6. Provide an accident dose criterion of 1 rem (0.01 Sv) TEDE for NPUFs other than testing facilities**

- Affects all NPUFs except testing facilities
- Standards in Part 20 are applied to NPUFs, other than testing facilities, as accident dose criteria
- Part 20 public dose limits are unnecessarily restrictive as accident criteria
- Proposed rule would create new accident dose criterion for NPUFs, other than testing facilities, in 10 CFR 50.34
- Proposed criterion is consistent with early phase PAG and provides adequate protection from unnecessary exposure to radiation

# Summary of the NPUF Proposed Rule

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## **7. Extend applicability of 10 CFR 50.59 to NPUFs regardless of decommissioning status**

- Affects all NPUFs
- 10 CFR 50.59 currently is not applicable to NPUFs during decommissioning
- Proposed rule would extend applicability during decommissioning
- Avoids burden of issuing license amendments

# Summary of the NPUF Proposed Rule

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## **8. Clarify applicant's requirement for meeting the existing provisions of 10 CFR 51.45**

- Affects all NPUFs
- 10 CFR 51.45 does not explicitly identify environmental documentation needed from NPUF applicants
- Proposed rule would define environmental reporting requirements for NPUFs
- Applicant must submit environmental report, or supplement, to assist the NRC staff's review
- Improves consistency and clarifies Part 51 requirements

# Summary of the NPUF Proposed Rule

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## **9. Eliminate requirement for NPUFs to submit financial qualification information with license renewal application**

- Affects Class 103 NPUFs and testing facilities
- 10 CFR 50.33(f)(2) requires financial qualification information at license renewal
- Proposed rule would eliminate financial qualification requirements at license renewal
- Financial qualification information does not have a significant impact on the NRC's determination on the license renewal application
- Reduces burden without affecting results of NRC's review

# Summary of the NPUF Proposed Rule

- **Costs and Costs Savings (Undiscounted)**

	<b>NRC</b>	<b>Licensee</b>
Implementation Costs	\$720,000	\$140,000
Operations Costs	\$1.8 million	\$1.6 million
Cost Savings	\$12 million	\$5.5 million
Net Benefits (Cost Savings – Costs)	\$9.4 million	\$3.8 million

- **Total Net Benefit (Undiscounted): \$13 million**
  - 3 Percent discounting: \$8.9 million
  - 7 Percent discounting: \$5.3 million
- **Backfit Considerations:**
  - Section 50.109 does not apply to NPUFs
  - Section 50.109 not applied to this proposed rule

# NPUF Proposed Rule Package

- SECY Paper.
- *Federal Register Notice* (FRN).
- Regulatory analysis & backfit discussion.
- Environmental assessment.
- Draft Reg Guide DG-2006.
- Rulemaking package currently in review by OGC.
- Additional supporting NPUF rulemaking documents.
  - Congressional letters.
  - Omb statement
- NRR/DPR supporting NPUF documents.
  - Project Manager Handbook Sections 4 & 5 updates.

# NPUF Rulemaking Schedule

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- ACRS Full Committee: March 3, 2016.
- Commission review: April 1, 2016.
- Proposed NPUF rule will be issued for public comment in the early summer of 2016.
  - 75 day comment period.
  - All supporting documents will be issued together.
  - The staff will hold a public on the proposed rulemaking during the 2016 TRTR conference in August.
- The final NPUF rule should be issued early in 2018.



# NPUF Proposed Rule Summary

- The proposed rule will amend the regulations related to license renewal for NPUFs licensed under sections 103 and 104a and c of the AEA.
- There are 9 proposed changes to the regulations which include:
  - Most NPUF would have non-expiring licenses.
  - Class 103 NPUFs and testing facilities can submit their license renewal application 2 years prior to the current license expiration date.
  - Require licensees to submit an updated FSAR every 5 years.
  - Establish an accident dose criteria for most NPUFs.



# NPUF Proposed Rule Summary

- Eliminating licensing terms will reduce the burden on both the licensees and staff.
  - Allowed by the AEA
  - Minimum regulation on licensees
  - Continued oversight and inspections by staff
  - Improved FSAR documentation
- Total quantitative benefit of the proposed rule: \$13 million
- Maintains the safe operation of the facility while protecting the public health and safety.

# QUESTIONS?



# BACK UP SLIDES

- NPUF experiments
- NPUF applications & utilization
- Regulatory basis information
- Typical fuel characteristics
- MHA types

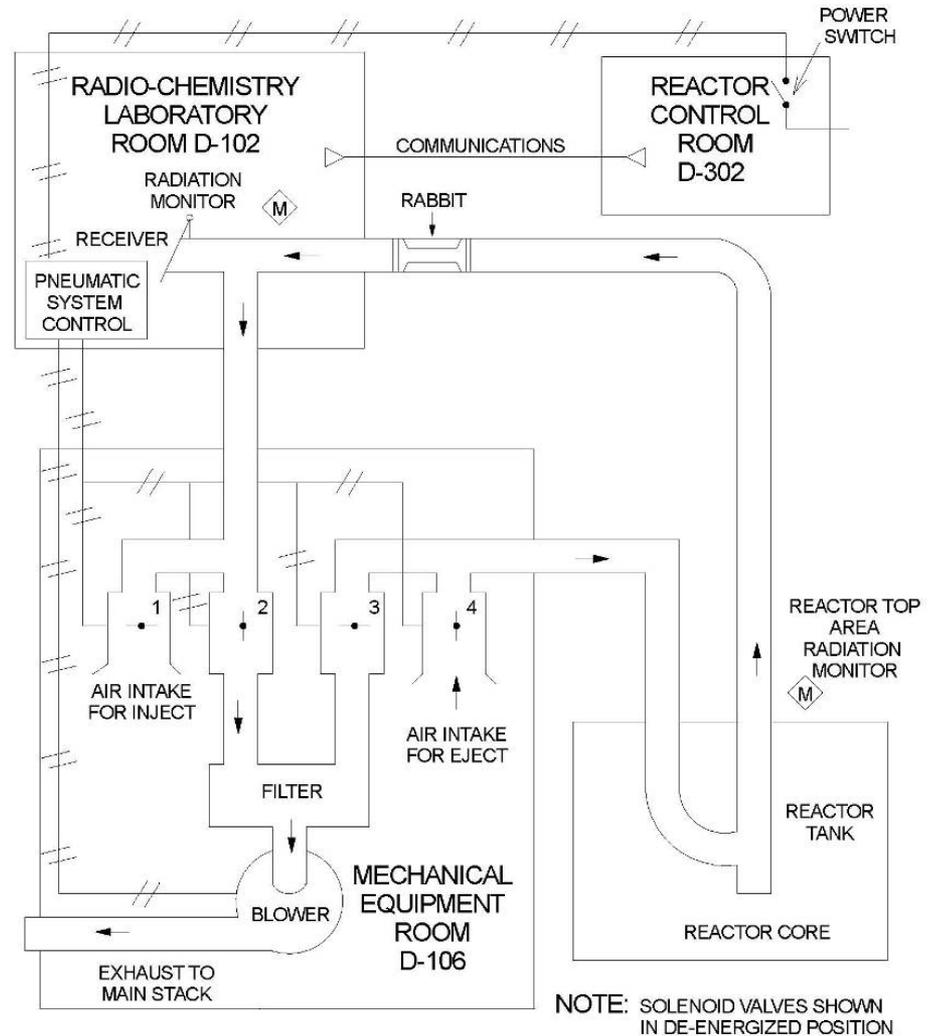
## Sample insertion

- Fixed location within or adjacent to core where samples can be placed for irradiation
- Can be fixed or moveable experiments
- Moveable experiments can be inserted or removed while operating



## Pneumatic Transfer System

- Pneumatically moves samples in and out of the reactor
- aka “Rabbit” system



# Experiments

## Pneumatic Transfer System



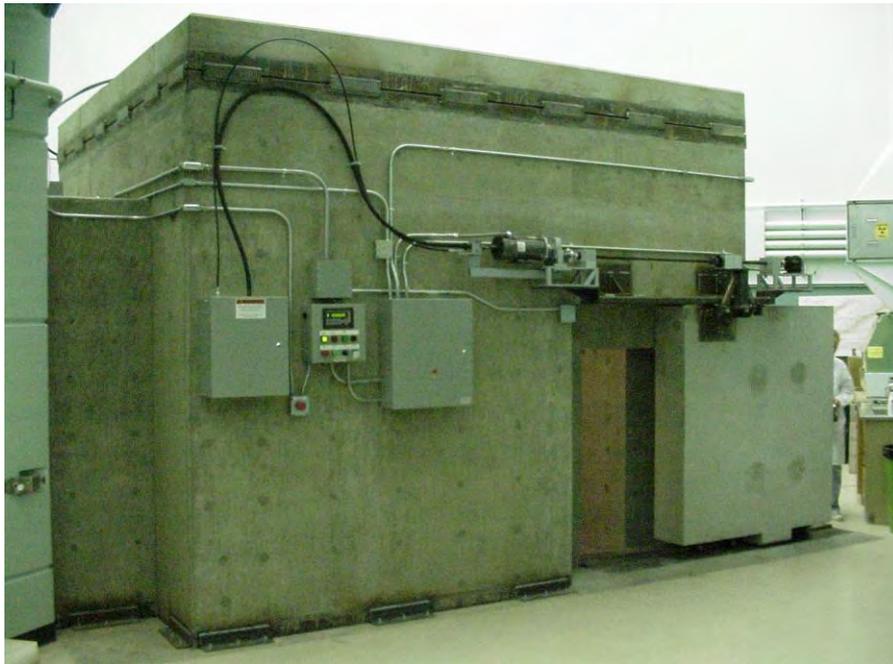
# Experiments

## Neutron Beam

Neutron beams



## Radiography Facility



# **NPUF Applications**

- Neutron activation analysis (NAA)
- Neutron radiography
- Neutron scattering
- Neutron irradiations
- Radioisotope production
- Education

# Neutron Activation Analysis Applications

- Environment – Measure pollutants vs time from tree rings, sediments and ice buildup
- Biology – Measure uptake of nutrients
- Anthropology – Determine trading practices of early man
- Forensics – Link evidence to suspect
- Art – Determine authenticity of artwork
- Hydrology – Use stable tracer to verify source of pollution

# Neutron Radiography Applications

- View inside metal enclosures
  - Fluid flow in automotive transmissions
  - Gaskets in valves
- Characterize artwork
- Dispersion of boron in Boral
- Presence of moisture or corrosion
  - Aircraft wings
  - Heat pipes
- Non-destructive quality control technique

# Neutron Scattering Applications

- Studies of biological matter; neutron interactions with hydrogen
- Studies of condensed matter physics, chemistry, polymer science, material science and neutron physics
- Powder diffraction used to study magnetism, superconductivity and material science
- Polarized neutron beams used to study electron spin in magnetic atomic structure
- Practical applications in ferro-fluid studies, stress analysis and fracture/flaw characterization

- Irradiation
  - Radiation effects studies
    - Biological effects
    - Metal embrittlement
  - Medical treatment (BNCT)
  - Transmutation
    - NTD silicon
    - Gemstones
- Simulation
  - Electronic hardness
  - Nuclear blast environments

- Radioisotope production
  - Tracers
    - Biological
    - Engineering processes
  - Medical
    - Diagnostics (Mo-99/Tc-99m generators)
    - Therapy (I-125 seed implants)
  - Sealed sources
    - Medical
    - Educational
    - Industrial

# Public Involvement

- Opportunity for hearing tied to licensing actions
- Other means of involvement available
  - 10 CFR 2.206 Petition
  - Allegation process
  - Public availability of FSAR updates
- Historically, only one hearing request in last 30+ years

# Constraints and Limitations

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- Identified Constraints and Limitations (C&Ls)
  - Renewal = Relicensing (initial licensing)
  - Lack of periodic SAR updates
  - Timely Renewal (10CFR 2.109)
  - Existing Rule Language
    - General organization and presentation
    - Definitions & terminology
    - Technical basis for Testing facility
    - 50.59 applicability to permanently S/D facilities
    - Accident Dose criteria for research reactors

# Regulatory Basis Options

- Five options and Five sub-options
  1. Do Nothing
  2. NUREG-1537 update to incorporate a streamlined license renewal process (Short-term plan)
    - extend the ISG concept to license renewal applications
    - *guidance* to periodically update SARs
  3. Rulemaking adopting streamlined license renewal process
    - Codify the ISG concept to license renewal applications
    - requirement for periodically SAR updates
    - change the current timely renewal provision
    - Segregation of non-power reactor license renewal regulations
  4. Eliminate license terms (and license renewals) and mandate PSRs
  5. Eliminate license terms (and license renewals) and mandate an enhanced NRC inspection program

# Regulatory Basis Sub-options

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- Low-hanging fruit:
  - 6. Revise 50.59 applicability
- Clarity of regulations:
  - 7. Update definitions & terminology
  - 9. RTR Dose criteria
- Out of Scope
  - 8. Document Technical basis for Testing Facilities
  - 10. Segregate NPR licensing regulations

# Rulemaking Path Forward

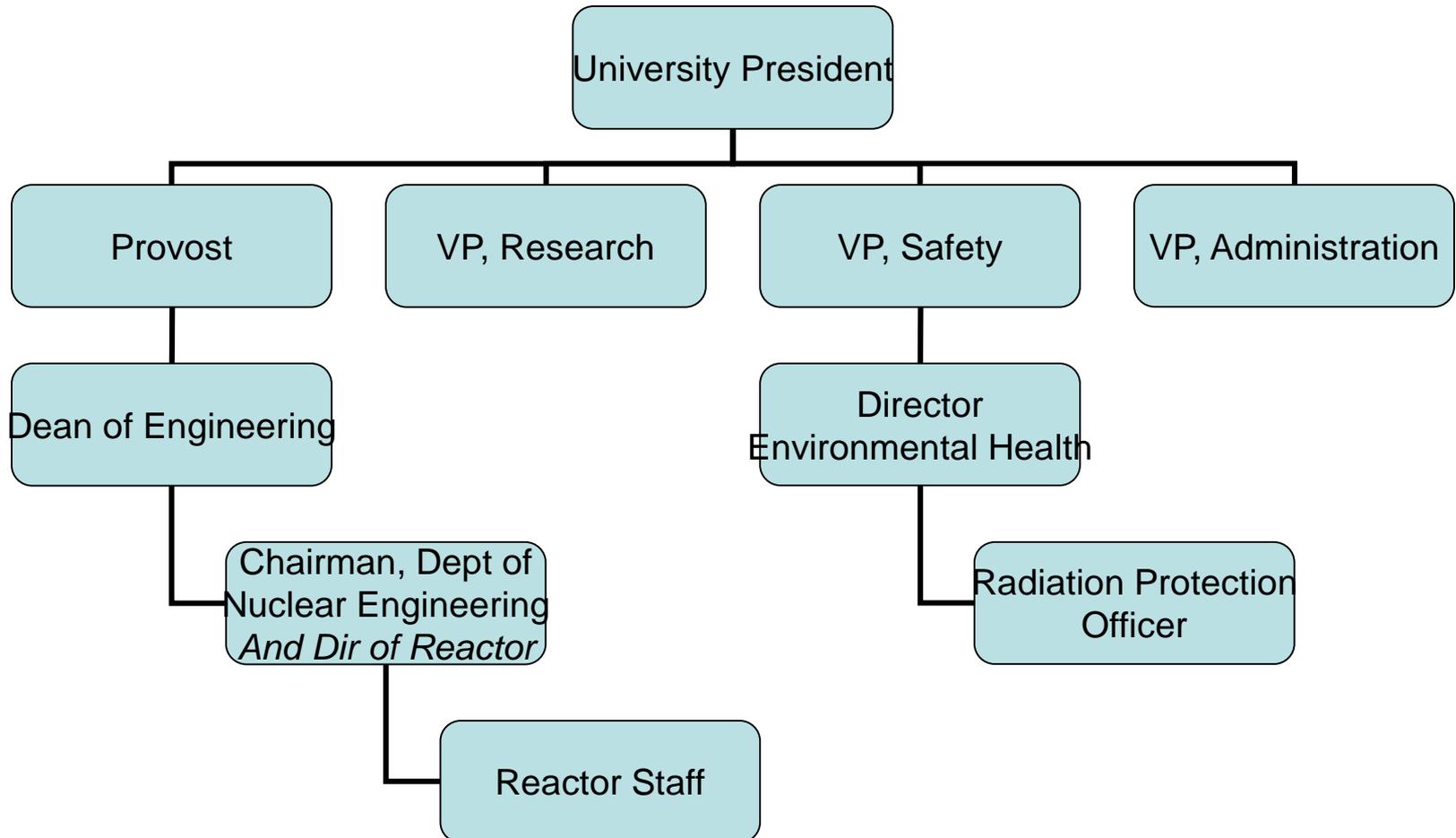
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Proposed rule invokes option 5 through 9:

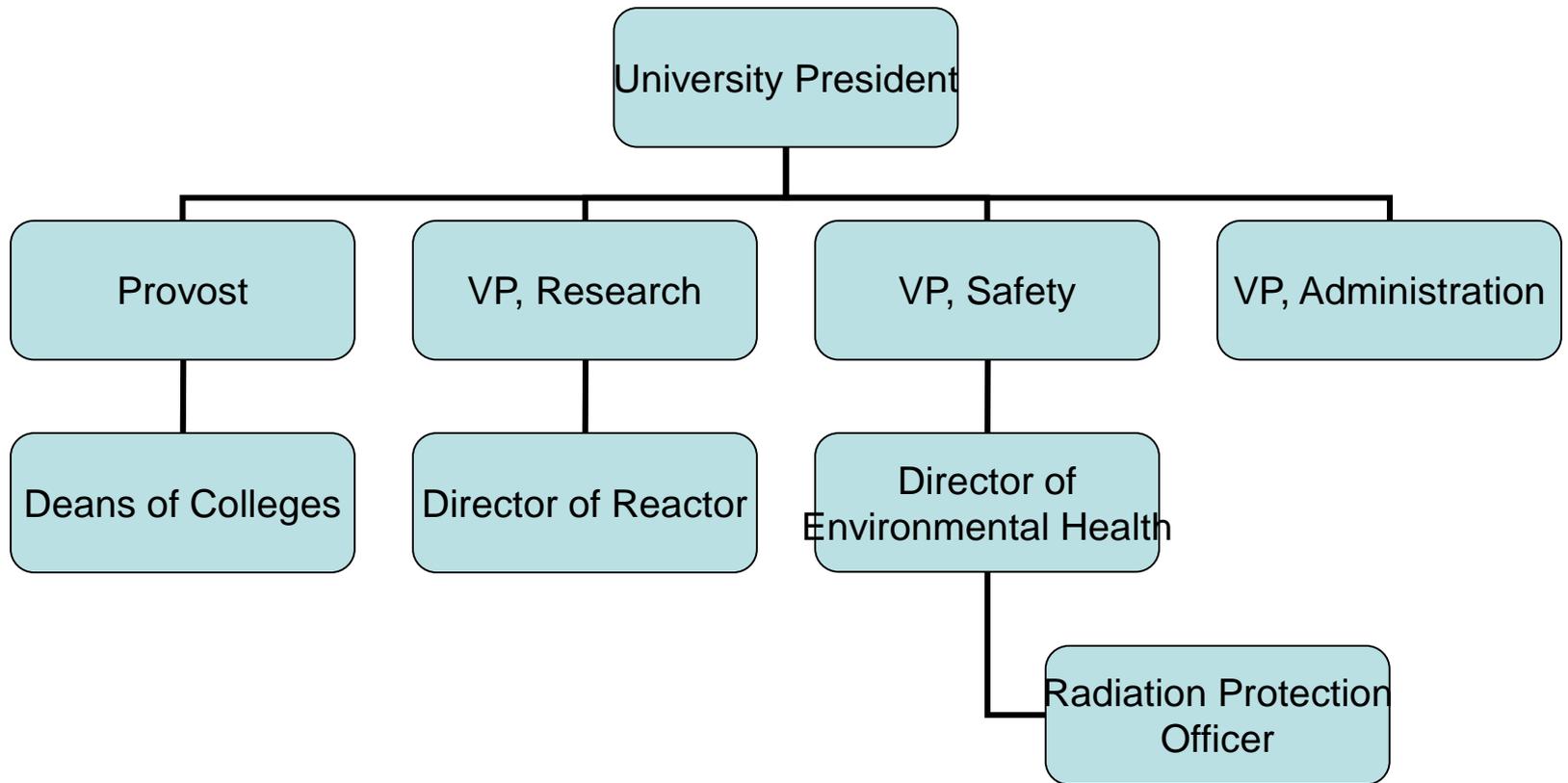
- Eliminate license terms (and license renewals)
  - Discarded notion of an enhanced NRC inspection program
- 6. Revise 50.59 applicability
- 7. Establish “NPUF” definition
- 9. Establish NPUF Dose criteria \*

\* *Excludes testing facilities under Part 100*

# Typical Organizational Structure - Small NPUF



# Typical Organizational Structure - Large NPUF



# Regulatory Policy

The policy for regulation of Class 103 NPUFs is described in the Atomic Energy Act of 1954, as amended, Section 103.

## **Sec. 103. Commercial Licenses**

a. The Commission is authorized to issue licenses to persons applying therefor to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, use<sup>100</sup> import, or export under the terms of an agreement for cooperation arranged pursuant to section 123, utilization or production facilities for industrial or commercial purposes.<sup>101</sup> Such licenses shall be issued in accordance with the provisions of chapter 16 and subject to such conditions as the Commission may by rule or regulation establish to effectuate the purpose and provisions of this Act.

c. Each such license shall be issued for a specified period, as determined by the Commission, depending on the type of activity to be licensed, but not exceeding forty years from the authorization to commence operations and may be renewed upon the expiration of such period.

# AGN Fuel Characteristics

- Solid Homogeneous core research reactor
- fuel:
  - UO<sub>2</sub> enriched to 20% <sup>235</sup>U
  - 10” diameter polyethylene disks
- Clad: None (tank)

# Plate-type Fuel Characteristics

- **MIT:** U-Alx, 93% enrichment, Al Clad
- **NIST:** U<sub>3</sub>O<sub>8</sub>-Al, 93% enrichment, Al clad
- **MUS&T:** U<sub>3</sub>O<sub>8</sub>-Al cermet MTR type fuel, < 20% enrichment, Al clad
- **Ohio State:** U<sub>3</sub>Si<sub>2</sub>-Al alloy, 20 elements with 16 MTR-type fueled plates per element, < 20% enrichment, Al clad
- **Purdue:** U<sub>3</sub>Si<sub>2</sub>-Al, 13 MTR-type elements with 14 plates per element, < 20% enrichment, Al clad
- **RIAEC:** U<sub>3</sub>Si<sub>2</sub>-Al < 20% enrichment, Al clad
- **UMass Lowell:** U<sub>3</sub>Si<sub>2</sub>, < 20% enrichment, Al clad
- **UFTR:** U-Al, 11 rectangular plates per fuel bundle

# TRIGA Fuel Characteristics

- Initial fuel:
  - Al clad, 8.5 w/o U enriched to 20 %  $^{235}\text{U}$
- Later fuel for higher power RTRs:
  - 12, 20, or 30 w/o U, 20 %  $^{235}\text{U}$ , and SS clad
- 19.75%  $^{235}\text{U}$  is used to remain <20% (LEU)
- FLIP (Fuel Life Improvement Program) fuel was 70% enriched (HEU)
- Fuel may contain burnable neutron poisons

# TRIGA Reactor Design

- Design objective was for an inherently safe reactor (no fuel melting or fission product release if all control rods were instantaneously removed)
- Most common core type for small to mid-sized NPUFs
  - (100 kW<sub>th</sub> to 2.3 MW<sub>th</sub>) today
- UZrH fuel element/moderator provides large prompt negative reactivity feedback
  - Pulse with \$3 pneumatic reactivity insertion
  - Attain 2000 MW<sub>th</sub> for 10 msec from 1 MW<sub>th</sub> reactor

# One-of-a-kind Fuel Characteristics

- **RPI:**  $\text{UO}_2$  sintered pellets in stainless steel tubes 4.8% enriched, SS clad (SPERT)
- **NCSU:**  $\text{UO}_2$  sintered pellets in stainless steel tubes, 4% Enrichment, Zircaloy clad
- **GE:** U-Al alloy, 16 fuel assemblies with 40 skewer-type disks per assembly, 93% enriched, Al clad
- **MURR:** U-Al or  $\text{U-Al}_x$  curved plates, 93% enriched, Al clad

# RTR Ageing Degradation Experience

- Buried piping corrosion; replace or insert internal flexible sleeve
- Metal lined pool weld defect; locate and repair weld
- Metal lined pool corrosion; replace tank liner
- Concrete pool leak; apply polymer coating
- Consider primary coolant leakage as an SAR pre-analyzed event

# AGN Reactor Accidents

- Maximum Hypothetical Accidents
  - Insertion of fissionable material (U-235) into reactor core
- Consequence
  - Meets 10 CFR 20

# Argonaut Reactor Accidents

- Maximum Hypothetical Accidents
  - Fuel damage
  - “Core crushing accident” is the initiating event
- Consequence
  - Meets 10 CFR 20

# Pulstar Reactor Accidents

- Maximum Hypothetical Accidents
  - Fuel pin cladding failure
- Consequence
  - Meets 10 CFR 20

- Maximum Hypothetical Accidents
  - Purdue: failed fuel experiment
  - MUS&T: failed fuel experiment
  - Ohio State: failed fuel plate
  - UMass-Lowell: failed fuel plate
  - RIAEC: fuel cladding failure
- Consequence
  - Meets 10 CFR 20

# Tank Reactor Accidents

- Maximum Hypothetical Accidents
  - Melting fuel plate
- Consequence
  - Meets 10 CFR 20

# Critical Assembly Accidents

- Maximum Hypothetical Accidents
  - Failed experiment with radioactivity
- Consequence
  - Meets 10 CFR 20



# TRIGA Reactor Accidents

- Maximum Hypothetical Accidents
  - Failed fuel element in air
- Consequence
  - Meets 10 CFR 20



# Testing Facility Accidents

- Maximum Hypothetical Accidents
  - Melting fuel plate
- Consequence
  - Meets 10 CFR 100



# Exposure Events

- A primary objective of the NRC is to protect the health of the public, as well as the health of those involved in the nuclear industry
- Radiation exposure is expected to be As Low As Reasonably Achievable (ALARA), as well as conforming to regulatory limits
- Radiation exposure events are closely reviewed and analyzed

# Exposure Events

- Texas A&M University – 2006
- MIT – 2007
- Kansas State University - 2010
- University of Maryland – 2011
- North Carolina State University\* – 2011
- Rhode Island Nuclear Science Center – 2012

\*Will be covered in another section

## **Texas A&M - 2006**

- A worker handling irradiated sample vials had an extremity dosimeter read a monthly total of 75.8 rem
- The yearly limit for extremity exposure is 50 rem
- No other workers had dosimetry results that were high, so the licensee determined that this was likely a defective dosimeter, and had it further evaluated
- The dosimeter was determined to be accurate
- Meanwhile, the worker had accumulated an additional extremity exposure of 37.54 rem in the following month

## **Texas A&M 2006**

- A special inspection was conducted
- It was found that the worker was gripping the vials with both hands, unlike other workers
- The NRC issued a severity level IV violation, due to the licensee not properly assessing the risk of exposure
- Texas A&M made adjustments to their monitoring and training programs. They also developed new tools to perform this task safely.



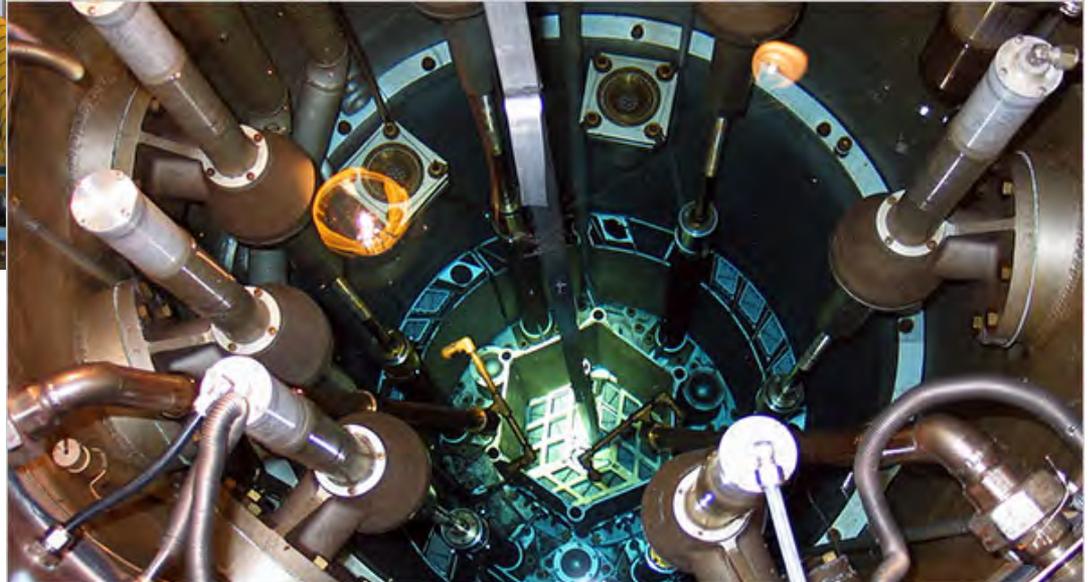
**U.S.NRC**

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

## **Texas A&M – 2006, Extremity Exposure**

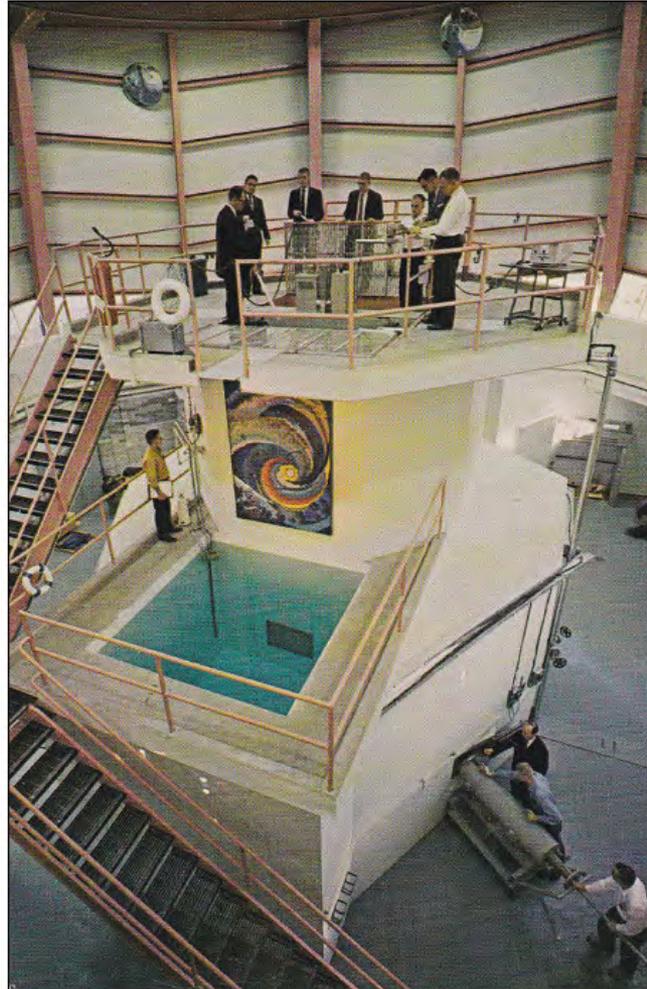
- Maximum yearly extremity dose: 50 rem
- Dosimeter results: 113 rem
- Calculated average extremity dose: 17 rem
  - This value was accepted as the true dose



- An operator in training's dosimetry reported a body dose of 4.04 rem in a quarter of a year
- An extremity dose of 5.81 rem was recorded, but the trainee was wearing his extremity dosimeter incorrectly
- The licensee determined that the majority of the dose was received while processing irradiated silicon ingots

- The trainee was not following procedure during the operation
- The licensee was issued two severity level IV violations for:
  - Failure to assess the radiation exposure during this operation
  - Failure to properly train the operator candidate in the use of dosimetry

# Kansas State University - 2010



Scview

[www.delcampe.net](http://www.delcampe.net)

- A senior reactor operator (SRO) was withdrawing irradiated oil samples in a sample tray for an experiment
- A radiation monitoring device read off-scale, and all local radiation alarms were triggered
- The SRO picked up the samples and sample tray with bare hands (and no extremity monitoring), and placed them behind nearby shielding, to reduce the area radiation to normal

- The licensee was issued a severity level III violation for:
  - Failure to assess the radiation levels that this experiment would produce
  - Failure to supply and require the use of extremity monitoring
  - Failure to have an adequate written procedure for the experiment



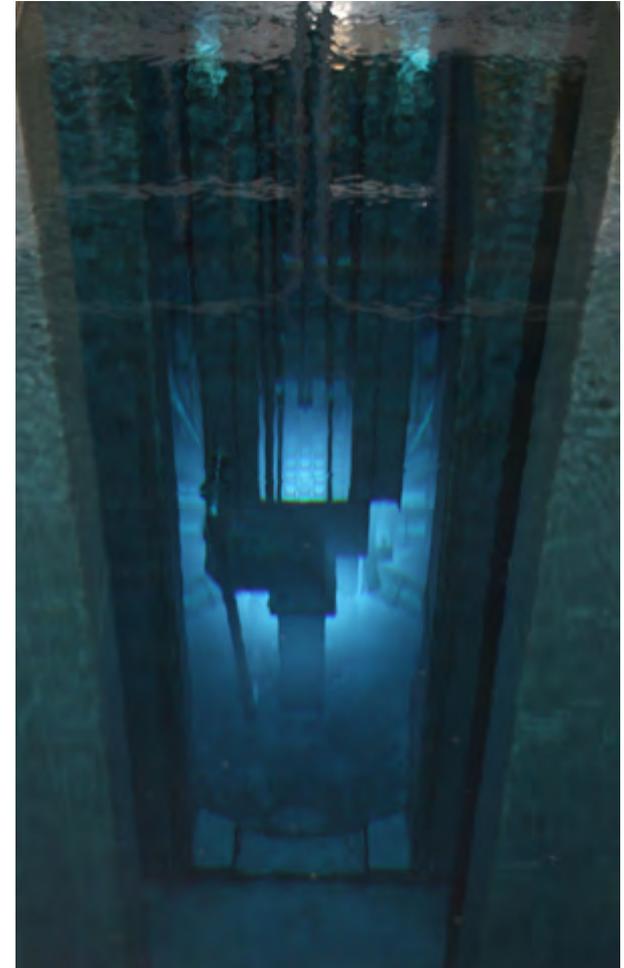


- Sensing equipment deteriorated by exposure
- Powder from irradiated insulation spilled and became airborne while removing graphite samples
- One individual experienced skin contamination from the powder and was successfully decontaminated.



- Exposure due to skin contamination was estimated to be 3 mrad (equivalent to exposure to 3 mrem)
- No exposure was found in the other individuals
- The licensee was cited with a severity level IV violation, due to not having this experiment reviewed and approved, despite its similarity to previous experiments.

# Rhode Island Nuclear Science Center - 2012





# **Rhode Island Nuclear Science Center - 2012**

- Senior reactor operator asked student trainee to lock the gate on a room adjacent to the reactor core
- The student entered the room instead of locking it, being exposed to a dose calculated to be 115 mrem
- NRC issued a non-cited violation for this incident

# Operator Error

## **Unintentional:**

- University of Missouri-Columbia – 2000
- Reed College – 2008

## **Intentional**

- Reed College – 2005

## **Operator Absences**

- U Texas - 2006
- U Wisconsin - 2011
- UC Irvine – 2012
- Reed College – 2013
- Texas A&M University – 2014

# Unintentional Operator Error

- University of Missouri-Columbia – 2000
  - Reactor was shut down, and a regular refueling process began
  - A pump seal started leaking, and became the main focus of maintenance
  - A control blade was removed from the reactor, but the minimum required number of fuel elements required by the technical specifications had not been removed



# Unintentional Operator Error

- Reed College – 2008
  - The reactor had been operating with a vacant space for a fuel element at a reduced power level
  - A new fuel element was being installed in a vacant position, during calibration the reactor operated above the licensed power level
  - A severity level III Violation was issued

# Intentional Operator Error

- Reed College - 2005
  - Operator removed a jumper related to the control rod system, and did not inform anyone
  - Licensee was issued a severity level IV violation for unauthorized modification of a safety system

# Operator Absences

## Severity level III:

- MIT – 2003
  - Operator asleep

## Severity level IV:

- U Texas - 2006
- U Wisconsin - 2011
- UC Irvine – 2012
- Reed College – 2013
- Texas A&M University – 2014

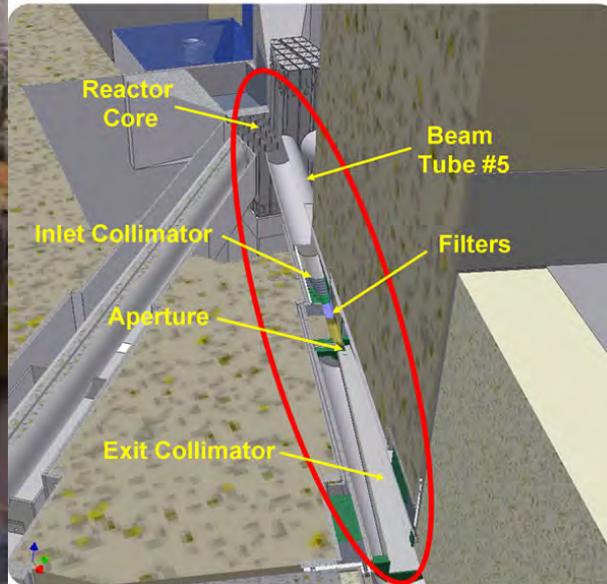
# System Failure

- Penn State - leak – 2007
- North Carolina State University – July 2011  
– technician exposure due to open beam port
- Aerotest - fuel failures – 2011
- North Carolina State University – September 2012 – reactor pool leak

# North Carolina State University, 2011



Beam tube #5 – cutaway view of NIF collimator assembly



## **North Carolina State University, 2011**

- A radiography technician entered the beam cave during reactor operation. A beam port shutter was meant to be closed at the time.
- A mechanical failure prevented the shutter from closing
- The technician noticed the open port and left the beam cave after 18 seconds
- The total exposure was about 150 mrem
- All violations were non-cited

## **Aerotest - 2011**

- In 2011, during a fuel inspection, Aerotest discovered cracks in four fuel elements
- It was found that 27 aluminum elements and 11 fuel-less graphite elements could not be removed from the core
- The fuel in the Aerotest reactor had been in a former General Atomics reactor, and had also been shipped and operated in a demonstration reactor at a worlds fair in India
- Upon returning from India, the fuel showed signs of damage, possibly from poor water conditions there

## **Aerotest - 2011**

- A contractor was hired to remove the fuel elements, but the fuel lid could not be removed completely
- In 2012 the lid was pried partially open, and tools were developed to carefully angle the fuel elements out of the core
- Upon inspection, 22 fuel elements showed signs of damage
- In 2013 another contractor was hired to enclose the damaged fuel elements in sealed helium-filled canisters.

# History of NPUF Oversight

- 1989
  - Non-power reactor licensees were being inspected by power reactor inspectors
  - Commission formed “Research Reactor Directorate”, and project managers for RTRs worked at headquarters
  - Inspections were still conducted by regional inspectors from the power reactor groups
- 1991
  - NRC hired RTR specific examiners, who worked at headquarters but not for the RTR group
- 1995
  - Regional RTR inspectors and RTR examiners joined the RTR group
  - Inspectors continued to work from the regions, new inspectors worked at headquarters

