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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

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585TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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THURSDAY

JULY 14, 2011

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear  
Regulatory Commission, Two White Flint North, Room  
T2B1, 11545 Rockville Pike, at 8:30 a.m., Said Abdel-  
Khalik, Chairman, presiding.

COMMITTEE MEMBERS:

- SAID ABDEL-KHALIK, Chairman
- J. SAM ARMIJO, Vice Chairman
- JOHN W. STETKAR, Member-at-Large
- SANJOY BANERJEE, Member
- DENNIS C. BLEY, Member
- MARIO V. BONACA, Member
- CHARLES H. BROWN, Member
- MICHAEL L. CORRADINI, Member

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DANA A. POWERS, Member

HAROLD B. RAY, Member

JOY REMPE, Member

MICHAEL T. RYAN, Member

WILLIAM J. SHACK, Member

JOHN D. SIEBER, Member

NRC STAFF PRESENT:

MAITRI BANERJEE, Designated Federal Official

MICHAEL MAYFIELD

DOUG COE

ROSS MOORE

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T-A-B-L-E O-F C-O-N-T-E-N-T-S

Opening Remarks by the ACRS Chairman

Opening Statement

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Items of Current Interest

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Safety Evaluation Report Associated with NEDC-33173,  
Supplement 2: Parts 1, 2, and 3, "Analysis of Gamma  
Scan Data and Removal of Safety Limit Minimum Critical  
Power Ratio (SLMCPR) Margin"

Remarks

Subcommittee Chairman, Dennis

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Briefing by and discussions with representatives  
of the NRC staff and General Electric Hitachi  
(GEH) regarding the safety evaluation report  
associated with NEDC-33173, Supplement 2, Parts  
1, 2, and 3

Michael Mayfield, Director, Division of  
Advanced Reactors . . . . . 6

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

8:29 a.m.

CHAIR ABDEL-KHALIK: The meeting will now come to order. This is the second day of the 585th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider the following: one, Small Modular Reactor Issue Identification and Ranking Process; two, future ACRS activities/report of the planning and procedures subcommittee; three, reconciliation of ACRS comments and recommendations; four, assessment of the quality of selected NRC research projects; and five, preparation of ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Ms. Maitri Banerjee is the designated federal official for the initial portion of the meeting.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions.

There will be a phone bridge line to preclude interruption of the meeting. The phone will be placed in a listen-only mode during the

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1 presentations and committee discussion.

2 A transcript of portions of the meeting is  
3 being kept, and it is requested that the speakers use  
4 one of the microphones, identify themselves, and speak  
5 with sufficient clarity and volume so that they can be  
6 readily heard.

7 At this time, we will move to the first  
8 module on the agenda, Small Modular Reactor Issue  
9 Identification and Ranking Process. And Dr. Bley will  
10 lead us through that discussion.

11 Dennis?

12 MEMBER BLEY: Thank you, Mr. Chairman.

13 I'm Dennis Bley, Chairman of the Future  
14 Plant Design Subcommittee.

15 I'll remind you that back in March, we had  
16 a session with staff reviewing their SECY on use of  
17 risk insights to enhance safety focus of small modular  
18 reactors. And one of our recommendations was that  
19 staff should consider use of a PIRT-like process to  
20 guide development of those design-specific review  
21 plans.

22 They must have been way ahead of us,  
23 because the purpose of this meeting is to discuss  
24 staff's issue identification and ranking process --  
25 IIRP -- for the small modular reactor program.

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1 They've developed the IIRP to ensure that all issues  
2 and questions have been identified that would need to  
3 be addressed prior to issuing licensing decisions.

4 We received a copy of their IIRP report on  
5 control room staffing, and we'd be delighted to see  
6 the others when we have them finished.

7 At this point, I'd like to turn it over to  
8 Mike Mayfield for the presentation.

9 MR. MAYFIELD: Thank you, Mr. Chairman.

10 Before I start, just, when I first joined  
11 the staff and started coming before the ACRS, the  
12 staff were the only ones with laptops, and the  
13 committee members all had piles of paper. I see the  
14 role reversal has taken place.

15 (Laughter.)

16 Could we go to the first slide?

17 The Commission has been urging the staff  
18 to pay attention to small reactors, early engagement,  
19 we've had the benefit of a couple of policy  
20 statements, some guidance, and some SRMS. This comes  
21 out of the policy statement on the regulation of  
22 advance reactors. It emphasizes NRC to provide for  
23 early identification of regulatory requirements.

24 Part of that goes to the issues that the  
25 staff and Commission and industry need to deal with

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1 going forward. We have presented to the committee  
2 previously the SECY paper 1034, and the policy issues  
3 and key technical issues that we had put before the  
4 Commission.

5 One of the SRMs that's come out on -- I  
6 guess it was actually the -- I've forgotten which one  
7 of the papers we'd put forward, but the SRM told us to  
8 think expansively about issues.

9 So we had been looking at, what else do we  
10 need to do? It's fine for the staff to get together  
11 and think up great things to go do, but is that really  
12 a concerted effort, and have we really looked broadly  
13 and thought expansively?

14 So, next one, Ross.

15 We decided that we needed to take a look  
16 at, what are we doing with the policy issues that we  
17 had identified? We do have project plans and  
18 schedules and we've been reporting out on those.

19 The question was, what have we missed?

20 Next one, please.

21 So we put together the Issue  
22 Identification and Ranking Project, Process, Program.  
23 That last P gets a lot of different words associated  
24 with it, but officially, it's the project.

25 When we were trying to decide how would

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1 you verbalize IIRP, because it really gets to be a  
2 tongue-twister after a while, IIRP, and Mike Johnson  
3 said, you know, you really need to work on that a  
4 little bit.

5 (Laughter.)

6 So, I said, all right, how would you say  
7 it? Well, I said, okay, how would you say it?

8 MEMBER CORRADINI: Beginnings of Issue  
9 Identification and Ranking Project, BIIRP.

10 MR. MAYFIELD: There you go.

11 (Laughter.)

12 His conclusion was, yeah, well, all right,  
13 move on. So it has stayed with IIRP, and it seems to  
14 work.

15 The idea was to identify and prioritize  
16 issues that are under NRC control. We can't solve the  
17 industry's problems for them, but the issues that are  
18 under NRC control that could impede the design,  
19 licensing, construction, operation or export of SMRs.

20 Now, there's also an import piece to that,  
21 that there's at least one vendor that originally was  
22 saying they had no interest in importing their design  
23 to the US, and now we're starting to hear that, well,  
24 maybe they do.

25 So, we're engaging with our friends and

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1 international programs and the rest of the federal  
2 government that deals with import/export to make sure  
3 there are no obstacles there.

4 CHAIR ABDEL-KHALIK: Why would the NRC  
5 care about issues that impede the export of SMRs?  
6 Isn't that the job of the developer?

7 MR. MAYFIELD: Well, yes and no, because  
8 we are part of the export license, and if there is  
9 some aspect of our policy that could impede that,  
10 first of all, we want to know about it, and secondly,  
11 too, is there some change to that policy that needs to  
12 be made?

13 So we don't know that there is, but it was  
14 something where that is part of a business model, and  
15 we are part of that overall export license project.

16 MEMBER POWERS: NRC is charged with  
17 enforcing certain aspects of the export control act --

18 MR. MAYFIELD: Right.

19 MEMBER POWERS: -- in America, and so you  
20 have to -- they have to look and see if you're on the  
21 do not export list.

22 MR. MAYFIELD: Right. Well, and it's also  
23 looking just at some of the nitty-gritty aspects of  
24 exporting the technology.

25 MEMBER CORRADINI: Another, I guess, kind

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1 of starting question. So a lot of what you have in  
2 your first bullet and second bullet kind of will  
3 probably mesh in with what DOE is doing relative to  
4 their program.

5 MR. MAYFIELD: Yes.

6 MEMBER CORRADINI: So, is it an active  
7 part of this that you're in communication and  
8 understand what is appropriate here and what they're  
9 going to do, so you don't --

10 MR. MAYFIELD: Well, we started with, what  
11 do we need to do?

12 MEMBER CORRADINI: Okay.

13 MR. MAYFIELD: And then we are in routine  
14 contact with DOE, so they are familiar with this, and  
15 we'll come back to engagement with external  
16 stakeholders, which of course includes the Department.

17 So, we wanted to look broadly across the  
18 agency. It's easy, you get in any single office, it's  
19 easy to get stove-piped, so we wanted to look broadly  
20 across the office and work with the affected offices  
21 to budget and develop resolutions for the issues that  
22 we've identified.

23 It's one thing to have identified the  
24 issue. It's quite another to make sure you've got  
25 budget in the agency's budget and people resource to

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1 go work on it.

2 We have, for the presentation this morning  
3 and the report that was provided, Doug Coe actually  
4 led, was the facilitator for the group on control room  
5 staffing, so, from the Office of Research, and we had  
6 people from, what, three other offices that were  
7 engaged in that.

8 And as we talk about one of the broader  
9 IIRPs that we're doing, we look literally across the  
10 agency.

11 So, we make use of a PIRT-like process.  
12 And what do we mean by that? It's a structured,  
13 expert elicitation. It's nothing more than that. We  
14 -- because we had to come up with some scheme for  
15 ranking the issues, we come up with some figures of  
16 merit, some metrics, put some numbers to them.

17 But the real value for me as the manager  
18 for the advanced reactor program is the thought  
19 process in getting the issues on the table. Is there  
20 some show-stopping kind of issue that we haven't  
21 thought about before? And then in terms of budgeting  
22 and making sure resources are applied, the ranking  
23 becomes of value. But it's the thought process and  
24 gaining insights from across the agency and  
25 ultimately, as we reach out to stakeholders, the

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1 people on the outside.

2 MEMBER POWERS: I mean, we have a lot of  
3 people show up here fairly regularly saying, well, we  
4 used a PIRT or PIRT-like process. It happens. I  
5 mean, it used to be confined to the thermohydraulics  
6 field, but it's proliferated.

7 Has anybody ever looked to see if it  
8 actually works?

9 MEMBER BANERJEE: We will give you a paper  
10 we are writing on this, where we have come to the  
11 other conclusion on thermohydraulics, that it doesn't  
12 work all that well. So --

13 MEMBER POWERS: Yes, I just wonder if it  
14 actually does what it's purported to do.

15 MEMBER CORRADINI: Well, I mean, I thought  
16 what all Mike was saying is it's a structured way of  
17 thinking, what's the gaps, and what's missing, because  
18 it's --

19 MEMBER POWERS: Well, the question is,  
20 does it find the gaps, and does it identify what's  
21 missing?

22 MEMBER BANERJEE: I think it establishes  
23 the conventional wisdom.

24 CHAIR ABDEL-KHALIK: You can't prove the  
25 negative.

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1 MR. MAYFIELD: You can't prove the  
2 negative. The proof of whether this does or doesn't  
3 work actually will come when the time comes to issue  
4 a license, and if something creeps out of the  
5 woodwork, then I'm going to feel very bad about it,  
6 but we tried.

7 MEMBER POWERS: Well, something's going to  
8 creep out of the woodwork. You know that. I mean, it  
9 always does.

10 MR. MAYFIELD: Yes, but we've given it  
11 what we think is a good-faith effort to identify and  
12 deal with issues that are --

13 MEMBER POWERS: Well, in looking and  
14 selecting a PIRT-like process, what alternatives do  
15 you have? I mean, are there any alternatives to PIRT?

16 MR. MAYFIELD: Well, is there an  
17 alternative to PIRT? Sure, it's the group of wizened  
18 folks sitting around in a smoke-filled room making  
19 their best guess. And that's not a very productive or  
20 useful -- well, we'd like to think that what we did  
21 with PIRT, at least the room wasn't filled with smoke.

22 (Laughter.)

23 Maybe hot air, but not smoke.

24 (Laughter.)

25 Okay. So it's -- when what we mean by

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1 PIRT-like is it's a structured approach. We create --  
2 each project has a working group and a charter so the  
3 people know what they're getting into.

4 We brought in knowledgeable staff that had  
5 not been directly tied to the ongoing issue  
6 resolutions. It's too easy to stovepipe, gee, we've  
7 already thought about this, so we brought in  
8 knowledgeable staff but that haven't been directly  
9 tied, again, trying to make sure that we're thinking  
10 expansively, getting smart folks to come in and look  
11 at it.

12 We use a Senior Executive Service  
13 facilitator to provide the vision and guidance, and  
14 that's -- Doug's going to, a little bit later in the  
15 presentation, talk about what the facilitator's role  
16 is and how that works.

17 The scope of these is somewhat limited by  
18 available time. We weren't turning these into an  
19 open-ended research project. This was a fairly  
20 focused look, a couple of meetings, and Doug will  
21 speak to the process.

22 MEMBER CORRADINI: Mike, can I just ask --  
23 because the most recent one that you guys participated  
24 in like this -- well, I mean, there were a couple, but  
25 the one that I remember that some of us were part of

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1 was for the NGNP. And that was pretty extensive.

2 MR. MAYFIELD: Right.

3 MEMBER CORRADINI: And the thing that  
4 tended to derail the NGNP wasn't the technical issues,  
5 it was the fact that nobody actually wanted to be --  
6 well, what do they say, derail -- slow down the NGNP,  
7 it was nobody wanted to be owner/operator.

8 MR. MAYFIELD: Pretty much.

9 MEMBER CORRADINI: Okay? So that wasn't  
10 in the PIRT.

11 MR. MAYFIELD: Right.

12 MEMBER CORRADINI: That was a thing that  
13 kind of popped out. So I'm assuming that one's now  
14 covered. You guys are well on top of that one for  
15 this.

16 If you went back to -- I'm trying to  
17 think, I don't know if you guys, but I thought the NRC  
18 participated, but perhaps not. There was also some  
19 gap analysis for fast reactors.

20 What I guess I'm saying is, you go back to  
21 recent PIRTs and kind of go to Dana's thing is, what  
22 things popped that wasn't in it as kind of like a --  
23 what popped out that you want to make sure you cover  
24 at least here to minimize the chance of a --

25 MR. MAYFIELD: And -- yes, and let me come

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1 to it.

2 MEMBER CORRADINI: Okay.

3 MR. MAYFIELD: Because my perspective, the  
4 things that have popped out, NNGP as well as fast  
5 reactors, aren't technical.

6 MEMBER CORRADINI: Right.

7 MR. MAYFIELD: Right? So recognizing that  
8 the Mother IIRP, we're going to talk about.

9 MEMBER CORRADINI: Okay. All right.

10 MEMBER CORRADINI: So potential results  
11 coming out of these things, potential impact on design  
12 decisions, so there could be things coming out of the  
13 policy issues that the vendors are going to have to  
14 come to grips with.

15 Are we going to need legislation for some  
16 of these, need for a rule-making or Commission policy  
17 changes, need for confirmatory research that we  
18 haven't been anticipating, and dependencies on other  
19 policies or key technical issues?

20 So the potential for these can be fairly  
21 broad. The specific projects, we looked at Emergency  
22 Planning. That was complete September 2010. That was  
23 the pilot.

24 We have identified some things out of  
25 that, and Dr. Bley said, could we see more? And the

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1 intent was to come brief the committee once we've kind  
2 of gotten through these. We may end up revisiting  
3 some of these things.

4 Source term was the first one out of the  
5 gate, and we used it to test the process -- I'm sorry,  
6 emergency planning. Source term is complete, and  
7 they're writing the report. I saw a draft last night.

8 Control room staffing is complete, and you  
9 have seen that report as an example of what we're  
10 doing. Security is in process. We expect that will  
11 be complete in August.

12 And then there's a thing called cross-  
13 organizational issues, and that's also known as the  
14 Mother IIRP, and that is in process, and we'll be  
15 complete with that by the end of the fiscal year.

16 So we wanted to -- kind of answering some  
17 of the questions about, gee, how do these things come  
18 out of the woodwork that aren't technical? We are not  
19 really focused in the cross-organizational on  
20 technical issues. We're focused on agency-wide, what  
21 are the things that could impede the licensing,  
22 construction, operation of nuclear power plants?

23 So it's a broad look across the NRC's  
24 organization. Our initial focus is on the integral  
25 PWRs, because those are likely to be the first

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1 deployment designs. But we're looking at any of these  
2 factors that could affect the high-temperature gas or  
3 fast reactors.

4 So, again, it's policy kinds of things,  
5 process kinds of things, that could impede moving  
6 forward with licensing construction and so on.

7 MEMBER SIEBER: Could you give them an  
8 example?

9 MR. MAYFIELD: I have some. I think I'll  
10 come to them.

11 Participating offices, NRO obviously, NRR,  
12 NMSS, NMSS Spent Fuel, Transportation, Fuel Cycle  
13 Facilities, Transportation and Storage, Research,  
14 obviously, NSIR from the security and EP standpoints.

15 FSME, really the role there is if the  
16 notion is that small modular reactors could be sited  
17 in non-traditional places. There's been some  
18 discussion of the potential siting on some of the  
19 Indian nations. FSME has that bit of outreach and  
20 linkage with the tribal nations.

21 General Counsel, human resources,  
22 training, what are we going to do about simulators?  
23 Are we going to have a simulator -- is the NRC going  
24 to have a simulator for every one of these designs?  
25 It's those kinds of things.

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1 International Programs, again, it's  
2 principally the import/export issue. Region II,  
3 looking at, are we going to have Resident Inspectors  
4 for every 250-megawatt unit? What do we do about  
5 construction inspection? Because these are going to  
6 be factory-fabricated rather than field-constructed,  
7 do we have resident inspectors in the fabrication  
8 facilities?

9 MEMBER BLEY: Mike, you just mentioned  
10 something I haven't thought about before, but given --  
11 and not just for small modular reactors, but all the  
12 new reactors with the new design control rooms, which  
13 are software-based, screen-based, rather than panels,  
14 and it's more a question for research, but is there a  
15 thought about, the next time we go to build a  
16 simulator, to build some kind of a general purpose one  
17 in which you could embed any of the designs you're  
18 looking at?

19 MR. MAYFIELD: Do you want to speak to it?

20 MR. COE: The answer is yes. I can't  
21 provide a lot of detail where we're at with that, but  
22 the answer is yes.

23 MR. MAYFIELD: And that is ongoing, so  
24 there's some generic simulators. The question is, how  
25 much should the NRC devote to simulators for the staff

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1 use for these?

2 Obviously, the vendors are creating  
3 simulators. What should we be doing internally? I  
4 think the given is the answer is not nothing, it's  
5 okay, if you're going to do something, then what is  
6 that and how expansive should it be? The project is  
7 underway. We expect to complete it in September.

8 Some examples, Jack, you'd asked about  
9 resident inspectors for the plants. If you think  
10 NuScale, the minimum would be two 45-megawatt units.  
11 Are you really going to have resident inspectors on  
12 every one of those sites? How many are you going to  
13 have?

14 There are at least one more opinion than  
15 you have people in the room any time you get into  
16 this.

17 MEMBER CORRADINI: If -- did the La Crosse  
18 Boiling Water Reactor have a resident inspector? I'm  
19 just -- I'm just bringing up a --

20 MR. MAYFIELD: Nobody had them back then.

21 MEMBER CORRADINI: In '93?

22 MEMBER SIEBER: That's right.

23 MEMBER POWERS: Wow, boy. Which one did  
24 you say?

25 MEMBER CORRADINI: LaCrosse.

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1 MEMBER POWERS: Oh, LaCrosse.

2 MR. MAYFIELD: They would have had one.

3 MEMBER BLEY: Okay. Okay, I thought they  
4 were gone, but --

5 MEMBER ARMIJO: Well before '90 --

6 MEMBER MAYFIELD: They would have had one.

7 MEMBER ARMIJO: They last that long?

8 MR. MAYFIELD: So their -- the point is,  
9 the point is, what should we be doing going forward?  
10 Do we treat the SMRs different than the large light-  
11 water reactors?

12 So it -- we'll see where it goes. Again,  
13 resident inspectors for the manufacturing facilities,  
14 is there going to be enough going on that we would  
15 want to put a resident or residents in a manufacturing  
16 facility?

17 What are we going to do about training  
18 courses for the staff? Are we going to ask HR to  
19 create a track for NuScale, you know a course series,  
20 for NuScale? What about mPower? What about Holtec  
21 and their HI-SMUR reactor? So how many of these are  
22 we going to do? What level of investment do we need  
23 to make?

24 When to expand training to non-LWR  
25 technology? We have a lot of fairly junior staff that

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1 have come on board, and by the time, if you look at  
2 DOE's deployment, 20, 25 years from now, when are we  
3 going to start teaching people on staff about fast  
4 reactors? And what should that training look like?

5 Think about the operations center. What  
6 do we need to be doing so that the ops center can deal  
7 with SMRs once they come online? What sort of  
8 resources, and I don't know that they are any  
9 different ones, but we need to ask the question.

10 Spent fuel storage transportation, if  
11 you're going to move half-height assemblies into  
12 casks, what are those casks going to look like? Is it  
13 just a redesign of the existing casks? What needs to  
14 be looked at going forward?

15 Fuel fabrication for non-LWRs, what's the  
16 timing, when we need NMSS to be thinking about fuel  
17 fabrication facilities? The non-LWRs, the fast  
18 reactors, you're talking 19 percent enrichment,  
19 anything less than 20.

20 What different issues does that bring to  
21 the table, and what do we need to be doing about it,  
22 and when? It's certainly not a near-term issue, but  
23 it's probably not a 25-year or a 2025 issue. So when  
24 do we start thinking about these?

25 DOE, John Kelly, sat before the Commission

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1 at the end of March and talked about a vision of a  
2 thousand SMRs in the US.

3 I think he had visions of within his  
4 lifetime.

5 But the notion of this, is even if he's  
6 off an order of magnitude and there's a hundred,  
7 that's kind of a big sea change for the NRC, and what  
8 would we need to be doing to deal with that large a  
9 number of operating nuclear power plants?

10 MEMBER CORRADINI: If I might just back  
11 up, the one thing that I guess that kind of pops up,  
12 Dana clarified it, is for export license.

13 Some of the vendors that might want to get  
14 export licensed are fast reactor vendors. They may  
15 not want a license here, but they'll come to you early  
16 on to get some sort of export license to take it  
17 somewhere else.

18 Like the one that pops into my head that's  
19 fairly aggressive is Tera Power, so that kind of  
20 changes the timing aspect.

21 MR. MAYFIELD: It's a little different.  
22 The export license isn't -- is on the technology, it's  
23 not on the design.

24 MEMBER CORRADINI: I don't know exactly  
25 what you guys have to do in that regards.

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1 MR. MAYFIELD: They'd get a license to  
2 export the technology, not the design, so we wouldn't  
3 do a safety review and license the design. They get  
4 a license to export specific aspects of the  
5 technology.

6 MEMBER CORRADINI: You would review the  
7 aspects of the technology against some sort of  
8 criteria?

9 MR. MAYFIELD: Against criteria that's  
10 spread across the government.

11 MEMBER CORRADINI: Okay.

12 MR. MAYFIELD: Proliferation aspects come  
13 into it.

14 MEMBER CORRADINI: But that's an example  
15 of one where at least we've been to professional  
16 meetings, they're very explicit that they don't want  
17 a license here.

18 MR. MAYFIELD: Right.

19 MEMBER CORRADINI: They want to  
20 essentially export.

21 MR. MAYFIELD: Right. And they have come  
22 in and have done a series of briefs with our  
23 international programs people and some of the  
24 technical folks. They've also been with DOE and some  
25 of the rest of the federal agencies that deal with

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1 export control.

2 MEMBER CORRADINI: I see. All right.

3 MR. MAYFIELD: So where the other part of  
4 the fast reactor, where it gets interesting, is where  
5 they want us to license the design and then they're  
6 going to export that thing, that licensed design.

7 MEMBER CORRADINI: That's another --

8 MR. MAYFIELD: Pardon me?

9 MEMBER CORRADINI: That's another group,  
10 too, is that not?

11 MR. MAYFIELD: There's been -- well,  
12 Toshiba has talked to us about the 4S, where they  
13 plainly are looking to -- they want an NRC license,  
14 and then that licensed design would be marketed and  
15 sold elsewhere.

16 Hyperion has had a similar business  
17 strategy where they're principally looking for an NRC  
18 license for that design, and then they'll market it  
19 elsewhere. Okay?

20 So, the control room staffing, you've seen  
21 the report, and what we wanted to do with sort of the  
22 rest of the brief was to give you an idea of how this  
23 process actually worked, first, from the facilitator's  
24 perspective and then Ross, who I will tell you, came  
25 into this late. He got stuck.

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1           The guy that had been the staff lead on it  
2 left the agency, and Ross has stepped in at the eleven  
3 and half hour, and has done a pretty good job of  
4 pulling it together. If you want to beat him up,  
5 please do.

6           (Laughter.)

7           So do feel free. Well, it's his first  
8 shot in front of the committee, so, go after him.

9           But with that, we'll turn it over to Doug.  
10 And Doug will talk about sort of from the  
11 facilitator's perspective how this worked out.

12           MR. COE: Thanks, Mike.

13           The first thing I wanted to convey to you  
14 from the facilitator's perspective is when I get the  
15 call from Mike or his staff asking for some help with  
16 leading or facilitating this process, of course the  
17 first question that comes to my mind is, well, how  
18 much time is it going to take?

19           And it's an extremely important question  
20 to know up front, not only from my own perspective,  
21 but also because part of the role of the facilitator  
22 is to find people to staff the -- to help find people  
23 to staff the process. And getting those people from  
24 their organizations, that's always the first question  
25 as well.

1           But I certainly did want to help, and in  
2           the spirit of collaboration. The one thing -- and it  
3           goes to this first bullet that the second question  
4           that I asked is, you know, research is doing human  
5           factors work in direct support of user need from NRO,  
6           and it's important, as Mike has laid it out, that this  
7           process be as independent as it can be from the  
8           immediate in-line thinking of the line organization,  
9           and it's intended to bring that diverse perspective.

10           So, as a facilitator, I would certainly  
11           commit to being independent, and to facilitate in a  
12           manner that didn't bias the discussion or the  
13           outcomes. But I wanted to make sure that even  
14           optically, that was satisfactory to the customer  
15           organization NRO. And it was.

16           And so we proceeded to put this together  
17           with the understanding and the idea that we would  
18           gather the members of the group from a variety of  
19           areas of expertise, a variety of offices, all being  
20           careful to try to keep them independent from what was  
21           actually being done in support of the control room  
22           staffing issues in NRO at the time. And there is  
23           ongoing research, as I said.

24           So we were able to gather a very -- I  
25           think a very good group, a group of individuals with

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1 diverse perspectives.

2 I was pleased to have participation from  
3 NSIR and from an EP perspective. We had a member of  
4 Research staff who was a PRA person who had actually  
5 been, for several months, in a rotation assignment at  
6 the Halden facility in Norway and had been deeply  
7 involved in some of their human factors work there.

8 And in addition, we had our French foreign  
9 assignee, who I saw in the back of the room here  
10 today, who very graciously also offered to help, and  
11 brings a very unique perspective to this effort from  
12 her background in maintenance in the French plants.

13 So we had a very good diversity of group.  
14 The brainstorming approach I think is very well known,  
15 and the role of the facilitator in conducting an  
16 effective brainstorming approach, I think again goes  
17 to this idea of ensuring that everyone in the group is  
18 able to, you know, provide their perspectives, and  
19 that those perspectives initiate, you know, creative  
20 thinking on the part of the other members of the  
21 group, that any one group member doesn't overtake the  
22 discussion, and the facilitator is responsible to  
23 ensure that at the end, everybody feels like their  
24 ideas were brought out, and that they had a collective  
25 creativity that rose above, that the sum is greater

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1 than the sum of the parts. And I think that that was  
2 achieved in this case.

3 As I mentioned, the time commitment and  
4 the number, I think at the end we all agreed that  
5 having seven or eight individuals participate in this  
6 is optimal, and that the time commitment seemed about  
7 right.

8 We had an initial meeting to sort of  
9 provide some background information on the technology,  
10 or an example of the technology.

11 In this case, the members were provided  
12 with some NuScale background information, and then we  
13 -- and sort of set up or tee off the process.

14 The second meeting was the brainstorming  
15 meeting, and it lasted for four hours, which was about  
16 right, because at the end of four hours of really  
17 creative brainstorming, people were pretty exhausted.

18 Then we took all of the ideas, and the  
19 coordinator basically did most of the legwork here,  
20 and he wrapped them up and he tried to categorize them  
21 in a rough way.

22 And then we came back together for another  
23 four-hour meeting, and there was refinements made to  
24 the way that the coordinator captured and categorized  
25 the issues.

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1                   MEMBER SHACK: Is the coordinator the same  
2 as the facilitator?

3                   MR. COE: No, no. The coordinator was  
4 essentially my right-hand man, and as Mike had  
5 indicated, he's left the agency since, but he did  
6 provide a very important function.

7                   He was the project manager in Mike's  
8 organization, so he was responsible for much of the  
9 ongoing work that's currently being done on this  
10 issue.

11                  But, you know, he essentially performed  
12 the project management function, and that was very  
13 important because it relieved myself and it relieved  
14 the members of the group from having to become too  
15 involved with the writing and the editing of the  
16 report.

17                  So, again, I think I want -- the key  
18 message with this is that the real benefit here, as  
19 Mike has described, and I will vouch for, is the  
20 diversity of the group members, bringing them together  
21 and having this kind of creative brainstorming  
22 approach to try to flush out, to shake the tree a  
23 little bit harder to see if we can flush out any  
24 issues that might not have been identified up until  
25 now.

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1           And success could even be that we didn't  
2 flush out any additional issues that needed to be  
3 addressed, and ultimately, as Mike had indicated, the  
4 proof is in the pudding at the end of the licensing  
5 process.

6           But I think we did add some value. And we  
7 have a further commitment to Mike to come back, now in  
8 my role as a researcher, to come back and talk about  
9 how the current work we're doing in research aligns or  
10 doesn't align with some of the ideas that were brought  
11 out in this report. And then it will be up to Mike  
12 and his staff as to whether or not we need to adjust  
13 the research program. That will happen later.

14           MEMBER BROWN: Was there any effort to go,  
15 as part of this brainstorming, or at least a precursor  
16 to it, to go to operating plants today and say, hey,  
17 what -- instead of trying to create staffing concepts  
18 or what have you, to see, what are your problems?  
19 What are the things that you run into that make it  
20 more difficult for you to operate in the control room  
21 environment?

22           Is it communications? Is it  
23 personalities? Is it, you know, number of people? Is  
24 it layout, engineers, designing them without input  
25 from whatever?



1           Or -- I mean, it just seems to me,  
2           grabbing a bunch of people and just sitting down and  
3           saying, let's think about how you're going to run a  
4           control room or how you're going to staff it is a  
5           little bit sterile if you don't have a great deal of  
6           experience from people who have lived it and -- I  
7           don't want to say died with it, but that's -

8                           (Simultaneous speakers.)

9           MEMBER BROWN: At least lived with it and  
10          had to fight casualties and stuff like that.

11          MR. COE: Right. It's a good point. We  
12          do have to recognize that there is a line organization  
13          embedded within NRO that has that expertise and does  
14          that and thinks about those things, about operator  
15          licensing and how that's done and the various, you  
16          know, issues that you've touched upon.

17                         And so in our case, with the limited  
18          numbers of members that we had, some of the background  
19          of some of the individuals, a couple of them, in fact,  
20          are very senior -- very experienced, I should say, and  
21          have some of that operational background, as I do.  
22          But again, I was not providing that kind of technical  
23          input.

24                         But we could have done more. We could  
25          have had, you know, had additional members come in

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1 that had that kind of, you know, direct operational  
2 experience or operator licensing experience. We  
3 thought that what we did was good enough.

4 MEMBER BLEY: Doug?

5 MR. COE: Yes, sir?

6 MEMBER BLEY: Didn't you have some of the  
7 guys from NRO who have extensive operating experience,  
8 licensed operators and trainers? I thought you'd told  
9 me one or two of those guys was on your group. Jimmy  
10 Kellum, or one of those?

11 MR. COE: We had two people that I'm  
12 thinking of, both actually came from NSIR at this  
13 point, but have had prior experience in NRR, and --

14 MEMBER BLEY: But not actual plant  
15 operators?

16 MR. COE: Not actual plant operators, no.

17 MR. MAYFIELD: But out of the NRO team --  
18 well, out of the working group outside of the IIRP  
19 that's dealing with control room staffing, some of  
20 those people have been licensed operators.

21 So, it -- what Doug was doing was shaking  
22 the tree a bit harder, as he characterized it, but the  
23 people that are involved in the working group that's  
24 dealing with this particular policy issue, some of  
25 them have been licensed operators.

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1           MEMBER BROWN: That didn't exactly answer  
2 my question. I mean, well, maybe it did. You kind of  
3 said no, that's what I kind of got out of that. And  
4 I'm not criticizing that. I understand where you're  
5 coming from.

6           But I mean, when you look across, you  
7 brought, you said, one or two people, and they're  
8 bringing their own particular individual -- I don't  
9 want to call it bias, but let's call it conclusion  
10 process --

11           MR. COE: That's right.

12           MEMBER BROWN: And it's of somewhat  
13 limited scope, relative to having a compendium of, you  
14 know, there's, what, 104 plants in operation, all with  
15 control rooms, and I'm sure there's a wide diversity  
16 of thought processes in terms of what's important or  
17 not important without having that not to say what  
18 you're going to do, but at least give you a  
19 perspective of, what are the issues people deal with,  
20 seems to be something that if it's not on the table,  
21 I find it hard to see how you can deal with it if you  
22 don't have that understanding of, across the board,  
23 what's the diversity of problems and issues that  
24 people have had, and their various plants have had?

25           MR. COE: It's a good point. And although

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1 we didn't have someone with direct plant control room  
2 operating experience, one of our members was versed in  
3 the human factors research work that we are doing.  
4 And a lot of that does touch upon some of the issues  
5 that you've raised.

6 But I think you've made a good point.  
7 That aspect could have been added to this group. It  
8 wasn't in this case.

9 MEMBER RAY: Let me ask another question  
10 about something you just said about the effectiveness  
11 of this will be demonstrated when you get to the end  
12 of the licensing process, which really brings to mind  
13 something that concerns me here, because you're  
14 looking at something, a small modular reactor of some  
15 type, in which the proponents have made some  
16 representations about.

17 And what they're really looking for, at  
18 least in my experience, is commitments on the various  
19 topics that you outlined, staffing, security, whatever  
20 it is.

21 How does that -- those -- what they will  
22 perceive to have been commitments survive the  
23 licensing process, when ultimately, you're looking at  
24 a holistic, actual design that you're going to  
25 certify, and people said, wait a minute, you only told

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1 me I need this or that, now, you're telling me I need  
2 something else, when they actually submit an  
3 application and you really find out what they're  
4 proposing.

5 Do you qualify what the conclusions are  
6 here to say, well, assuming everything is the way you  
7 represented it to be, then the result might turn out  
8 the way you say or not?

9 MEMBER CORRADINI: That is so polite.

10 MEMBER RAY: Listen, I've sat -- and you  
11 have, too, Mike, I've sat through lots of meetings in  
12 which people will say all kinds of things in an effort  
13 to get you to commit to something, and you know darn  
14 well that many of them, they aren't actually going to  
15 deliver.

16 MR. MAYFIELD: I've been taken down a  
17 garden path way too many times, and had to find my way  
18 home. I'm trying to keep this clean, in deference to  
19 --

20 MEMBER RAY: So these are bulletproof  
21 findings you're going to make?

22 MR. MAYFIELD: No. No. Let's be careful.  
23 Let's be careful.

24 This activity is for the staff to look at  
25 what we're doing and things we need to do, okay, when

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1 the vendors submits a topical report, so there's a  
2 couple of different things in terms of the pre-  
3 application discussions we're having with the vendors,  
4 which are outside of this particular process.

5 They can submit us a topical report, and  
6 we will review that, write a safety evaluation on that  
7 topical report, and they can then reference that  
8 safety evaluation in their application, and that  
9 stands.

10 So that goes beyond, well, gee, we think  
11 we told you. It's in writing. It's on the document.

12 They can submit a white paper, and we'll  
13 have wonderful discussions around a white paper. And  
14 at the end of the day, those are wonderful  
15 discussions, and everybody feels good, and it means  
16 nothing, because until they make a submittal and the  
17 staff writes a safety evaluation, it don't count. All  
18 right?

19 And we try to be extremely clear with the  
20 vendors and with this committee and everybody else  
21 that when we write a safety evaluation, you stay true  
22 to the topical report, the safety evaluation stands,  
23 end of discussion.

24 Submit a white paper, bring us a  
25 PowerPoint presentation, we'll have a wonderful

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1 conversation, and when you bring us a submittal, we'll  
2 review it. And those are completely different  
3 processes.

4 MEMBER RAY: Okay. I hadn't gotten that  
5 so far from what you were saying.

6 MR. MAYFIELD: Well, but those review  
7 processes are not this. This was looking at, what do  
8 we need to be doing so that we can be ready to deal  
9 with those applications when they come in?

10 MEMBER CORRADINI: So can I just follow  
11 up? So you're saying it's more of a -- I don't want  
12 to use the word staff training, but this is more of a  
13 staff training exercise for the unusual features of  
14 these designs that might not fit into the normal  
15 design?

16 I mean, maybe I'm saying it wrong. But  
17 you have normal design centers now for the big Gen-3  
18 reactors, so there's unusual features about these  
19 designs that you want the staff to think through, so  
20 that as these designs come forward, whether they be in  
21 the pre-application phase or the application phase,  
22 you guys are ready to ask the appropriate questions,  
23 understand the breadth of the cross-cutting issues.  
24 That's what I'm --

25 MR. MAYFIELD: Yes.

1                   MEMBER CORRADINI: That's what I heard you  
2 say --

3                   MR. MAYFIELD: Yes. It is -- so I  
4 wouldn't have quite characterized it as training, but  
5 --

6                   MEMBER CORRADINI: Well, that's okay.  
7 That's a fair word.

8                   MEMBER RYAN: Well, the thing is, I hope  
9 that people will first of all understand that when  
10 people come in and say, we've been to the NRC and had  
11 these discussions and gotten certain results, that  
12 they can differentiate between the --

13                   MR. MAYFIELD: That's why I --

14                   MEMBER RYAN: We've been in meetings where  
15 we've --

16                   MR. MAYFIELD: That's why I have regular  
17 conversations with the people actually at Germantown,  
18 but same --

19                   MEMBER CORRADINI: You're right. Thank  
20 you. Thank you.

21                   MEMBER SIEBER: One of the problems is  
22 perspective. Buyers of these units go to the NRC to  
23 try to extract commitments to determine whether they  
24 can afford to run them or not.

25                   One of the key issues, if you look at



1 power plants, whether nuclear, coal, or what have you,  
2 is we run a lot of units out of one control room, the  
3 human factor issues get to be stupendous.

4 If the unit goes bad, everybody runs to  
5 that one. Everything else is now on automatic.  
6 People are not prepared to respond. And I've lived  
7 through that a couple of times.

8 And that has to be taken into account.  
9 And you need to do it upfront before you actually have  
10 the actual experiences, because the commitment should  
11 be extracted to justify building the units in the  
12 first place. So it's a difficult situation.

13 MR. MAYFIELD: It is. And I guess we're  
14 okay on time, but it -- this, when we have an issue  
15 for the small modular reactors, and NuScale is perhaps  
16 the easiest example to see, they're talking about one  
17 operator to deal with four modules.

18 MEMBER SIEBER: That's right.

19 MR. MAYFIELD: At the same time. And the  
20 staff has said, it's nice you think that.

21 (Laughter.)

22 Now let's talk specifics. And so the  
23 going-in proposal that the staff is looking at, and we  
24 have not yet brought it to the committee, so bear in  
25 mind where we are, we haven't worked this through to

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1 the point where we're ready to come to the committee,  
2 the going-in proposal is in evaluating a specific  
3 submittal.

4 The staff will use, if you will,  
5 traditional task analysis coupled with the  
6 thermohydraulics and accident analysis to look at  
7 timing.

8 So what does an operator have to do for  
9 that design, and how quickly do they have to do that,  
10 to decide, is it credible that one operator can deal  
11 with multiple modules, and how many is multiple?

12 And so that will be the process. We won't  
13 commit to a number until we see the specifics of the  
14 submittal and the analyses to support it, which is  
15 going to be further supported by simulator  
16 demonstrations.

17 MEMBER SIEBER: I think that's the right  
18 approach.

19 MEMBER STETKAR: When you do that, will  
20 you also consider events like a tornado hitting the  
21 switchyard that affects all four of those modules?

22 MR. MAYFIELD: That's part of, how far are  
23 we going to go with this, and it's --

24 MEMBER STETKAR: But those are real world  
25 events that happen.

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1 MR. MAYFIELD: Those are real-world  
2 events, absolutely. Absolutely.

3 MEMBER STETKAR: And, you know, and get  
4 people into trouble.

5 MR. MAYFIELD: And that's part of the  
6 discussion. And like I said, we're not ready to come  
7 to the committee. How far do you go with that, and  
8 the report that somebody had earlier from the  
9 Fukushima Task Force, what spill-overs are going to be  
10 on these designs from that event.

11 So we're not ready to come to you with a  
12 story, but that's the general direction that we think,  
13 at least at this stage, we're going to go.

14 The proof is in the pudding, right? The  
15 devil's in the details. All those wonderful little  
16 sayings.

17 What we were looking at with this process,  
18 this project, is there something at this stage, the  
19 fairly early stages, is there something we've missed?

20 Your point's a fair one. Do we need to  
21 look more broadly at operating plant experience and  
22 control room experience, control room design, as we  
23 look at the small modular plants?

24 MEMBER STETKAR: But in particular, design  
25 is part of it. I was a licensed senior reactor

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1 operator that had a shared control room. And some of  
2 my experience was the same as what Jack was mentioning  
3 before.

4 It's not only the design. It's how people  
5 --

6 MR. MAYFIELD: Right.

7 MEMBER STETKAR: -- react, so that when  
8 you mentioned earlier that you have licensed operators  
9 on your team, just simply having a licensed operator  
10 who has only operated at a single-unit reactor is  
11 perhaps different from the experience of people who  
12 have actually operated in a, you know, two-reactor  
13 environment.

14 MR. MAYFIELD: And that experience, the  
15 two-unit control rooms, that experience is likely to  
16 be different than what we're going to see in these  
17 multi-module control rooms that are largely digital,  
18 a lot of flat screens, annunciators, switches.

19 They're going to be different, and the way  
20 the human will react to those is going to be  
21 different, which is why we have a fairly large input  
22 from the human factors folks looking, trying to look  
23 forward and build on that experience.

24 I'm not disagreeing with your point, but  
25 even the two-unit control rooms, that experience is

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1 going to be different than we think. It's going to be  
2 different than what these folks are looking at.

3 MEMBER STETKAR: I think I agree with you  
4 to some extent, but people still think the way that  
5 people think.

6 MR. MAYFIELD: Absolutely.

7 MEMBER STETKAR: And the ability of a  
8 crew, whether that crew is a single individual, or  
9 whether that crew is four people --

10 MR. MAYFIELD: Right. Right.

11 MEMBER STETKAR: To maintain a broad  
12 perspective of what's happening at other units,  
13 especially if they know that the other units are going  
14 to take care of themselves --

15 MR. MAYFIELD: Right.

16 MEMBER STETKAR: -- is actually very  
17 similar, regardless of whether you have a two-unit  
18 analog, traditional big-switch control room, versus,  
19 you know, a digital flat-plane screens and things like  
20 that.

21 MR. MAYFIELD: Yes.

22 MEMBER STETKAR: And that's a bit of, I  
23 think, the concern that Charlie is elaborating on.

24 MR. MAYFIELD: I'm not disagreeing with  
25 you.

1                   MEMBER BROWN: John, your point and  
2 Harold's and Jack's are all the same. I mean, I'm  
3 having a hard time getting my mind wrapped around four  
4 plants at one place with one operator. I mean, I just  
5 throw that one out, because that's what he mentioned.

6                   And you think about -- I mean, I've been  
7 -- I wasn't an operator, but I was in plants when we  
8 had something happen, and watched operators trying to  
9 respond to multiple things going off, not as complex  
10 as -- not even with the complexity, they were Naval  
11 plants --

12                   MR. MAYFIELD: Right.

13                   MEMBER BROWN: -- and didn't have the  
14 complexity -- not the complexity, ours were more  
15 complex, but didn't have the plethora of alarms and  
16 annunciators going off like crazy in the plant.

17                   I mean, we limited those things to make  
18 sure operators didn't get confused. And we divorced,  
19 on the one plant where we had multiple units, the  
20 aircraft carriers, we explicitly do not allow the  
21 central control station to control either one of those  
22 adjacent plants, that you've got your own operators in  
23 each one of your -- and there's another, even larger  
24 aircraft carrier that had lots of plants, eight of  
25 them all in one ship.

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1 MEMBER BLEY: Well, one guy did control  
2 two reactors on one of those ships.

3 MEMBER BROWN: Yes. But we didn't like  
4 that. And why do you think we stopped?

5 MEMBER BLEY: There were other reasons  
6 than technical, but let's not dwell on them.

7 MEMBER BROWN: There were -- no, but no,  
8 exactly right. There were a lot of reasons, other  
9 than technical, and some of them were human-factors  
10 types reasons, as well as cost.

11 MR. MAYFIELD: Well, we will have a lively  
12 discussion, I'm sure, but let's be clear.

13 Four modules per operator with up to 12  
14 modules for the plant is the proposal. The staff has  
15 not reviewed it, accepted it. That's the proposal.

16 One of the other things to keep in mind  
17 that we are -- and as well as NEI, have started  
18 focusing on more, the number of licensed operators in  
19 the control rooms is an important consideration.

20 It's an important consideration from the  
21 economic viability of the design. It's an important  
22 consideration from the safety, safe operation of the  
23 unit.

24 I don't care how many they got in the  
25 control room. I want to know about the balance of the

1 shift complement. I want to know what they're going  
2 to do about a fire brigade. I want to know how many  
3 mechanics they're going to have in the plant, when  
4 they're up and running.

5 I want to know, if you look at some of the  
6 NuScale design they're doing, if you will, online  
7 refueling. They're going to list a module that needs  
8 to be refueled while the others are running -- this is  
9 the proposal -- move it to a refueling station.

10 Okay, I want to know how many people are  
11 in the plant, what all is going on, and how that could  
12 affect the operation of the other units.

13 So, that's the four modules per operator  
14 is the proposal. There's a whole lot of other things  
15 we want to know a lot about to decide whether or not  
16 that's even on the table.

17 So, we've spent a fair bit of time now on  
18 a design that is yet to be presented. We appreciate  
19 the input. Again, I'm sure we'll have a lively  
20 discussion when the day comes.

21 MEMBER BROWN: I can hardly wait. But  
22 really, you want to move on, right?

23 MR. MAYFIELD: Sort of, yeah.

24 MEMBER CORRADINI: But from an engineering  
25 standpoint, I think what you're getting at was the

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1 multiple units operating simultaneously with different  
2 actions occurring, one being in start-up, one being --

3 MR. MAYFIELD: Right.

4 MEMBER CORRADINI: -- going to refueling,  
5 whatever.

6 MR. MAYFIELD: Right. And how does that  
7 play out.

8 What we were trying to do with this  
9 process, is there something early in this pre-  
10 application stage where we're looking at  
11 infrastructure for the staff, when we're looking at  
12 licensing guidance and review guidance, is there  
13 something else we need to be doing now so that we'll  
14 be in a position to credibly review the design when it  
15 shows up?

16 So that's really what the process was  
17 about.

18 So, I'm going to let Doug get back to his  
19 job here.

20 MR. COE: Just to put a final bow on this,  
21 because I've been thinking about your question, as  
22 this discussion has occurred, and based on my  
23 recollections of the discussions that took place  
24 during the brainstorming session and the followup  
25 session, you know, the focus was on these higher-level

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1 issues that Mike was just speaking of.

2 And as I reflect on those discussions that  
3 we had, that sort of the larger picture, which is  
4 represented in the report, you know, I guess I -- I  
5 felt comfortable as the facilitator because I had had  
6 operating experience myself.

7 I was a nuclear plant operator, and I was  
8 a licensing examiner for the NRC. And so being  
9 familiar with the intricacies of how operators  
10 interact with the plant, it was clear to me and  
11 apparent to me that the value of this initiative would  
12 be for the larger picture, to examine the larger  
13 picture.

14 And I think there was a sense on my part,  
15 anyway, that there was some reliance on the in-line  
16 work that Mike and his organization are doing, drawing  
17 from the people who are specifically tasked to develop  
18 operator licensing processes, for example, and control  
19 room design, that the reliance on them would also be  
20 a reliance on people who have had that operating  
21 experience and they could draw from that.

22 So, without further ado, we should  
23 probably move into the results of the control room  
24 staffing to help you see more clearly, perhaps, some  
25 of the things that we've been just talking about now.

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1 Ross?

2 MR. MOORE: So I'm going to continue with  
3 a little more discussion about the control room  
4 staffing IIRP and some of the results and issues that  
5 were identified as a result of it.

6 Again, the purpose was to focus on  
7 regulatory policy and technical issues that might be  
8 challenging to the staff as we approach control room  
9 staffing.

10 The working group was first tasked, as  
11 Doug had mentioned, with identifying issues, and then  
12 subsequently tasked with then ranking them based upon  
13 a ranking criteria and weighting them based on their  
14 relative importance. And we'll go into a little more  
15 detail in a bit here.

16 But the three top issues that were  
17 identified as critical were scaling, integration, and  
18 design basis.

19 And then the two listed just below that as  
20 having a high impact on safety were multi module human  
21 systems interfaces and mixed technologies. And I'll  
22 provide a little description of each of these, so  
23 you're not left hanging.

24 Scaling, because you can't get a lot out  
25 of the word scaling, really, the intent is to

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1 understand, you know, a lot of the proposed, you know,  
2 design and construction ideas behind some of these  
3 plants is that you'll start with a set number of  
4 modules, and you might increase the number of modules  
5 as you continue operating.

6 And so the intent of the scaling issue is  
7 to establish, how do you identify an operator's roles  
8 and responsibilities, as they could be changing in  
9 both scale and scope, as you increase in the number of  
10 modules?

11 Is that a linear scale? Is it an  
12 exponential scale? How does that change? And the  
13 consideration that as you're increasing these modules,  
14 you're going to operating a number of different  
15 modules in different operating modes, and again, how  
16 you address the scope of those tasks.

17 MEMBER CORRADINI: So that's different?  
18 I'm reading it. So that's different than basically  
19 going into these folks and saying, okay, you tell us  
20 what you define as a plan.

21 In other words, you can't have -- it's not  
22 -- you can't have everything. You can't say,  
23 sometimes it's two, sometimes it's four, sometimes  
24 it's six.

25 Is it four modules a machine? Is it two

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1 modules a machine, and then scale off that? Because  
2 in some sense, having this be variable concerns me.

3 It seems to me you've got to have them  
4 come in and say, okay, four of these modules are what  
5 I consider an integrated unit, and then you've got to  
6 decide on things relative to that.

7 Maybe I'm getting ahead of you, but --

8 MR. MAYFIELD: No, again, NuScale is the  
9 easiest one to think about this for.

10 MEMBER CORRADINI: Pick on them some more.

11 MR. MAYFIELD: Well, it's not really pick  
12 on them, it's just, that's the easiest way to  
13 visualize that.

14 Their nominal plant is 12 modules.  
15 However, they -- the business model doesn't include  
16 putting all 12 in at the same time. The basic  
17 building would accommodate 12.

18 They may only put two in initially, and  
19 then they can expand the number of modules over time  
20 as the need for power grows, for whatever economic  
21 reason. So they can add modules over time.

22 And so what Ross is talking about here is,  
23 you've got a control room set up to accommodate 12  
24 eventually, and now, they started at two and they're  
25 going to add two more. Now they're going to add --

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1                   MEMBER CORRADINI: So, this is under the  
2 assumption that they've defined whatever the plant is.  
3 I see. Okay. Thank you.

4                   MR. MAYFIELD: Does that help?

5                   MEMBER CORRADINI: Yes, it helps. Thank  
6 you.

7                   MR. MOORE: So the second critical issue  
8 that was identified is the issue of integration. And  
9 going outside of the bounds of prescriptive regulatory  
10 requirements and identifying what tasks should be  
11 addressed in the staffing analysis beyond operation of  
12 the facility, including integrating EP teams or  
13 external entities, EP teams, fire brigades, and that  
14 connection to the control room staff.

15                   The third issue, which was also ranked as  
16 critical, is the design basis. Should -- how should  
17 one define the design basis of the SMR of the small  
18 modular reactor?

19                   Should it include multi-module accident  
20 scenarios? And can we use the advantages of PRA to  
21 identify what the appropriate number or what the  
22 appropriate number of accidents should be in a design  
23 basis?

24                   MR. MAYFIELD: And this kind of goes to  
25 your question about what are you going to do if the

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1 tornado hits the switchyard.

2 CHAIR ABDEL-KHALIK: Have you defined the  
3 word operator for these plants?

4 MR. MAYFIELD: I'm not sure I follow your  
5 question.

6 CHAIR ABDEL-KHALIK: I mean, what's an  
7 operator, if -- can the definition and the role of an  
8 operator in a plant of this type be totally different  
9 than our perception of someone, the person at the  
10 controls?

11 MR. MAYFIELD: By and large, what we're  
12 talking about here is the licensed individual in the  
13 control room at the controls of the reactor, the  
14 modules. And that's -- so that, when we say operator,  
15 that's really what we're talking about.

16 And what -- the point earlier is we need  
17 to make sure that the vendors and potential utilities  
18 are thinking shift complement, not just the licensed  
19 individual in the control room.

20 But by operators, what this policy issue  
21 has been talking about is the licensed individual at  
22 the controls of the reactor module. Does that help  
23 answer your --

24 CHAIR ABDEL-KHALIK: Yes, I understand.  
25 But the role of an operator in a plant of this type

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1 may be totally different --

2 MR. MAYFIELD: It may be different. And  
3 that's one of the things we want to get to.

4 What tasks is that individual going to be  
5 asked to perform, and in what settings and sequences?  
6 Are they going to leave the control room? Are you  
7 going to all of a sudden have four modules per  
8 operator, except in the tornado hits the switchyard,  
9 and now you've got an extra four, because one of the  
10 licensed operators left the control room to go deal  
11 with whatever?

12 So it's that operation that we have --  
13 haven't yet discussed with the vendor. What is that  
14 operational role going to look like?

15 So, I think I understand your question a  
16 little better. The operator is the licensed  
17 individual in the control room at the controls.

18 What other tasks may they be asked to  
19 perform in different settings, that's part of what  
20 Ross is talking about and what Doug's team was looking  
21 at.

22 CHAIR ABDEL-KHALIK: Maybe, because the  
23 balance between what a licensed operator would do in  
24 a traditional large plant versus what a non-licensed  
25 operator would do is going to be maybe quite

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1 different.

2 MR. MAYFIELD: The other thing that we  
3 think may get to be challenging, based on the business  
4 models, both for the vendors as well as eventually the  
5 utilities, there is a desire to reduce O&M costs.  
6 There is a desire to reduce staffing costs.

7 It's a noble desire. We're not opposed to  
8 the desire. Now let's talk specifics.

9 And we have not yet had those discussions.  
10 We're not that far into the process yet.

11 VICE CHAIR ARMIJO: Unless they can  
12 demonstrate that satisfactorily, the economics are so  
13 marginal that the likelihood that the economics of  
14 these designs --

15 MR. MAYFIELD: Well, and that's part of  
16 the discussion.

17 VICE CHAIR ARMIJO: -- you have to get  
18 some -- have to deliver some very significant safety  
19 benefits sufficient to even challenge the issue of  
20 emergency planning beyond the site boundary. And if  
21 they can't do that, most of them are dead at the  
22 starting line.

23 MR. MAYFIELD: Well, the beauty of my job  
24 is, that ain't my problem.

25 VICE CHAIR ARMIJO: Yeah. That's their

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1 problem.

2 MR. MAYFIELD: That's their problem, to  
3 make their case, and to make the case about the safe  
4 operation of these facilities.

5 VICE CHAIR ARMIJO: Yes. Right.

6 MR. MAYFIELD: That's our role.

7 MEMBER RAY: I want to ask about the  
8 dichotomy that's embedded in this second item. It  
9 says, instead of prescriptive regulatory requirements,  
10 should a fully integrated staffing analysis be  
11 required for SMRs.

12 What is it about SMRs that would make them  
13 different? I mean, the question could be asked about  
14 existing plant, couldn't it? What is it that leads to  
15 this, on the one hand, versus on the other hand, kind  
16 of a question?

17 Why is it that you're asking about a fully  
18 integrated staffing analysis for SMRs instead of  
19 prescriptive regulatory requirements, which presumably  
20 would apply to not SMRs?

21 MR. COE: If I may, I think, trying to  
22 recall the discussion that the group had, I think it  
23 was simply that it doesn't exist today, and there's a  
24 sense that it could be very beneficial in the future.

25 MEMBER RAY: Okay. But would you apply --

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1 just a second, Mike -- wouldn't you apply it equally,  
2 then, to existing plants --

3 MEMBER CORRADINI: Or to try out the  
4 concept on an existing plant?

5 MEMBER RAY: Yes, what is it that's  
6 causing SMRs to raise this question, uniquely?

7 MR. MOORE: I guess if I can add here, the  
8 SMR -- the expectation here, you know, and the reason  
9 we're having this -- I guess the IIRP was -- we expect  
10 them to come in proposing a smaller number of staff to  
11 operate the facility, or operate a number of modules.

12 With that, we expect that to rely heavily  
13 on a task analysis, because that's what the exemption  
14 request is currently founded upon. And so with that  
15 task analysis, it's not clearly proscribed what tasks  
16 need to be addressed.

17 And I guess what we're asking here is, do  
18 we need to go beyond simple operation of the plant and  
19 make sure that we're including all of the global tasks  
20 that the operator could be asked to perform under a  
21 number of different scenarios, and how do we, I guess,  
22 address that?

23 MEMBER RAY: All right. But if the  
24 existing plants wanted to reduce staffing, I guess  
25 you'd say, well, we'd better do an integrated staffing

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1 analysis.

2 MEMBER POWERS: Is this -- plants have --

3 MR. COE: Well, they'd have to get an  
4 exemption. Those requirements are currently very  
5 prescriptive.

6 MEMBER CORRADINI: Well, then, that -- I  
7 was guessing there was going to be three answers to  
8 the question.

9 One, what you just said is, plants -- the  
10 current plants are down the road, that would require  
11 some sort of big regulatory change or exemption.  
12 Something's inherently safer about these plants so we  
13 might allow them to do it, or, this is a way to  
14 essentially develop a staffing plan that might then go  
15 backwards to current and existing plants.

16 MEMBER RYAN: Well, but I think Doug's  
17 answer is what I expected. There isn't a logical  
18 reason why you would use an integrated staffing  
19 analysis or SMRs uniquely.

20 MR. MAYFIELD: The reason to take it up at  
21 all for the SMRs is, they asked.

22 MEMBER RAY: I see. All right.

23 MR. MAYFIELD: It's pretty much that  
24 simple.

25 MEMBER RAY: That's simple, and a good

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1 answer.

2 MR. MAYFIELD: 54 lays out prescriptive  
3 requirements on control room staffing. It's there,  
4 black and white, everybody can read it, everybody  
5 conforms to it.

6 The SMR vendors, as part of their design  
7 and their business model, their operations model --

8 MEMBER RAY: Yes.

9 MR. MAYFIELD: -- has asked for relief  
10 from that, and so the staff's exploring, what's that  
11 really going to look like?

12 MEMBER RAY: I guess, given what you said,  
13 then, I would substitute the word allowed for  
14 required.

15 In other words, should it be allowed for  
16 SMRs, rather than, should it be required, because  
17 that's what confused me primarily, I think.

18 At the end of the day, though, I would  
19 think we would want to be able to reconcile the  
20 outcome with existing plants, in other words, be able  
21 to explain why it is that we continue to impose  
22 prescriptive requirements without a staffing analysis  
23 on an existing plant, but allow a staffing analysis to  
24 be the basis of --

25 MR. MAYFIELD: Well, one of the reasons --

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1 and one of the reasons we've reached out to NRR,  
2 because they deal with staffing for the operating  
3 fleet, is to make sure that what we're doing here,  
4 they understand, and they understand the potential  
5 implication for the operating fleet.

6 There's nothing that would prevent an  
7 operating unit from coming in to seek an exemption  
8 based on --

9 MEMBER RAY: Yes, precisely.

10 MR. MAYFIELD: Whether it can be proved is  
11 another issue, but they could come in and ask.

12 MEMBER RAY: All right.

13 MR. MAYFIELD: So we're trying to make  
14 sure that both offices understand what's going on and  
15 why.

16 MEMBER RAY: Well, like I said, to me,  
17 then, it would have made more sense to say, should it  
18 be allowed for SMRs, because that's really what you're  
19 talking about.

20 MR. MAYFIELD: It's a fair point.

21 MEMBER BLEY: But the other side of what  
22 you brought up, Harold, is kind of interesting,  
23 because as you pursue that question, you expanded it  
24 a little bit, and said, as well as interfaces with  
25 external entities.

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1           And I just went back through the 07-11,  
2           the Human Factors Engineering Program Review Model,  
3           and I don't see anything in there about that. I  
4           didn't remember anything.

5           And we've had two or three incidents in  
6           the last ten years that have pointed out that maybe we  
7           should have thought harder about those things. So  
8           we'll get something useful coming back to other  
9           reactors.

10           MEMBER RAY: Yes, that's right.

11           MR. MAYFIELD: We hope so.

12           MEMBER STETKAR: Mike, let me ask you  
13           something, because this discussion is focused on SMRs,  
14           which are a concept, and existing plants that are  
15           being regulated under the current licensing regime.

16           What about current applicants for combined  
17           licenses, which are real-world, in-progress events?  
18           And there are, in fact, some combined licenses that  
19           are coming in for dual units at a single site that are  
20           integrating some of their response facilities with  
21           existing units at that site.

22           You know, if we're talking about kind of  
23           testing this process, have any of those folks come in  
24           and asked for --

25           MR. MAYFIELD: Not to my knowledge.

1 MEMBER STETKAR: They haven't? Okay.

2 MR. MAYFIELD: One of the --

3 MEMBER STETKAR: Okay --

4 MR. MAYFIELD: So the answer is, they  
5 haven't asked.

6 MEMBER STETKAR: That's good enough.  
7 We'll keep on trying.

8 MR. MAYFIELD: The other thing to keep in  
9 mind, these things are called small for a reason.  
10 Physically, the units just aren't that big. So, the  
11 number of people on site is different.

12 It's easier, I suspect, to have people at  
13 an AP 1000 that are going to do that bit of outreach  
14 that will be separate from the licensed operators in  
15 the control room.

16 So part of this integration issue is,  
17 well, wait a minute. We're talking about a physically  
18 smaller unit. Fewer staff is the model, right. Not  
19 approved but that's the going in presumption, fewer  
20 staff that may have more tasks to perform. And what's  
21 that need to look like?

22 So, they haven't -- whether it's the  
23 operating units or the design search for the large  
24 lights, they haven't asked.

25 Will they ask, as we pursue this and they

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1 see what this really looks like? I don't know. I  
2 think it is a more critical issue for the small  
3 reactors, just because they're small. They're  
4 business models are different. Their staffing models  
5 are different.

6 MEMBER STETKAR: Except, as Dennis has  
7 noted, that even some of the big existing plants,  
8 there have been issues --

9 MR. MAYFIELD: Sure. Again, there may be  
10 something that comes out of this that we will want to  
11 look hard at.

12 Should we make a change for the large  
13 lights? That's why we're keeping NRR involved.  
14 That's why we've got so much linkage with research on  
15 this.

16 MR. MOORE: I'd like to move now into the  
17 second group of issues, which were the high impact to  
18 safety issues.

19 There were two issues identified as high  
20 impact -- having a high impact on safety, and they  
21 were the multi-module human systems interface and  
22 mixed technologies.

23 Multi-module human systems interface kind  
24 of attacks the -- how do you establish  
25 responsibilities and tasks when you have a set of

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1 multiple operating reactors in front of you with a  
2 single interface that's not separated like they are  
3 under the current lease? And how is peer checking  
4 going to be achieved through these multiple modules,  
5 when you have, you know, a lot of automated displays  
6 and controls, and they could be reconfigurable?

7           The second is, is mixed technologies. Is,  
8 as these SMRs are manufactured, constructed, and  
9 operated, and then again maintained, you have the  
10 potential for different designs, equipment, software,  
11 and upgrades to be implemented to different modules  
12 that may not be comparable.

13           So how do you address that challenge to  
14 the operator, that one operating module might have a  
15 different component installed than another operating  
16 module?

17           And what impacts that might have on the  
18 rest of the staff -- the module -- the plant.

19           And then how does that increase in the  
20 complexity of the tasks, and potentially reduce the  
21 safety in the event of an accident or non-steady-state  
22 operational scenario?

23           And then, lastly, what measure of that  
24 technology is spread across multiple modules, and how  
25 that impacts the single operator.

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1           So, what I'm going to get into now is the  
2 summary ranking table. And this is basically where,  
3 how these were identified to be critical, high impact  
4 to safety, and subsequently, items to be aware of.  
5 This is kind of a busy table, so I kind of attack it  
6 from a number of different pieces here.

7           The top row includes the weighting  
8 factors. The weighting factors were identified as  
9 being safety, the impact on licensing, the timed  
10 resolution, the resources needed, and knowledge gap.

11           Knowledge gap has a zero percent weighting  
12 factor. I know that you guys -- the reason the  
13 knowledge gap was included was really to understand  
14 the staff's level of knowledge associated with each of  
15 these issues.

16           It was an information column, more just a  
17 -- I guess, not to sway the rankings one way or the  
18 other, but really to let the staff be aware of their  
19 level of knowledge associated with each of these  
20 issues, and that's why it was given a zero percent  
21 rank.

22           Safety was given the highest ranking, as  
23 in accordance with our mission to protect the public  
24 health and safety. And so we weighted that just  
25 slightly higher than the last three, which were the

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1 impact on licensing, timed resolution, and resources  
2 needed.

3 MEMBER BROWN: I suppose it's only -- the  
4 license's importance is impact on licensing.

5 MEMBER STETKAR: It's slightly higher. You  
6 mean, twice as high.

7 MR. MOORE: Twice as high.

8 MEMBER BROWN: It's only twice as high.  
9 I mean --

10 MR. MOORE: I mean, it was given a -- I  
11 guess that was a reasonable --

12 MEMBER BROWN: It's hard to imagine that  
13 safety is not 60 or 70, okay. That would be more than  
14 half the importance. I'm just speaking personally.

15 MEMBER CORRADINI: But if you look at the  
16 rankings, Charlie, nothing would have changed.

17 MEMBER BLEY: But these are to help them  
18 decide where they need to focus their efforts.

19 MEMBER BROWN: This is for your research  
20 focus.

21 MR. MAYFIELD: What do I need to work on  
22 first, and with what urgency? It's not the -- again,  
23 I think the point was, it wouldn't have changed the  
24 outcome.

25 MEMBER BROWN: I'm just thinking thought

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1 process.

2 MEMBER RAY: Now, again, is impact on  
3 licensing defined in terms of a topical -- going back  
4 to our conversation? How is that perceived to take  
5 place, this impact on licensing?

6 MR. MOORE: It's the impact, as associated  
7 with -- the level of impact, it would be incumbent  
8 upon the applicant themselves.

9 Would it delay the licensing process? Not  
10 necessarily -- yeah, basically --

11 MR. MAYFIELD: Let me try it a little  
12 differently. If we don't come to grips with this, it  
13 could impede the effective licensing.

14 MEMBER RAY: I guess, though, Mike, I'm  
15 still -- I'll go -- I'll answer my own question by  
16 saying, the input to the licensing process is only a  
17 consequence of an SER that's written on a topical  
18 report, not based on any other kind of feedback that  
19 comes out of this process.

20 MR. MAYFIELD: I'm sorry, say it again.

21 MEMBER RAY: I'm trying to figure out, how  
22 does this impact take place?

23 MR. MAYFIELD: Oh, okay. Okay.

24 MEMBER RAY: And you're suggesting it only  
25 takes place during actual licensing processes?

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1 MR. MAYFIELD: No, no, no, no. I'm  
2 suggesting that we -- do we need to come to grips with  
3 scaling, so that we can perform an effective licensing  
4 review?

5 Is that something where we, if there's a  
6 change in Commission policy related to scaling --

7 MEMBER RAY: Okay.

8 MR. MAYFIELD: -- we need to get that out  
9 early so that the vendors can address it as part of  
10 their submittal.

11 MEMBER RAY: Okay. But it's still based  
12 on a submittal --

13 MR. MAYFIELD: Yes.

14 MEMBER RAY: -- not based on white papers  
15 and --

16 MR. MAYFIELD: Right.

17 MEMBER RAY: -- PowerPoint presentations  
18 --

19 MR. MAYFIELD: Right.

20 MEMBER RAY: -- and that kind of stuff.

21 MR. MAYFIELD: Right.

22 Go ahead.

23 MR. MOORE: Okay. And the way that the  
24 numbers were derived from were the collective --  
25 basically, the collective input from the group

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1 identified, well, how they perceived each issue as it  
2 related to each weighting factor.

3 So in the case of safety, where it was  
4 ranked five, each of the members believed that that  
5 was clearly a level five impact on safety, and it had  
6 that much of an impact.

7 On the far right-hand column, then, you  
8 also see an additional relatedness column. The key  
9 role of this column is to establish whether it's  
10 simply a staffing issue or whether it could have  
11 impact on other areas of SMR designs.

12 You know, does it relate to emergency  
13 preparedness? Does it relate to security? Does it  
14 relate to -- is it more than just operator staffing?  
15 And that's where the x comes in.

16 And in this case, all but one, you know,  
17 could have a potential impact on other SMR areas.

18 And then once these were collectively  
19 identified in this ranking, they were ranked according  
20 to their overall weight and priority.

21 MEMBER REMPE: So for scaling, you have a  
22 five across three of these columns, which,  
23 accordingly, like on impact on licensing, it means you  
24 need to do research before you could even start the  
25 pre-application phase, is what I've -- looking at this

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1 other table that was handed out to us, on what a five  
2 means?

3 MR. MOORE: It means that additional  
4 activities are necessary to really fully understand  
5 the breadth of that issue.

6 MR. MAYFIELD: And not necessarily just  
7 research.

8 MEMBER BLEY: I want to go back to your  
9 zero percent on knowledge gap. I like that, by the  
10 way, I've seen some other people do this sort of thing  
11 who put something more there.

12 It seems to me, nothing's on this list  
13 unless it's a knowledge gap, and the value of it --  
14 you really wouldn't want the fact that NRC staff is  
15 weak in this area to affect the overall scaling, the  
16 overall value.

17 But if the value is high and you're weak,  
18 then you need to beef it up. Am I reading that right?

19 MR. MAYFIELD: Yes.

20 MEMBER BLEY: Okay.

21 MEMBER CORRADINI: This is almost -- I  
22 mean, the way I view this is, this is a PIRT. It's a  
23 different PIRT, but if you think about the PIRT  
24 process, first, you talked about impact, and then you  
25 talked about the knowledge gap, given impact. So in

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1 some sense, I kind of see how it fits together

2 I'm curious about Joy's question. It's  
3 not only -- you said it's not necessarily research,  
4 but in some sense, within the agency, you're going to  
5 have to do some legwork to --

6 MR. MAYFIELD: Yes, so that would --

7 MEMBER REMPE: Yes, it says, including  
8 adequate research.

9 MR. MAYFIELD: I'm sorry, when research --  
10 am I going to send in a User Need and have him go  
11 spend contractor funds?

12 (Laughter.)

13 Not necessarily. So there are things  
14 we'll have to go do, some legwork. Some of it may be  
15 -- I'm going to send him a User Need and say you need  
16 to go do x and send us a report.

17 Does that --

18 MEMBER REMPE: But it just means you  
19 couldn't start a process until you beefed up your  
20 capabilities, and that could delay the process.

21 MR. MAYFIELD: It would be better if --  
22 let me back up. Going in, we can license these plants  
23 today, right? I don't have to do any of this stuff to  
24 be able to license these plants.

25 We would like to be able to do this in

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1 preparation to doing the reviews and getting the  
2 submittals and writing the safety evaluations, because  
3 we think accomplishing these things, cleaning up these  
4 issues, getting the Commission to weigh in where we  
5 need them to weigh in, will make for a more efficient  
6 and effective licensing process. We'll get there  
7 faster and cheaper.

8 But we can do the licensing review today.

9 MEMBER BLEY: Okay, but do you appreciate  
10 the concern that is, in getting the Commission to  
11 weigh in, that they're weighing in based on  
12 assumptions that don't materialize when the  
13 application actually is tendered?

14 MR. MAYFIELD: Well, that's why we're  
15 doing a lot of discussion with the vendors about, what  
16 are you really going to bring us, to make sure that  
17 we're not asking the Commission to go chasing a  
18 phantom.

19 MEMBER RAY: Well, and I guess that's  
20 where the issue in my mind lies, anyway, how  
21 effectively or how completely, how thoroughly, can we  
22 reach a holistic conclusion at the end when we've made  
23 incremental silo decisions along the way?

24 MR. MAYFIELD: I can wait for them to  
25 submit an application, and I will fail. Or I can take

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1 a run at it up front, recognizing that at the end of  
2 the day, I may still or I will, as Dana pointed out  
3 earlier, I will still have some things that are  
4 challenging.

5 MEMBER RAY: Well, I'm not arguing with  
6 the difficulty here or with the worthiness of the  
7 objective.

8 I'm just expressing a concern, because I  
9 see a lot of -- like I say, assumptions being  
10 incorporated into these kinds of decisions that I  
11 think merit some skepticism.

12 MR. MAYFIELD: And I wouldn't disagree  
13 with that, but I can't -- if I don't make those  
14 assumptions and try to move this forward on our best  
15 understanding of where the vendors are, then, we're  
16 going to be ten years trying to license 45 megawatts.

17 MEMBER RAY: I'll shut up, by just saying,  
18 when these things come around, at least I'm going to  
19 be looking that the assumptions are explicit.

20 MR. MAYFIELD: That's fair.

21 MEMBER POWERS: May I ask a question about  
22 just a list of items up there? Number 11, you have  
23 Research Test Reactors as an example for SMRs. Why  
24 isn't aircraft carrier reactors as an example of SMRs  
25 listed there?

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1 MR. COE: Why isn't it? Is that the  
2 question?

3 MEMBER POWERS: Yes. Yes, I mean, correct  
4 me if I'm wrong. We have eight units. We have  
5 control rooms for them. They've obviously made a  
6 decision on how they want to do their staffing. It  
7 seems like the best example I can think of, offhand.

8 MR. MAYFIELD: Within some limits, Naval  
9 Reactors, respectfully, isn't real chatty.

10 (Laughter.)

11 So the point's a fair one. Drawing a lot  
12 of --

13 MEMBER POWERS: I've found exactly the  
14 opposite, Mike. I've found them very chatty and  
15 willing to discuss with me -- where they become a  
16 little quiet is when you go in and ask about specific  
17 features and operational procedures.

18 But how they go about making decisions,  
19 I've found them very -- in fact, quite the opposite.  
20 They want to share with you, here's how we're going to  
21 make this decision, what do you think?

22 I mean, they're always asking me that kind  
23 of question.

24 MEMBER SIEBER: The difficulty with the  
25 Navy is, and after 11 years working for them, they are

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1 not a commercial enterprise, and they do not do things  
2 to minimize the production costs.

3 MEMBER POWERS: And that would be --

4 MEMBER BROWN: Hold it. I'm going to --  
5 from your experience, you know, whatever, however many  
6 years ago you worked for them --

7 MEMBER CORRADINI: Way to get him roiled  
8 up.

9 MEMBER BROWN: Yeah, you want to get me  
10 jacked up, I'm ready to -- but I'll make the point  
11 quickly, in the last initial part of the program, sat  
12 -- and Jack's 100 percent right, a certain way things  
13 were going to be done, and they were cookie-cuttered  
14 after that, because it worked. And in order to not  
15 run the bill up, we made things the same, the same,  
16 the same.

17 There were exceptions. The Enterprise was  
18 an exception because it had eight reactors. It wasn't  
19 a submarine with one. The Nimitz class was different  
20 because it was now down to two, not eight, and there  
21 were questions of reliability of the plants relative  
22 to landing airplanes if reactors went down.

23 How do you cope with that? You can't  
24 afford to have \$25 million airplanes all bailing and  
25 having helicopters going out to pick these guys up.

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1 Not a good plan.

2 But if you look at the latest from the  
3 Seawolf class on, there were actually evaluations made  
4 of the staffing requirements across the board in order  
5 to -- because of cost, they were driven to modify the  
6 plants, make them similar, simpler, excuse me, and  
7 make them easier to maintain, which was not an early  
8 consideration.

9 I mean, we're trying to get reactors to  
10 see and meet a threat, and in terms of control room on  
11 the Virginia class, there are -- there was a highly  
12 detailed analysis made for control room staffing, and  
13 there's fewer people in the maneuvering area now than  
14 there are on any of the other submarines.

15 That was a very difficult decision, but it  
16 was done for two reasons. Part of it was getting the  
17 number of people in the engine room down because  
18 people are cost. But yet, you can't sacrifice the  
19 safety.

20 How do you make the plant better and  
21 simpler so that fewer operators can actually do the  
22 job? It just went from four to three, so it's not  
23 like, you know, there was this truncating -- but,  
24 there was a significant amount of analysis that went  
25 into it.

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1 MEMBER CORRADINI: He seems pretty chatty  
2 to me.

3 (Laughter.)

4 MEMBER BROWN: On the philosophical basis  
5 -- I know, I'm with Dana.

6 I think if you ask high-level questions,  
7 and I can't speak for what they'll do. I've been out  
8 of the program for 12 years almost now, so I can't say  
9 what they would do. But on the high level, I believe  
10 they're quite willing to talk to people on the high  
11 level.

12 MR. MAYFIELD: On the high level, I would  
13 agree with you.

14 MEMBER BROWN: And I don't mean Admiral  
15 Donald --

16 MR. MAYFIELD: No, no.

17 MEMBER BROWN: -- okay, I mean, you know,  
18 the senior section head --

19 MR. MAYFIELD: When you're asking, high --  
20 you know, sort of philosophical questions --

21 MEMBER BROWN: Yeah, why did we go this  
22 direction vice that and stuff --

23 MR. MAYFIELD: Naval reactors will be  
24 happy to engage. The problem is, some of this gets  
25 you down to fairly nitty-gritty kind of questions.

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1           We've been -- look, why not naval  
2 reactors? Of course, they are one of the entities we  
3 need to reach out to.

4           One of the others that we've been talking  
5 and looking at, are there any bits of information we  
6 can use? Are they Predator pilots? Real-time control,  
7 long distance, multiple modules.

8           Is there something there that we can  
9 benefit from?

10           MEMBER BROWN: Yeah, but if they crash --

11           MR. MAYFIELD: Is there something in the  
12 control, and that's staffing, that we can benefit  
13 from?

14           So we're certainly interested in asking  
15 those questions more broadly.

16           And this was a specific example. You  
17 bring a bunch of NRC people together. We're going to  
18 think about things NRC controls, so it -- but it's a  
19 fair point.

20           Can we -- do we have any more good abuse  
21 for Ross?

22           MEMBER BLEY: I think we're done.

23           MR. MAYFIELD: Let me come back to the  
24 last slide real quick.

25           The Commission has challenged us to think

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1 expansively. That's what we're trying to do.

2 We wanted to do some outreach with the  
3 committee early on to let you know what we're doing to  
4 get any insights you might have. We will be back to  
5 you as we go along.

6 Industry has asked us to come chat with  
7 them, as we move along with this, so we will be  
8 engaging through NEI and the small reactor working  
9 group, with what we're doing, what we think we're  
10 finding, and the process we're following.

11 So we will be back to you as we move  
12 along, and as we've got more things to tell you.

13 With that --

14 MR. COE: One final thought, if I may.  
15 The committee may know that the Commission has tasked  
16 the staff to look at standardizing the expert  
17 elicitation processes that are often used throughout  
18 the agency, and one example could be something like  
19 this. And I just wanted to offer two thoughts to the  
20 Committee relative to my experience here.

21 Number one is, it's really important to be  
22 able to do these kind of things with a minimum amount  
23 of resources and still get benefit out of it. That  
24 encourages the staff and people like Mike to think  
25 about using this as a tool.

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1           And the ability to get some benefit out of  
2           it without a great investment of resources means that  
3           we need to be flexible enough to conduct these kinds  
4           of things at this sort of level of resource expense.

5           Secondly, there's often a -- not  
6           misunderstood, but often missed understanding of the  
7           value that this kind of effort has in cross-  
8           fertilizing knowledge across different elements of the  
9           staff, different organizations.

10           The more you do these kinds of group  
11           things where you draw people from different places in  
12           the organization and get them together to think about  
13           a specific topic and hear and be challenged to think  
14           creatively and expansively, they carry that back to  
15           their organizations, and there's great benefit in  
16           doing that.

17           So the more that we can do these kinds of  
18           things I think has great value and benefit to the  
19           agency as a whole.

20           Thanks.

21           MR. MAYFIELD: Mr. Chairman, we're done.  
22           Thank you.

23           MEMBER BLEY: Thank you very much,  
24           gentlemen, for a good presentation, and keeping us  
25           abreast of what is going on.

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1 Mr. Chairman, back to you.

2 CHAIR ABDEL-KHALIK: Thank you.

3 At this time, our schedule calls for us to  
4 take a break, a 15-minute break.

5 We will reconvene at 10:15, and at that  
6 time, we will be off the record.

7 (Whereupon, at 10:00 a.m., the meeting was  
8 recessed, to reconvene at 10:15 a.m.)

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**U.S.NRC**

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

*ADVANCED REACTOR  
PROGRAM - IIRPs*

**Michael Mayfield, Director**

Advanced Reactor Program

Office of New Reactors



# *Advanced Reactors have benefitted from Commission Guidance*

---

“To provide for more timely and effective regulation of advanced reactors, the Commission encourages the earliest possible interaction of applicants, vendors, other government agencies, and the ***NRC to provide for early identification of regulatory requirements for advanced reactors*** and to provide all interested parties, including the public, with a timely, independent assessment of the safety and security characteristics of advanced reactor designs. Such licensing interaction and guidance early in the design process will contribute towards minimizing complexity and adding stability and predictability in the licensing and regulation of advanced reactors.”

- Policy Statement on the Regulation of Advanced Reactors (NRC-2008-0237) and Final Policy Statement, 73 Federal Register 60,616 (October 14, 2008)



# Staff Identified Key Policy and Technical Issues

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- SECY-10-0034 : “POTENTIAL POLICY, LICENSING, AND KEY TECHNICAL ISSUES FOR SMALL MODULAR NUCLEAR REACTOR DESIGNS”
- Project Plans and Schedules Developed
- Progress being made
- **WHAT HAVE WE MISSED?**



# Issue Identification and Ranking Project (IIRP)

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- Identify and prioritize issues under NRC control that could impede design, licensing, construction, operation, or export of SMRs
- Further explore identified issues to ensure they are fully addressed
- Look broadly across agency
- Work with affected Offices to budget and develop resolutions to identified issues



# IIRP Approach

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- Make use of a PIRT-like process
- Each project has a specific working group and charter
  - Knowledgeable staff not directly tied to on-going issue resolutions
- A SES facilitator provides the vision and guidance for the working group
- Scope somewhat limited by available time and resources





# Potential Results

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- Impact on design decisions
- Need for legislation
- Need for rulemaking or policy changes
- Need for NRC confirmatory research
- Dependencies on other policy or technical issue (e.g., source term impact on EP)



# IIRP SPECIFIC PROJECTS

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- Emergency Planning – Complete: September 2010
- Source Term – Complete: June 2011
- Control Room Staffing – Complete: June 2011
- Security – In Progress, completion date: August 2011
- Cross-Organizational Issues – In Progress, completion date: September 2011



# IIRP for Cross Organizational Issues

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- Broad look across NRC organizations
- Issues that could impede design, licensing, construction, operation, or export of SMRs
- Initial focus on iPWRs but cognizance of other technologies (HTGR and fast reactors)
- Participating Offices: NRO, NRR, NMSS, RES, NSIR, FSME, OGC, OHR, OIP, Region II
- Project is underway – expected completion in September 2011



# IIRP for Cross Organizational Issues (cont'd)

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## Examples of cross organizational issues

- Resident Inspectors for plants?
- Resident Inspectors for manufacturing facilities?
- Training courses for staff? When to expand training to non-LWR technology?
- What is needed to support Ops Center?
- Spent fuel storage and transportation
- Fuel fabrication for non-LWR designs – timing
- DOE vision of a thousand SMRs – implications for NRC?



# IIRP for Control Room Staffing (cont'd)

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## **IIRP Process – Facilitator’s Perspective**

- Independence from line organizations
- Diversity of group members
- Brainstorming approach
- Role of Facilitator
- Time commitment and number of group meetings
- Final report



# IIRP for Control Room Staffing

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- ARP Lead: Ross Moore
- Established to focus on early identification of policy, regulatory, and technical issues related to Control Room Staffing
- Working group identified issues directly involving or related to control room staffing
- Issues were then ranked based on priority ranking criteria which were weighted to emphasize their relative importance
- Three issues identified as critical (Scaling, Integration, Design Basis)
- Another two were listed as having high impact-to-safety (Multi-Module Human Systems Interface and Mixed Technologies)



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**Scaling** – As the number of modules increase at an SMR plant, how do an operator's roles, responsibilities, and interactions with other operators and external organizations (e.g. EP, security) change? What non-linearities might need to be addressed in staffing analyses, and how will operators be trained as the number of modules increase, including consideration of multiple simultaneous operating modes?

**Integration** – Instead of prescriptive regulatory requirements, should a fully integrated staffing analysis be required for SMRs that accounts for control room tasks as well as interfaces with external entities (e.g. EP teams, fire brigades, administrative and maintenance staff) ?

**Design Basis** – Should SMR design basis explicitly include control room staffing needs during multi-module accident scenarios? Can PRA be used to determine how many modules must be included in a multi-module accident scenario?



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**Multi-Module Human Systems Interface** – What is the technical basis for determining if something is allowed in HSI in a multi-module plant? How will peer-checking be achieved with multiple modules presented on multiple, possibly re-configurable, displays and controls?

**Mixed Technologies** – As SMR modules are manufactured and added over time, with potentially different designs, equipment, software, and upgrades operating simultaneously in a single plant, what impacts might this have on I&C, HSI, and operator training?

Would the presence of mixed technology across SMR modules in a single plant contribute to increased complexity and reduced safety in the event of an accident or other nonsteady-state scenarios?

What measure of technology spread is appropriate across multiple SMR modules given that any mix of them may be operated by a single operator?





# IIRP for Control Room Staffing (cont'd)

Summary Rankings

Overall Rank	Issue Heading and Descriptions	40%	20%	20%	20%	0%	100%	Relatedness
		Safety	Impact on Licensing	Time to Resolution	Resources Needed	Knowledge Gap	Total	Staffing (S), Cross-Cutting (X), or Other (O)
1	<i>D. Scaling</i>	5.00	5.00	5.00	4.00	3.00	4.80	S,X
2	<i>E: Integration</i>	5.00	5.00	5.00	4.00	1.00	4.80	S,X
3	<i>K: Design Basis</i>	5.00	4.67	4.00	3.00	1.00	4.33	S,X
4	<i>B. Multi-Module Human-Systems Interface (HSI)</i>	5.00	4.20	3.00	2.60	2.00	3.96	S,X
5	<i>J: Mixed Technologies</i>	4.33	3.00	4.00	2.67	3.67	3.67	S,X
6	<i>I: Completeness of Task, Job, and Workload Analyses</i>	3.67	3.00	3.00	2.67	1.33	3.20	S,X
7	<i>G: Control Room Design and Crowding</i>	3.67	3.33	2.67	2.33	1.33	3.13	S,X
8	<i>F: Operator Attentiveness</i>	3.67	3.00	2.33	2.00	1.33	2.93	S
9	<i>H: SMRs for Non-Electrical Generation and Mixed Use</i>	2.33	2.67	2.67	1.33	1.33	2.27	S,X
10	<i>A. Reverse Transferability of Staffing Determination</i>	1.00	2.60	1.60	1.00	2.00	1.44	S
11	<i>C. Research Test Reactors as an Example for SMRs</i>	1.00	1.33	1.67	1.00	1.33	1.20	X



# SUMMARY

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- Commission has challenged staff to think expansively
- Exploring identified issues and looking broadly for impediments
- Will engage industry and other stakeholders to further expand thinking
- Will engage ACRS as we go forward