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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

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

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

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

presentations and committee discussion.

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

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

Dennis?

MEMBER BLEY: Thank you, Mr. Chairman.

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

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

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

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

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

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

MR. MAYFIELD: Thank you, Mr. Chairman.

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

(Laughter.)

Could we go to the first slide?

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

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

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

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

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

So, next one, Ross.

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

The question was, what have we missed?

Next one, please.

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

When we were trying to decide how would

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

(Laughter.)

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

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

MR. MAYFIELD: There you go.

(Laughter.)

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

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

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

So, we're engaging with our friends and

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

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

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

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

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

MR. MAYFIELD: Right.

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

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

MEMBER CORRADINI: Another, I guess, kind

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

MR. MAYFIELD: Yes.

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

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

MEMBER CORRADINI: Okay.

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

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

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

go work on it.

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

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

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

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

people on the outside.

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

Has anybody ever looked to see if it actually works?

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

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

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

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

MEMBER BANERJEE: I think it establishes the conventional wisdom.

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

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

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

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

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

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

(Laughter.)

Maybe hot air, but not smoke.

(Laughter.)

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

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

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

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

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

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

was for the NGNP. And that was pretty extensive.

MR. MAYFIELD: Right.

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

MR. MAYFIELD: Pretty much.

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

MR. MAYFIELD: Right.

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

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

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

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

to it.

MEMBER CORRADINI: Okay.

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

MEMBER CORRADINI: Right.

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

MEMBER CORRADINI: Okay. All right.

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

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

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

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

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

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

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

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

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

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

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

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

MEMBER SIEBER: Could you give them an example?

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

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

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

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

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

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

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

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

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

use for these?

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

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

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

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

MR. MAYFIELD: Nobody had them back then.

MEMBER CORRADINI: In `93?

MEMBER SIEBER: That's right.

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

MEMBER CORRADINI: LaCrosse.

MEMBER POWERS: Oh, LaCrosse.

MR. MAYFIELD: They would have had one.

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

MEMBER ARMIJO: Well before `90 --

MEMBER MAYFIELD: They would have had one.

MEMBER ARMIJO: They last that long?

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

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

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

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

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

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

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

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

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

DOE, John Kelly, sat before the Commission

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

I think he had visions of within his lifetime.

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

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

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

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

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

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

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

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

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

MEMBER CORRADINI: Okay.

MR. MAYFIELD: Proliferation aspects come into it.

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

MR. MAYFIELD: Right.

MEMBER CORRADINI: They want to essentially export.

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

export control.

MEMBER CORRADINI: I see. All right.

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

MEMBER CORRADINI: That's another --

MR. MAYFIELD: Pardon me?

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

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

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

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

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

(Laughter.)

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

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

MR. COE: Thanks, Mike.

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

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

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

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

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

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

diverse perspectives.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(Simultaneous speakers.)

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

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

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

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

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

MEMBER BLEY: Doug?

MR. COE: Yes, sir?

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

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

MEMBER BLEY: But not actual plant operators?

MR. COE: Not actual plant operators, no.

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

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

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

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

MR. COE: That's right.

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

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

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

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

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

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

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

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

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

MEMBER CORRADINI: That is so polite.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MR. MAYFIELD: Yes.

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

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

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

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

MR. MAYFIELD: That's why I --

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

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

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

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

One of the key issues, if you look at

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

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

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

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

MEMBER SIEBER: That's right.

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

(Laughter.)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MR. MAYFIELD: Right.

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

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

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

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

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

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

MR. MAYFIELD: Absolutely.

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

MR. MAYFIELD: Right. Right.

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

MR. MAYFIELD: Right.

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

MR. MAYFIELD: Yes.

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

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

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

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

MR. MAYFIELD: Right.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MR. MAYFIELD: Sort of, yeah.

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

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

MR. MAYFIELD: Right.

MEMBER CORRADINI: -- going to refueling, whatever.

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

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

So that's really what the process was about.

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

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

issues that Mike was just speaking of.

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

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

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

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

Ross?

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

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

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

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

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

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

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

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

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

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

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

Is it four modules a machine? Is it two

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

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

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

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

MEMBER CORRADINI: Pick on them some more.

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

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

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

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

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

MR. MAYFIELD: Does that help?

MEMBER CORRADINI: Yes, it helps. Thank you.

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

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

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

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

tornado hits the switchyard.

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

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

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

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

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

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

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

may be totally different --

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

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

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

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

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

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

different.

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

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

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

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

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

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

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

VICE CHAIR ARMIJO: Yeah. That's their

problem.

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

VICE CHAIR ARMIJO: Yes. Right.

MR. MAYFIELD: That's our role.

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

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

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

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

MEMBER RAY: Okay. But would you apply --

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

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

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

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

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

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

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

analysis.

MEMBER POWERS: Is this -- plants have --

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

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

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

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

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

MEMBER RAY: I see. All right.

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

MEMBER RAY: That's simple, and a good

answer.

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

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

MEMBER RAY: Yes.

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

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

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

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

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

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

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

MEMBER RAY: Yes, precisely.

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

MEMBER RAY: All right.

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

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

MR. MAYFIELD: It's a fair point.

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

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

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

MEMBER RAY: Yes, that's right.

MR. MAYFIELD: We hope so.

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

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

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

MR. MAYFIELD: Not to my knowledge.

MEMBER STETKAR: They haven't? Okay.

MR. MAYFIELD: One of the --

MEMBER STETKAR: Okay --

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

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

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

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

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

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

Will they ask, as we pursue this and they

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

impact on licensing, timed resolution, and resources needed.

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

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

MR. MOORE: Twice as high.

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

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

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

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

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

MEMBER BROWN: This is for your research focus.

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

MEMBER BROWN: I'm just thinking thought

process.

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

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

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

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

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

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

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

MR. MAYFIELD: Oh, okay. Okay.

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

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

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

MEMBER RAY: Okay.

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

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

MR. MAYFIELD: Yes.

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

MR. MAYFIELD: Right.

MEMBER RAY: -- PowerPoint presentations --

MR. MAYFIELD: Right.

MEMBER RAY: -- and that kind of stuff.

MR. MAYFIELD: Right.

Go ahead.

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

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

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

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

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

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

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

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

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

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

MR. MAYFIELD: And not necessarily just research.

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

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

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

MR. MAYFIELD: Yes.

MEMBER BLEY: Okay.

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

some sense, I kind of see how it fits together

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

MR. MAYFIELD: Yes, so that would --

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

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

(Laughter.)

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

Does that --

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

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

We would like to be able to do this in

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

But we can do the licensing review today.

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

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

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

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

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

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

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

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

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

MR. MAYFIELD: That's fair.

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

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

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

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

(Laughter.)

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

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

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

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

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

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

MEMBER POWERS: And that would be --

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

MEMBER CORRADINI: Way to get him roiled up.

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

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

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

Not a good plan.

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

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

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

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

MEMBER CORRADINI: He seems pretty chatty to me.

(Laughter.)

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

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

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

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

MR. MAYFIELD: No, no.

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

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

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

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

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

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

Is there something there that we can benefit from?

MEMBER BROWN: Yeah, but if they crash --

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

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

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

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

MEMBER BLEY: I think we're done.

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

The Commission has challenged us to think

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

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

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

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

With that --

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

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

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

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

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

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

Thanks.

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

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

Mr. Chairman, back to you.

CHAIR ABDEL-KHALIK: Thank you.

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

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

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

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

- 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)

- 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

- 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

- 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

- 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

- Broad look across NRC organizations
- Issues that could impede 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)

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)

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

- 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)

IIRP for Control Room Staffing (cont'd)

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?

IIRP for Control Room Staffing (cont'd)

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

SUMMARY

- 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