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UNITED STATES NUCLEAR REGULATORY COMMISSION'S ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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FUKUSHIMA SUBCOMMITTEE

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THURSDAY

JUNE 23, 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, Rockville, Maryland, at 1:00 p.m., Said Abdel-Khalik, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

SAID ABDEL-KHALIK, Chairman

JOHN W. STETKAR, Member-at-Large

J. SAM ARMIJO, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, Member

MICHAEL L. CORRADINI, Member

COMMITTEE MEMBERS PRESENT (CONTINUED):

JOY REMPE, Member

MICHAEL T. RYAN, Member

WILLIAM J. SHACK, Member

JOHN D. SIEBER, Member

NRC STAFF PRESENT:

EDWIN HACKETT, ACRS Executive Director

HOSSEIN NOURBAKHSH, ACRS, Senior Technical Advisor

MARTIN J. VIRGILIO, Deputy Executive Director for Operations

ALSO PRESENT:

DIANE CURRAN, Harmon, Curran, Spielberg & Eisenberg, LLP

PAUL GUNTER, Director of Reactor Oversight, Beyond Nuclear

LUCAS HIXSON, Bison Resource Development Group

EDWIN LYMAN, Union of Concerned Scientists

LOUIS A. ZELLER, Blue Ridge Environmental Defense League*

*Participating via telephone

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Adjourn	

P R O C E E D I N G S

(12:59 p.m.)

CHAIRMAN ABDEL-KHALIK: The meeting will now come to order.

This is a meeting of the Advisory Committee on Reactor Safeguards Fukushima Subcommittee. I'm Said Abdel-Khalik, Chairman of this Subcommittee. ACRS members in attendance are Michael Ryan, Charles Brown, Dennis Bley, William Shack, Michael Corradini, Sam Armijo, John Stetkar, Jack Sieber, and Joy Rempe. Dr. Edwin Hackett is the Designated Federal Official for this meeting.

The Subcommittee will review information regarding events at the Fukushima site in Japan. We will hear a presentation from the NRC staff.

We have received written comments from Ms. Diane Curran regarding today's meeting. Copies of her comments have been provided to the members. Ms. Curran will also be providing oral comments.

In addition, we have received requests from Mr. Paul Gunter and Mr. Lewis Zeller to provide oral comments. Ms. Curran, Mr. Gunter, and Mr. Zeller will be given time to provide their comments following the scheduled presentations and Committee discussion.

The entire meeting will be open to the

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

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register.

There is a phone bridge line for members of the public. To preclude interruption of the meeting, the phone will be placed in a listen-only mode during the presentations and Committee discussions.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice. Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the Subcommittee. The participants should first identify themselves and speak with sufficient clarity and volume so they can be readily heard.

We will now proceed with the meeting and I call upon Mr. Marty Virgilio, Deputy Executive Director for Reactor and Preparedness Program of NRC to begin the presentation.

Marty?

MR. VIRGILIO: Thank you, Mr. Chairman, and good afternoon ladies and gentlemen, members of the Committee, and ladies and gentlemen in the audience.

My responsibilities, in addition to being the Deputy Executive Director for Operations, include managing the away team that we have in Japan, the team we have here in Washington providing support to that team, the near-term Task Force and eventually, as we establish the longer-term Task Force, will all become collateral assignments that I will manage.

I do not take that assignment lightly. I'll tell you that I think that our response to the Fukushima events are very important to the Agency, probably one of the most important things that we are working on today. So with that context, let me go ahead and proceed to tell you where we are today on a number of different issues.

If we go to slide number two, it was back in April where the staff had its last opportunities to come forward and brief the Committee and talk about some of our understanding about the early implications around the events in Japan and some of the actions that we were taking in response to those events.

Today I'll give you an update on where we are relative to those activities and talk about some additional actions that we also have underway, including the review of some of the reports that we've received. So now what we're getting is reports from other countries, from other sources, as well as the information that we're gathering from our team in Japan today.

Slide three, I think it's an over simplification but as you all well know, that at the time of the event, we go back to March 11th, Units 1, 2, and 3 at Fukushima Daiichi were in operation, Unit 4 was defueled, Units 5 and 6 were in cold shutdown when the earthquake occurred and subsequently the tsunami struck the site.

Our understanding of the sequence of events and the cause of the damage to the facility and what eventually led to the severe accident that they experienced, we're still learning. I think almost every day we learn a little bit more about what happened at the site at the time. But it really does appear that the bulk of the damage and the onset of the severe accident were really precipitated by the tsunami, not so much by the earthquake itself.

I would say, and we've said over and over

again, that they are still in a severe accident mitigation mode. If you think about the condition of the plants today, it's static as we continue to say but anything but stable. So we're continuing to assess the conditions through the site team and provide the support that we're asked to provide.

The situation today continues to get better. I will say that in terms of if you look at things that they've done over the last few weeks, up until last -- I think last week they were still feeding and bleeding the reactor. They were still feeding using essentially fire hoses that were eventually attached to piping and plant equipment.

And today we can say that they have moved away from the fire hoses. They've gotten to more permanent structures, different types of piping that they've installed at the site. I think that you could say that the reliability of the on-site power supplies have been improved by bringing additional temporary diesels and other activities.

Spent fuel pools, we're now on normal or more normal source of cooling. Make up is -- I think on Unit 4 now is the only one where they're actually dumping water in from the top. Everything else is being made up through more permanent systems given the

conditions.

There has been a lot of speculation I would say over the last -- well, actually since the beginning of the event with respect to the core. How damaged is the core? Was the reactor vessel damaged? Was there any ex-core situations? And it's still, I think, somewhat speculative as to where all that is.

MELCORE runs would tell you that some of the core is, in fact, on the floor. But I think, again, it's all speculative and it will be, I think, until we can or the Japanese can actually get in there and do some observations and some more measurements. And they're making progress in that regard, too. I think this week they've gotten the Unit 2 containment opened. They're ventilating and so the humidity issues that they were dealing with are being lowered. But they're still challenged by the radiation inside the buildings.

I think one of the biggest challenges they're dealing with currently is the amount of waste water that they have. Essentially they're running out of space to store water. This week they actually got one of the water treatment systems on line but it's fits and starts in terms of its operability.

So I think that's a critical issue for

them at this moment is to be able to process some of the waste water because at this point, for every drop of water they put into the reactor vessel, well, of course, some evaporates and goes up as steam but the rest of it is leaking into the turbine building and creating another waste hazard that they have to deal with. And essentially they've basically run out of space to store waste on the site.

So shifting away from the conditions at the site and the plant, what I just want to talk a little bit about is our actions to date in terms of our inspection activities. If you go to slide number four, where we are is shortly after the event, we issued an Information Notice to our licensees to make sure that they were aware of the conditions, as we knew them. And subsequent to the event, it was later in March, on March 23rd, that we issued the first of two Temporary Instructions.

The first Temporary Instruction, 183, went to the points of station blackout, what we call B5B. And I'll stop for a moment there.

Shortly after the events of 9/11, the terrorist attacks on the World Trade Center, we issued a series of bulletins. And one of the bulletins that was issued in February of 2002 included a section B5B.

And in that section, we required our reactor operators to actually have the capability to mitigate large fires or the effects of a large fire and explosion in the plant. We were thinking about an aircraft hitting the plant and causing and extensive amount of damage.

And so that equipment was actually installed in response to that order. And our understanding of the strategies evolved to the point of about 2009 when we incorporated the B5B into the rulemaking 50.54(hh)(2). And so I'll refer to B5B but it's really equipment now required by the regulations to mitigate the effects of large fires and explosions.

So back to where I started. It was that Temporary Instruction 183 where we sent our inspectors out to say is that equipment installed? Is it operable? Is it capable of performing its intended function?

And then the third area that we looked at under that Temporary Instruction was external events. In particular we were looking at flooding damage to the plants. So that was 183.

What we found from that Temporary Instruction -- so we implemented that at 104 operating reactors and what we found was some issues. Now I would say that if you look at overall were functions

capable of being performed? And at the end of the day we would have to say yes. But were individual strategies compromised? And what we found from our inspections were that some equipment wasn't maintained. We found in some cases that the strategies were not capable of being executed. We found in some cases that the equipment wasn't there that was required under B5B and --

CHAIRMAN ABDEL-KHALIK: Let me just ask you a question about the --

MR. VIRGILIO: Yes.

CHAIRMAN ABDEL-KHALIK: -- statement you just made that even though this equipment was not, in some cases, in place, that you conclusion was that the functions can still be performed.

MR. VIRGILIO: Yes.

CHAIRMAN ABDEL-KHALIK: Is that correct?

MR. VIRGILIO: Yes. That was our conclusion.

CHAIRMAN ABDEL-KHALIK: Would the functions still be performed under the conditions in which the equipment was originally envisioned to perform?

MR. VIRGILIO: Only. See -- and I'll get to that in a little bit because that equipment was not

-- it was there for one purpose: large fires and explosions. It wasn't there for flooding. It wasn't there for earthquakes. And I'll talk about that a little bit later in my presentation because the equipment under B5B, while it provides some advantages, it is limited by intent.

We never required it to be seismically qualified. We never required it to be hardened for other external events.

CHAIRMAN ABDEL-KHALIK: You required it to be present.

MR. VIRGILIO: Yes, we did. And so there is a likely advantage to having that equipment there if, in fact, it's operable. Do you follow me?

CHAIRMAN ABDEL-KHALIK: Well, you'll get to it later in your presentation. Maybe we can talk about it at that time.

MR. VIRGILIO: Okay. Switching to the second TI that we issued, that was the 184, we issued that in April, toward the end of April. And what that focused on was the severe accident management guideline.

Severe accident management guidelines were put in place in the 1990s. They were a voluntary initiative on the part of industry. And they were

meant to take you beyond the design basis accidents. If there were a severe accident at the plant, how would you cope with it? What strategies would you execute? And they are symptom-based -- it's a symptom-based approach. And it's a guidance for the Technical Support Center, guidance for the operators. It's how they could, in fact, take actions to mitigate a severe accident event.

What we found as we went out and conducted that Temporary Instruction that there was an uneven application across the industry. And again, it wasn't a requirement. It was a voluntary initiative on the part of the industry. But what we found was that there was an unevenness with respect to the maintenance of the procedures, the location of the procedures, the training that licensees provided with respect to those procedures. And that unevenness led to, I think, some I think vulnerabilities or weaknesses in that approach.

MEMBER CORRADINI: Marty, if I might, if you're going to do it later, just tell us to wait. Does all the plants exercise on these SAMGs in some fashion?

MR. VIRGILIO: No. What we did find was there was training. But we did not find --

MEMBER CORRADINI: I'm sorry. I meant to say --

MR. VIRGILIO: Yes, there was training. It seemed like there was an initial round of training. We didn't find any case where that wasn't occurring. But what we found was is there was an unevenness as far as whether they were exercised or tested --

MEMBER CORRADINI: In some sort of scenario?

MR. VIRGILIO: -- or in a systematic way.

MEMBER CORRADINI: Does INPO -- is there any INPO oversight --

MR. VIRGILIO: I can't say.

MEMBER CORRADINI: -- on SAMGs?

MR. VIRGILIO: I don't know the answer to that question.

MEMBER CORRADINI: Okay.

MEMBER STETKAR: Marty? To kind of follow up on that a little bit, because they are voluntary procedures, is there any notion of NRC licensing? When you go through license training, for example, an NRC --

MR. VIRGILIO: It's not a part of our training --

MEMBER STETKAR: It's not part of the --

MR. VIRGILIO: -- it's not part of our operating license --

MEMBER STETKAR: -- not part of your license --

MR. VIRGILIO: -- it's not part of that process.

MEMBER STETKAR: So even on the walkthroughs, people don't --

MR. VIRGILIO: Right. It's not there today. But I'll get to some of the issues around that as I talk about where we are.

CHAIRMAN ABDEL-KHALIK: Well, let me just follow up.

MR. VIRGILIO: Sure.

CHAIRMAN ABDEL-KHALIK: I'm sure you are familiar with the Japanese government's report for the IAEA. And on page 32 of that report, it said that accident management measures are basically regarded as voluntary efforts by operators, not legal requirements. And so the development of these measures lacked strictness. Moreover, the guidelines for accident management has not been reviewed since their development in 1992, which I believe is the same timeline for our own SAMGs. And it has not been strengthened or improved.

Would you agree that the same statement describes the state of affairs in the U.S. with regard to SAMGs?

MR. VIRGILIO: I think that's pretty close to where we are today. It's a voluntary initiative. It's unevenly implemented. And there are some gaps.

CHAIRMAN ABDEL-KHALIK: Okay. If that is the case, how does the Nuclear Regulatory Commission make a decision as to whether a response to some issue can be voluntary or that it must be promulgated into law through rulemaking? Is there a threshold, a guide, a rule that informs that decision?

MR. VIRGILIO: You're getting ahead of my presentation by just a little bit. But I would want to answer that to say that I -- my personal experience over 35 years with watching the NRC and being with the NRC for almost that long, it's been very uneven.

If you look at where we are with respect to some initiatives being voluntary and some initiatives being incorporated into the regulations, it is a decision that was made at the time of the Commission, whichever Commission was sitting at the time, based on the facts before it at the time.

And I can point to things -- I can point to particular issues where the Commission make

conscious decisions like shutdown risk, for example, where we did not incorporate many of those provisions into the regulations. We have relied on voluntary industry initiatives.

Another case, a more recent case, is groundwater protection where we are, as the staff, recommending to the Commission that we rely on voluntary initiatives. And I think that -- we'll get to that in my -- later in my presentation. But I think that's one of our key findings of the Task Force.

Where we go with that, I think it's a little bit too soon to tell. But it is a finding that we have been somewhat inconsistent as a function of time and almost issued the specific with our decisionmaking around whether it's voluntary or whether it's brought into the regulations.

CHAIRMAN ABDEL-KHALIK: But would you agree that over the past 25 years there has been an increased trend towards accepting voluntary activities?

MR. VIRGILIO: I've not done that.

CHAIRMAN ABDEL-KHALIK: Or is it random?

MR. VIRGILIO: I've not done that study. I would say it's probably more issue by issue. I

don't know that I could say there is an increasing or decreasing trend.

CHAIRMAN ABDEL-KHALIK: Okay. We'll I guess we'll revisit this when you talk later about it.

MR. VIRGILIO: Okay.

CHAIRMAN ABDEL-KHALIK: Thank you.

MR. VIRGILIO: Good.

The next issue is the bulletin. We issued the bulletin in May. Again, because we wanted to make sure -- not solely driven but I would say in part informed by what we received from the TI, we felt it was important to go out and make sure that we had confirmation from all licensees that they had both the equipment and the procedures in place to implement what we required under B5B.

So we issued that bulletin on May 11th. And we broke it into two parts. The first part, the 30-day response for licensees to affirm that the equipment necessary to execute the strategies was, in fact, available and capable of performing its intended function and the second part was that the guidance, all the procedures, the training and everything else was in place.

We've reviewed the 30-day responses and we found that at this point all licensees have, in fact,

confirmed that they have the capacity and the procedures. The second piece of that, which is the 60-day response, is due on July 10th. And in that response, they have to confirm to us that they're doing the maintenance testing, configuration control, and everything else that you would want surrounding that equipment to ensure its continued operability.

MEMBER BROWN: Does that include the exercising under the procedures that you were talking about? You said that you had the training --

MR. VIRGILIO: The training and exercising?

MEMBER BROWN: -- and exercising, yes.

MR. VIRGILIO: Yes, yes that is part. They will have to affirm --

MEMBER BROWN: Okay.

MR. VIRGILIO: -- at the 60-day mark yes, that they are conducting the training.

MEMBER BROWN: I just asked the exercise because you said that hadn't been -- the training was there but the exercising --

MR. VIRGILIO: I'm sorry. I might have confused you.

MEMBER BROWN: You did.

MR. VIRGILIO: There are the severe

accident management guidelines and then there is the B5B part.

MEMBER BROWN: Okay.

MR. VIRGILIO: What I was referring to when I talked about the unevenness about the exercise, that had to do with the severe accident management guidelines.

MEMBER BROWN: Okay. Thank you.

MEMBER CORRADINI: And then, if I might just go back, there's -- INPO has put out its own set of requests to look at these sorts of things, is there a coordination between NRC INPO because after Three Mile Island in this similar fashion, INPO was formed and it took on a number of responsibilities to ensure, from the licensees' standpoint, in some sort of collective responsibility of safety is. In this regard, are you guys -- I don't want to say coordinating but at least being informed of each other relative to what they're finding in their inspections?

MR. VIRGILIO: Yes.

MEMBER CORRADINI: Okay.

MR. VIRGILIO: Yes. Without a question, we're maintaining an awareness of what they're doing and they're maintaining an awareness of what we're doing. But by design, the Task Force was asked to do

its assessment independently.

MEMBER CORRADINI: Separately.

MR. VIRGILIO: And so --

MEMBER CORRADINI: Okay. Thank you.

MR. VIRGILIO: -- we're not counting on them for anything at this point.

MEMBER CORRADINI: But when all is said and done, you'll --

MR. VIRGILIO: Oh, yes.

MEMBER CORRADINI: Okay.

MR. VIRGILIO: Yes. The last thing on this slide that I wanted to mention is we're continuing to work not only domestically to understand what our counterparts are doing but we're also working very aggressively internationally to make sure that we understand what others are doing.

And two weeks ago, we had our representatives at an NEI forum. Just this week the Chairman and Bill Borchardt were at a ministerial conference at the IAEA. I'll talk a little bit later about an IAEA mission that was conducted to Japan. We actually had a staff -- actually one of our managers on that mission to Japan.

And if you look ahead, we've got a number of activities this fall, including the IAEA General

Conference where there will be additional discussions with respect to what individual members countries are doing in response to the Fukushima events.

Slide five, the government of Japan has just recently issued its report to the IAEA. That report was developed, I think, primarily to support the ministerial meeting that's ongoing this week. And that report, although we recently received it, I think it didn't jar us. There was nothing in that report that said that we needed to anything today to provide additional protection to the operating nuclear power plants.

It was consistent with our understanding of the event. I think I would have to say that we learned more details about the sequence of events from the review of that report. And we're continuing with our review of that effort.

CHAIRMAN ABDEL-KHALIK: So when you read the 28 commitments made by the government of Japan, none of this stuff struck you as appropriate for U.S. plants?

MR. VIRGILIO: Well, what struck us is that there is a little bit of a gap, and maybe it's our understanding of the report, but what you have is a set of facts and you get a set of recommendations.

What I don't think that report includes is the detailed analysis that carries you from the facts that they start with to help you or help the reader understand what was the underlying root cause or problem that then takes you to the recommendations.

And so we're still studying that report. But I would say it is a little challenging for us right now. And I think we're going to need a little bit more information from the government of Japan to fill that gap with respect to what issue are you trying to resolve? What was the problem you are trying to address? What root cause are you trying to solve through those recommendations?

CHAIRMAN ABDEL-KHALIK: So you think that that information and those recommendations or commitments that are being made by the government of Japan are being made on the basis of incomplete understanding?

MR. VIRGILIO: Information we don't understand. I'm sure they have a rationale. But it's not -- I don't think it is well documented in that report. And we need more dialogue with them to fully understand how they get from Point A to Point B.

MEMBER STETKAR: You think some of that might come out of the meeting in Vienna this week?

MR. VIRGILIO: It might because I fully expect that the government of Japan will be making presentations. Bill and a number of our staff are there -- Bill Borchardt and a number of our staff are there to hear more about what's happened. And we continue to have dialogue with the government of Japan so there's opportunities for us to fill the gap, to try to really understand a little bit more around how did they get to the point of those recommendations.

The next slide, slide six, just touches on the expert mission. There was a factfinding mission between May 24th and June 2nd. We did have a member of our management team on that assessment. And I think that was very helpful to us to understand a little bit more about how it was conducted and what they found.

They developed their preliminary assessment and came up with 15 conclusions and 16 lessons learned. We only received that report this past Monday. So it is a little bit too soon for us to say anything about its findings and recommendations. But we have it under review.

Now I'm going to get to the point of the presentation that I think you really invited me to talk about and that is our near-term Task Force and

where are we with respect to the near-term Task Force activities. As you're well aware, the Chairman tasked us to convene a group of staff members to conduct a very methodical and systematic review of NRC's requirements in light of our understanding of the events at Fukushima and identify framework for and/or actions that we needed to take in the near term.

That Task Force is led by a former FSME Office Director, Charlie Miller. And includes a number of senior staff members on that Task Force. And they are well underway to completing their mission to develop a report to present to the Commission. That report is due to the Commission on the 12th of July. And we're scheduled to have a Commission meeting that will present the results of their effort on the 19th of July.

Slide eight please. The Task Force has relied on a number of sources of information. They have tapped into the Agency's experts to it is not only the members of the Task Force but they've leveraged all of our staff. We've leveraged the information that we've gained from our site team in Japan as well.

We visited several operating reactors. We've observed some of the inspections that I talked

about earlier, those Temporary Instructions. And we've actually visited with INPO and had some discussions with them about what they found as a result of their efforts.

I'd say on that issue finally we also are still reviewing information we received from our international counterparts to make sure we understand what others have done. You might have been -- you might have seen the report the UK did. Mike Whiteman put out his report. There have been other reports that we're aware of. We've been interacting with other countries like Canada, who has also completed their assessment or their initial assessment of the actions that they needed to take.

Slide nine sort of lays out at a very high level how the team is approaching -- how the Task Force is approaching their charter, looking at protection, mitigation, and emergency preparedness as well as looking at NRC's programs.

Now with that said, I want to make sure that NRC's programs are with respect to the Operations Center. And what we did immediately following the event is a separate task not being reviewed by Charlie Miller's Task Force but being undertaken by Jim Wiggins and the staff of NSIR. So we're doing our own

lessons learned review about how the Agency responded to the events in Japan that's different than what Charlie Miller's Task Force is looking at.

Slide ten, in approaching the assessment, what the Task Force has done is to divide their thinking or the way they're binning their activities into four themes. And this slide and the next slide touch on those themes, the first being that the protection of equipment from external hazards is a key foundation and extremely important to safety.

The second theme is that the mitigation equipment and strategies that prevent core damage or spent fuel damage are there for defense-in-depth.

If you go to the next slide, the next theme has to do with emergency preparedness and the need to ensure that we have that defense-in-depth by minimizing public exposure should a radiological release occur.

And then the fourth theme is around our Principles of Good Regulation. And it is really a reflection back on NRC's programs and processes.

Now what I want to do today is to talk about the facts. And if you think about how we typically conduct analysis, we look at findings and from those findings, we draw conclusions. And from

those conclusions, we draw recommendations. And so what I'm prepared to talk about today are the findings or the facts. I'm not prepared to talk about the conclusions or the recommendations. It's a little bit too soon to tell but we'll have those certainly at the time that we provide the report to the Commission on the 12th of July.

MEMBER STETKAR: Marty? Before -- because I know you're going to start talking about facts on the next slide -- has the Task Force constructed timelines of the events at each of the units that include not just what was available but what was done or what was not done?

MR. VIRGILIO: Not to the level of detail that you might want at this point in time. Some of that information just --

MEMBER STETKAR: No, I understand. It's an evolving process.

MR. VIRGILIO: Right.

MEMBER STETKAR: But do you have a framework --

MR. VIRGILIO: But to the best we can, at a fairly high level, yes.

MEMBER STETKAR: Okay.

MR. VIRGILIO: Yes, we have. But even

this week we're still learning new things.

MEMBER STETKAR: Sure.

MR. VIRGILIO: I mean last week, I think we first became aware of what really happened within Unit 1 and why the behavior and the core melt in Unit 1 occurred probably much sooner than it did in Units 2 and 3. So it's -- our state of knowledge with respect to the detailed timeline is continuing to mature.

MEMBER STETKAR: The only reason I ask is if a lot of the factfinding has to do with what equipment was available and where was that equipment, that's part of the equation. The other part of the equation is what were the human beings doing with what they had available.

MR. VIRGILIO: Right. And on that point --

MEMBER STETKAR: And that's --

MR. VIRGILIO: -- that's probably where we know the least.

MEMBER STETKAR: -- that's what we know from the timeline.

MR. VIRGILIO: Yes.

MEMBER STETKAR: Well, that's right. But I mean you might be able to at least know what

questions to ask like why gaps in the information in the timeline.

MR. VIRGILIO: But to point to why we developed this construct of a near-term Task Force and a longer-term Task Force, if you go back to the tasking memo from the Commission, it was clear in the Commission's mind at the time they gave us this assignment that we would have a limited understanding of this detailed sequence of events in 90 days.

MEMBER STETKAR: Sure.

MR. VIRGILIO: And so they said as part of the longer-term Task Force, one of the first things that you need to do is have a more detailed sequence of events in order to then do the type of analysis that the Commission expects from us as part of the longer-term review. So the 90 days is really quick.

MEMBER STETKAR: Understand that. But --

MR. VIRGILIO: Yes.

MEMBER STETKAR: -- the notion is that you don't necessarily want to wait --

MR. VIRGILIO: Yes.

MEMBER STETKAR: -- until the long-term make early conclusions and recommendations that might be off the mark simply because you are waiting for more detail to come in in the long run.

MR. VIRGILIO: Yes.

MEMBER STETKAR: You might -- you know, you are aware of that.

MR. VIRGILIO: Absolutely. And based on where we are today, I would say I don't think there is a problem with the areas that we're focusing on. I think they're pretty clear --

MEMBER STETKAR: Okay.

MR. VIRGILIO: -- as we go into this and, you know, you think about external events, station blackout, all the issues that we are going to talk about today. I'm not sure that there's much doubt that they were important issues.

MEMBER STETKAR: No, that's --

MR. VIRGILIO: -- with respect to this event ad the mitigation of this event.

So findings, conclusions, and recommendations will focus on the findings. And if we go to slide number 12, it's just the facts. And the first theme with respect to natural phenomenon, what the facts are is over time, our understanding of natural phenomenon and their impacts on a nuclear power plant, our methodologies, our tools have all evolved.

And you can look at, for example, seismic

design and Reg Guides that were developed in the early '70s and how our thinking about natural phenomenon, about seismic, about response spectra, about qualification of mechanical and electrical equipment in response to seismic events, all of this has matured and continues to mature. And depending on where you were in the licensing process, the plants that were licensed earlier in the point in time do not necessarily have the same criteria applied later in time.

Where we felt there was a significant safety issue, we certainly went back and we did backfit the older plants. But if there wasn't that rationale to support the backfit, you wound up with a difference. And that's where I think we are today with respect to our thinking and the evolution.

Slide 13 I think lays it out even more clearly, that I can see major points in time -- in the 1970s when we were doing the Systematic Evaluation Program and we looked at those plants that were designed and built prior to the General Design Criteria, well that's one set of requirements that were put in place.

We also see, I think, another significant watershed event when we did the IPEEEs. I mean that

again changed our thinking about external events and what licensees should or shouldn't have in terms of margins for the design against external events. All of these point to, I think, differences.

Are there safety gaps? That's part of what we're evaluating today. But I would say that there are differences depending on at what point in time the plant was licensed and what is the margin to safety that exists at the plants with respect to external events.

Slide 14 goes to the second theme and that is around the importance of mitigating equipment and strategies. Station blackouts, the way we think about station blackouts and the way that we thought about them up to the point of Fukushima is that there must be multiple concurrent equipment failures. And we really were thinking about the loss of onsite power and the loss of offsite power as independent events that occurred simultaneously.

We did not, as we promulgated the station blackout rule, think about one external event that would impact both the onsite and the offsite power supplies.

CHAIRMAN ABDEL-KHALIK: Has the Task Force looked at coping times for station blackout in

different parts of the world? In France, for example, what is the coping time for station blackouts?

MR. VIRGILIO: I can't say whether they have or haven't.

CHAIRMAN ABDEL-KHALIK: Are you familiar with NUREG-1206, which was issued during the station blackout rulemaking deliberations regarding comparison between blackout -- I mean coping periods during station blackouts?

MR. VIRGILIO: If that is the NUREG that formed the basis for how we came to conclude, okay then no.

CHAIRMAN ABDEL-KHALIK: I think that NUREG pointed out that new at the time, standard plant designs in France require plants to cope with a station blackout duration of up to three days. And I was wondering why was that sort of rejected as an option at the time?

MR. VIRGILIO: I can't say specifically why we did not adopt that approach. But I would say that the approach we adopted was based on a detailed study on the reliability of both the onsite and offsite power supplies in the United States and the amount of time that it would take to either restore the offsite power supplies or bring a diesel back on

to service.

And we looked at mean time to restoration and we concluded those coping times were consistent. As a matter of fact, we came to conclude that the coping times were on the order -- or the restoration times are on the order of about two hours. And we just somewhat arbitrarily doubled it to make sure that we had sufficient time to get diesels back in service.

CHAIRMAN ABDEL-KHALIK: That was done, of course, in conjunction with a backfit analysis?

MR. VIRGILIO: Yes.

CHAIRMAN ABDEL-KHALIK: So if that is the case, in your view do you believe that the backfit rule and the so-called finality rule for design certification adequately serve the interest of the public?

MEMBER CORRADINI: That's a tough one. Don't answer that.

MR. VIRGILIO: Okay.

CHAIRMAN ABDEL-KHALIK: Well, I mean you're the Deputy EDO --

MR. VIRGILIO: Part of what we're doing as part of this Task Force is to go back and look at that. And I'll get you there in this presentation. But as the -- I'm sorry?

CHAIRMAN ABDEL-KHALIK: Go ahead please.

MR. VIRGILIO: But on a more generic basis, are we or should we be looking at a different approach to assessing backfits.

MEMBER CORRADINI: I guess where Said's going is kind of what I was going to ask in a general sense, which is I'm sure -- I go back to INPO. I'm sure INPO when they were doing the post-TMI analyses and their IPEEEs probably had a long laundry list of things they might think to do but it didn't cross the cost benefit line to do.

And it seems to me it would be beneficial to historically go back and see what are the things that that would do for degraded core because you had -- I mean the genesis of MAP was the integrated -- the industry degraded core rulemaking group, which then did a whole range of calculations.

I guess what I'm saying is if you're going to venture in -- from a policy standpoint, if you're going to venture into the realm of outside the design basis, it seems to me you have a history coming out of TMI of a lot of work that was done that this might work, this might work, this might not work. And a lot of cost benefit calculations and analyses already are sitting out there not only here but also in other

countries that would benefit the Task Force. That's what I'm --

MR. VIRGILIO: Thank you.

MEMBER CORRADINI: To me, I'm sure there is a wealth of it. That's why I was going back to INPO because I'm assuming the INPO folks -- I assume the INPO folks are thinking in a similar fashion and are going back into their files and saying what did we do here, what do we think there.

MR. VIRGILIO: I don't know if they are but I think you've raised a very good point in terms of what we can do to draw on information that exists. With respect to the backfit group --

CHAIRMAN ABDEL-KHALIK: My question with regard to the backfit rule and the so-called finality rule and whether they really adequately serve the interests of the public, I'm just wondering if they have also become a reason for increased tendency towards voluntary responses or reasons for the Agency to accept or adopt voluntary responses.

MR. VIRGILIO: Yes. And in a good way. I can think of our approach to groundwater protection as a really good example of where I, in my personal opinion, we have an issue that is of very high public interest but not a lot of safety significance. And

here the backfit rule would, in fact -- and we didn't run through a rigorous analysis on this, we did a back of the envelope kind of review, which is allowed. You are allowed to do a qualitative assessment.

We came to conclude that with respect to groundwater protection, the voluntary industry initiatives were appropriate and far more than what we could ever do through rulemaking. Furthermore, I'm not sure rulemaking was appropriate in that case.

I look at the backfit rule, which predates TMI, but was updated subsequent to TMI. I think that serves the public well in a number of ways because I was here at the time of TMI. And I remember the lists that people took out of their desks and put on the table as a result of that accident that had really nothing to do with that accident or the mitigation features that one should have for that type of accident. They were imposed on the industry and later we wound up taking away some of those requirements because they just did not contribute to safety.

So on balance I think the backfit rule is a good rule. I think it has served the Agency well. Do we need to look at it again --

CHAIRMAN ABDEL-KHALIK: That's the question.

MR. VIRGILIO: -- in light of this event? Yes.

CHAIRMAN ABDEL-KHALIK: Okay. Please continue.

MR. VIRGILIO: Okay. Slide 14 I think we've touched on. So slide 15, yes. Where we are today is the current station blackout rules, it's a fact it does not address common cause failure of all onsite and offsite AC power sources and distribution.

The Reg Guide 1.155 contemplates the loss of offsite power as the result of grid failure and severe weather and external events but it really doesn't contemplate the loss of offsite power and the failure of the onsite power supplies as the result of that one event. And again, as you point out, our current coping times of four hours and eight hours continue -- are based on an assumption that the diesels, primarily that the diesels can be restored to operable status within two to four hours. So it's facts.

If you go to slide 16 --

CHAIRMAN ABDEL-KHALIK: Facts that need to be reevaluated?

MR. VIRGILIO: Yes, I'm sorry. They are the facts that we're looking at today as we look at

what are our conclusions about the adequacy of those regulations and what recommendations we might make. So that's -- those are the facts.

MEMBER ARMIJO: But that adequacy is based on the threat, the event you are protecting yourself against. And in the case of Fukushima, we never imagined or at least the Japanese never imagined that they would flood all of their emergency diesels at the same time that they lost all offsite power.

So in some cases, they are perfectly adequate. For another event, they may be inadequate. So I think if we review Fukushima, we shouldn't lose sight of the fact it was a massive natural disaster that nobody ever anticipated.

MEMBER BLEY: Well, the counterpoint to that, and I wonder if you'll address it, is do we, as yet, understand their design basis for tsunami on that part of the coast.

MR. VIRGILIO: I think we have some sense but I'm not -- I would not assert that we have a complete understanding of how they went about with the design for seismic, for tsunamis. That's information that we're getting. As a matter of fact, by direction of the Commission, we've been directed in the area of station blackout, to go back and compare their design

requirements to ours.

MEMBER BLEY: Okay. It's kind of -- I understand from a little digging and talking to people who have been chasing it, that that tsunami was really somewhere between 100 year and 1,000 year tsunami. And I think we usually try to look for something a little more rare when we think about these things. So -- well, later we may hear about this, not today.

MR. VIRGILIO: Right.

MEMBER BLEY: Okay. That's good for me.

MEMBER SIEBER: I presume that you will sooner or later focus on those plants who may have a vulnerability to tsunamis from the station blackout standpoint to determine whether additional modifications need to be taken, you know, because not all plants are subject to that.

MR. VIRGILIO: Right.

MEMBER SIEBER: And --

MR. VIRGILIO: As we look at external events, we will consider that. And you've got primarily your West Coast plants that you've got that.

But if you also think about external events, we need to be thinking about hurricanes --

MEMBER SIEBER: Right.

MR. VIRGILIO: -- which is a different set

of plants.

MEMBER SIEBER: Right.

MR. VIRGILIO: And so we'll -- we are, you know -- the facts are --

MEMBER SIEBER: Or flooding.

MEMBER SHACK: Or flooding.

MR. VIRGILIO: Flooding, yes.

MEMBER SIEBER: And you intend to do that.

MR. VIRGILIO: Yes.

MEMBER SIEBER: That's correct. Okay. Thank you.

MEMBER STETKAR: Marty, a simple question. And I should know the answer to this but I haven't looked it up. Is the switchgear at Fukushima in the basement?

MR. VIRGILIO: Our understanding of Unit 1 was yes.

MEMBER STETKAR: Okay.

MR. VIRGILIO: And that was part of the problem with Unit 1.

MEMBER STETKAR: Well, yes. But this integrated perspective -- perhaps it was in the basement because they thought really hard about seismic but didn't think about flooding.

MR. VIRGILIO: Possibly but I don't know

the answer to that.

MEMBER STETKAR: You don't know the answer. You don't know about Units 2 and 3 where --

MR. VIRGILIO: Well, I think it's down low but I don't think it was effected by the tsunami --

MEMBER STETKAR: It wasn't effected, okay.

MR. VIRGILIO: -- in the same way.

MEMBER STETKAR: Okay. Thanks.

MR. VIRGILIO: Slide 16 please. So another fact is that the B5B equipment and the mitigating strategies are certainly there to provide a capability to respond to large fires and explosions. They might be useful for other events but that's not their design basis.

Slide 16 goes into a little bit more detail on that fact. It's not required to be protected against natural phenomenon.

CHAIRMAN ABDEL-KHALIK: Seventeen you mean?

MR. VIRGILIO: I'm sorry, 17, yes. It's not required to be protected against natural phenomenon. Licensees are also only required to have the resources available for a single unit event. This is not -- and that's not what we saw in Fukushima. It's a fact that we're dealing with right now. And as

I mentioned earlier, the TI found some deficiencies that were addressed.

CHAIRMAN ABDEL-KHALIK: So let's hold it here. 10 CFR 50.54(hh)(2) is the law of the land.

MR. VIRGILIO: Yes.

CHAIRMAN ABDEL-KHALIK: So were you surprised by these inspection results?

MR. VIRGILIO: Yes. And they will be put into our Reactor Oversight Process and whatever actions are appropriate through that process for the deficiencies we identified will be taken.

CHAIRMAN ABDEL-KHALIK: Okay. So on a scale ranging from prevalent to rare where would you classify the extent of these noncompliances?

MR. VIRGILIO: And you can go to the internet and you can go to our website and you can go on a plant-by-plant basis to see where deficiencies were identified. We also have the inspection reports up there. And so my judgment is that it wasn't prevalent. There wasn't a significant trend that would cause me to stay awake at night. But there were instances.

And I'll let you make your own judgment about where they fit on that scale. But in my judgment, it wasn't prevalent.

CHAIRMAN ABDEL-KHALIK: Well, I'm asking you where does it fall on the scale between rare and prevalent.

MR. VIRGILIO: I would say there were instances. They were not prevalent.

CHAIRMAN ABDEL-KHALIK: Okay. Let me follow up then. In 2008, the NRC conducted a comprehensive inspection of the implementation of the mitigation strategies developed by the licensees, presumably to comply with 10 CFR 50.54(hh)(2).

MR. VIRGILIO: It might have been before because we promulgated that rule, I thought, in '09. But --

CHAIRMAN ABDEL-KHALIK: Subsequently these inspections were incorporated into the triennial fire protection inspection.

MR. VIRGILIO: Right.

CHAIRMAN ABDEL-KHALIK: So why were these noncompliances not identified during the presumably comprehensive 2008 inspection?

MR. VIRGILIO: I will speculate that the team is going to find that our triennial fire protection inspections were not as robust as they needed to be.

CHAIRMAN ABDEL-KHALIK: I'm talking about

the 2008 comprehensive inspection that you performed.

MR. VIRGILIO: What may have been in place in 2008, I can only speculate, could have eroded between then and today. I mean what we saw, for example, was that equipment that had been there at one time was no longer there. Or equipment that had been operable was no longer operable. Equipment that was there and not blocked by something else, some modification, some temporary modification or some permanent modification. Those are the kinds of things you found.

I don't think that undermines my confidence in the 2008 inspection. But it does challenge my thinking around the adequacy of our triennials in this area.

CHAIRMAN ABDEL-KHALIK: So let's talk about that. Since 2008 when this inspection was sort of put into, as a part of the triennial fire inspection, I assume each and every plant has had a triennial fire inspection.

MR. VIRGILIO: Yes. But you know that they are audits. They're not 100 percent comprehensive walkdowns that we've required through this TI and the bulletin.

CHAIRMAN ABDEL-KHALIK: They're samples.

MR. VIRGILIO: We do a sampling.

CHAIRMAN ABDEL-KHALIK: So what does that tell you about the process?

MR. VIRGILIO: Maybe we didn't do a smart enough sample. And I'm not being flip. I'm just -- that we need to, you know, we need to rethink. And that's clearly what the near-term Task Force is looking at when it looks at that fourth theme --

CHAIRMAN ABDEL-KHALIK: I'm trying to get --

MR. VIRGILIO: -- with respect to NRC's --

CHAIRMAN ABDEL-KHALIK: -- to a much bigger question.

MR. VIRGILIO: Okay.

CHAIRMAN ABDEL-KHALIK: Is the Task Force asking the bigger question of whether or not the NRC is an effective regulator?

MR. VIRGILIO: In part, I think we are. And if we're not doing it there, we'll be doing it during the longer-term review.

CHAIRMAN ABDEL-KHALIK: Is that part of the tasking of the longer-term --

MR. VIRGILIO: I think it is part of the tasking of both the near-term and the longer-term.

CHAIRMAN ABDEL-KHALIK: Now it's been

nearly -- over two months, I guess, since the near-term Task Force started. And you sort of passed the 70 percent point. Are there any conclusions that the near-term Task Force has arrived at with regard to the efficacy of NRC as a regulator?

MR. VIRGILIO: Said another way is there anything we need to do to change our programs and no, there hasn't been any issue that we believe is of a significant safety gap that we need to take an action today. Where I would say the team -- now there have been actions that have come out of the team, for example, the TI, the second TI with respect to the severe accident management guidelines, that came out of the team.

So the team -- we're not waiting for the 90-day mark to take any actions. But the expectations that are on that team right now is that if they identify something that requires an immediate action on our part of any action on our part, they spit it out and we do it now.

The TI is an example of what we felt we needed in terms of additional information and additional confirmation. And so we took that action with respect to the severe accident management guidelines.

CHAIRMAN ABDEL-KHALIK: Okay. Please continue.

MEMBER CORRADINI: Can I ask a question? I guess I'm back on your first bullet. Is there anything that you learned in your -- these 100 percent inspections that surprised you that certain applicants did something far above and beyond better than what you required?

MR. VIRGILIO: That was not part of what we asked under the TI.

MEMBER CORRADINI: But what I guess I'm looking for is the lessons learned can be both positive and negative. There might be something there that a particular licensee felt even though it wasn't required, in doing their analysis they said, you know, if we only did this more, this protected against this. I'm curious if the Task Force is going to get some of that information, too, because I'm always looking for ways that one licensee might have done something that can inform and help others.

MR. VIRGILIO: We did not do that under the TI.

MEMBER CORRADINI: Okay.

MR. VIRGILIO: And I understand your question but we did not do that. It was strictly to

see where they were relative to compliance.

MEMBER CORRADINI: That they met what they needed to meet.

MR. VIRGILIO: Yes.

MEMBER CORRADINI: Okay. Fine.

MR. VIRGILIO: And again with the SAMGs, while there was no compliance around that, that's a voluntary initiative, our inspection was to see whether they were meeting the terms of what they volunteered to, not whether they exceeded it.

MEMBER CORRADINI: Okay. Thank you.

CHAIRMAN ABDEL-KHALIK: Now Bulletin 2011-01 was issued to collect information also from licensees to determine whether or not further regulatory action would be warranted. And if you were to look at page 35 of the Japanese government report, it essentially states that the instrumentation of the reactors and containments at Fukushima did not function quote. "sufficiently" during the accident. As a result, it was difficult to identify how the accident was developing.

So what information are you currently collecting through that bulletin that will allow you to determine whether during an accident, during an event, there will be adequate instrumentation for the

licensees to know the state of the plant and whether the mitigating strategies are actually working before you engage in deciding whether or not further regulatory action is warranted?

MR. VIRGILIO: The issues and the questions you raise are outside the scope of that bulletin but not outside the scope of our reviews. The bulletin was strictly focused on the 50.54(hh)(2) --

CHAIRMAN ABDEL-KHALIK: Right.

MR. VIRGILIO: -- which is large fires and explosions that did not -- it's not focused on instrumentation, post-accident monitoring instrumentation. It's a very narrow scope for the purposes of --

CHAIRMAN ABDEL-KHALIK: I fully understand. But if you are evaluating --

MR. VIRGILIO: But I understand.

CHAIRMAN ABDEL-KHALIK: -- the efficacy of mitigating strategies, if you don't know the state of the plant, you have no idea whether these mitigating strategies are actually effective.

MR. VIRGILIO: I understand. And a big lesson learned from Three Mile Island with respect to our ability to assess even how much water was in the

core.

CHAIRMAN ABDEL-KHALIK: The same problem Fukushima.

MR. VIRGILIO: Right. And they wound up going to acoustic monitors in order to figure out whether they actually did have water and at what level they had the water. So -- but it is outside the scope of the bulletin. It's not outside the scope of our review.

CHAIRMAN ABDEL-KHALIK: Right. I wasn't pointing to the bulletin specifically as the only vehicle for you to collect information. I was wondering how are you collecting that information.

MR. VIRGILIO: We haven't started collecting information with respect to instrumentation for post-accident monitoring at this point. The assumptions under B5B are that you would have -- that the large fires and explosions have not impacted the installed instrumentation for mitigating the accident. But it has impacted your distribution of power and your ability to get water into the core.

CHAIRMAN ABDEL-KHALIK: But you can't have your cake and eat it, too. You know you can't say these were designed that way but now we're taking credit for them for other things that may happen.

MR. VIRGILIO: That's a fact. They were designed for wat they were designed for.

CHAIRMAN ABDEL-KHALIK: I know.

MR. VIRGILIO: And the fact is we can't take credit for them to serve other purposes without going back and changing the design or making sure the design that exists is qualified for other purposes. You are right.

CHAIRMAN ABDEL-KHALIK: Okay.

MR. VIRGILIO: Slide 18, severe accident management guidelines, another fact that we came out is that it is system-based guidance. It is there for the technical support center, as supported by the plant operators to stabilize and recover from a severe accident. It's focused on terminating the core damage progression, maintaining containment activity, et cetera, et cetera. It is there as a voluntary initiative. That's the fact.

And I noted earlier that as such, there is a variance in the implementation. There are differences in how different licensees have, in fact, implemented the requirements, how they have maintained the procedures, and whether or not they exercise using those procedures.

CHAIRMAN ABDEL-KHALIK: So let me go back

to my -- the question I raised much earlier during the meeting, which is whether or not there is a threshold guide, a rule, a piece of paper that informs their decision as to what remains voluntary what is promulgated into law by rulemaking.

MR. VIRGILIO: What we're looking at is defense in depth, the Commission's safety goals, the backfit rule, and other considerations as. As we go from this fact to what is our conclusions and what is our recommendation.

CHAIRMAN ABDEL-KHALIK: I don't think that sort of addresses the issue of other than your indication that the process is seemingly random as to when a decision -- when an action is left as voluntary and when it is promulgated into law.

MR. VIRGILIO: Our history for the 35 years, I wouldn't say random but it has been case by case on a number of decisions that were made by the Commission at the time as to whether it is incorporated into the regulations. It has been a matter of policy. And those policy decisions were made at different points in time by different Commissions on different issues. The rationale is documented in all --

CHAIRMAN ABDEL-KHALIK: On each case.

MR. VIRGILIO: On each case. But I wouldn't say that there -- you could say that there is a consistency. And that's a fact.

CHAIRMAN ABDEL-KHALIK: Would it be appropriate to establish such guidance so that that consistency is attained?

MR. VIRGILIO: That might be a recommendation.

CHAIRMAN ABDEL-KHALIK: Are you at all concerned about the increasing trend towards voluntary activities and whether or not we're sort of moving on a slippery slope?

MR. VIRGILIO: In my view, I don't know that there is a discernible trend.

CHAIRMAN ABDEL-KHALIK: Okay.

MEMBER ARMIJO: I'd like to ask a question. In these SAMGs, as you -- you don't, necessarily, review them -- you don't? Does anyone do it, INPO or anything else, so you have a feeling of whether some licensees have really good practices? I guess this is Mike's question, because these are important, not only for protection of health and safety, but it's also for protection of their investment, which is a massive loss if they're not prepared to deal with it.

MR. VIRGILIO: At the time they were developed in the 1990s, we were close observers of the process. And I think that at that point in time we came to a degree of confidence that they were going to be able to do what they said they were going to do.

The more recent evidence that I think we have is that in the response to the accident at Fukushima, we were advising the Japanese as to how to help in responding to that event using our Severe Accident Management Guidelines.

MEMBER ARMIJO: Okay.

MR. VIRGILIO: And there wasn't anything that struck me at the time, and this goes back to probably toward the end of March when we were in the Operations Center, and dealing with I think the accident in some of its worst form, if you will, using our Severe Accident Management Guidelines to inform the decisions that were being made. And I think it was working.

MEMBER STETKAR: Marty, you mentioned international -- you try to learn from what people do internationally, also. Do you have any sense of other -- I'm thinking mostly Europe right at the moment, whether any countries have more formally implemented Severe Accident Mitigation Guidelines into their

emergency procedures, or things like that?

MR. VIRGILIO: We know some have, but we don't know the details that I think we're going to need to know as we move forward.

MEMBER STETKAR: Thanks.

MR. VIRGILIO: And as -- I'm trying to remember part of the -- I don't recall whether the stress test that is being done in the EC countries actually includes this, or not.

MEMBER STETKAR: Actually, I don't know either.

MEMBER BLEY: I think it does.

MEMBER STETKAR: It may, because I think in some countries, at least in the European -- in the EU, the SAMGs are more formalized into the emergency operating -- extensions in the emergency operating procedures, in a sense.

MR. VIRGILIO: Slide 19. Mr. Chairman, have I got the time to finish this? I mean, are you okay?

CHAIRMAN ABDEL-KHALIK: Yes, of course you do.

MR. VIRGILIO: Okay. All right. Good.

CHAIRMAN ABDEL-KHALIK: We're here as long as it takes.

MR. VIRGILIO: I was hoping I was running out the clock.

(Laughter.)

MEMBER BLEY: Nice try.

MEMBER REMPE: I, actually, wanted to bring something up, too, with the Severe Accident Management Guidelines issues.

Back in the `90s, the NRC sponsored some studies looking at the instrumentation and its ability to survive severe accident conditions. And in order to implement some of the Severe Accident Management Guidelines, you need those sensors to work; and, yet, it was recognized back then they'd be beyond their operating envelope.

And I'm wondering -- I'm really hoping that somebody reviews that again, and thinks about it a bit, and ways to improve that instrumentation as they go through and review how these management guidelines are being implemented.

MR. VIRGILIO: That's a very good point. And it's not part of what the near-term group is looking at, but it could be part of what the longer-term review would include. But it is a very good point.

Slide 19 takes you to hardened vents. And

it's, again, tied to that second theme. And to address concerns that we had in the 1989 time frame regarding containment over-pressure during a severe accident, the BWR Mark I plants installed hardened wet weld vents as part of their severe accident guidance strategies.

The vents were not required by regulation, and the implementation followed BWR Owners Group guidelines. And what we know as a fact is that there are differences in the way the designs were handled. In some cases, differences around the number and location of the valves, differences associated with the mode of power for opening the valves, differences associated whether they're rupture disks, whether they're tied to multiple units, how backflow is prevented. So, there's a series of differences.

And I think most importantly, the sequence that we all had in mind at the time was loss of decay heat removal, and not specifically long-term station blackout. Just a fact.

CHAIRMAN ABDEL-KHALIK: The fact that these are not included in regulations means that they're outside your purview. And if it wasn't for the recent interest in hardened vents, and venting of the Fukushima plants, you wouldn't have known the

range of conditions that exist at current plants, would you?

MR. VIRGILIO: Probably not. We did know there were differences, but to the extent that we're starting to see now, I think that's new information to us. I'm not saying that any one design is the right design or the wrong design. I will note, again, that it was never designed for the long-term station blackout. It was there for a specific accident sequence, the loss of decay heat removal.

CHAIRMAN ABDEL-KHALIK: But, again, in retrospect, looking at this specific case, do you think having this as a voluntary response was the right decision to make?

MR. VIRGILIO: Well, said another way, whether we bring this into our regulatory requirements is an issue that the short-term task force is looking at right now.

CHAIRMAN ABDEL-KHALIK: Okay.

MEMBER ARMIJO: Marty, it's my understanding that the Japanese plants did implement hardened vents like our's. Is that correct, or not correct?

MR. VIRGILIO: Well, we're still learning about that, in particular, specifically. One of the

theories around how you had the explosion in Unit 4 without an operating reactor, or even a core in the reactor, is -- and now we know that there has not been significant fuel damage in the spent fuel pool. So, one of the theories is that the hydrogen gas migrated from Unit 3 through some system of piping into Unit 4, and that's the accumulation and combustion. I mean, that's sort of a theory that we're operating with right now.

MEMBER ARMIJO: So, we still don't have sufficient detail on the Fukushima plants, as on the design of their venting systems. Is that -- that's where we are?

MR. VIRGILIO: Right. But we are learning more each day, but I don't think I would -- I would not want to assert that we fully understand all of the design features. We imagine that it got the same variation that we're seeing across the plants.

And there is one theory that the system on at least one of the units is interconnected and not hardened all the way outside of the plant. So, at some point -- it is connected to the standby gas treatment system, so it goes from a hardened vent to a not so hardened vent. That's one understanding, but we haven't verified that yet.

MEMBER ARMIJO: Okay.

MEMBER CORRADINI: If I may just follow-on Sam's point, it kind of connects with John. The way you have this structured, which I think is good, is you're working from the outside in; that is, John's original question to you was do you have a time line and an operator action line? And you're saying you guys have something, but you're kind of still filling in and modifying. And so far, the findings are out here, and you're slowly working your way in. But as you work your way in, this one, in particular, I'd be careful not to -- personally, I'd be careful not to jump the gun because if the equipment isn't there, then you might choose to do something here from a conclusion or a recommendation that may not make sense, given the fact that that design isn't this design, or the operator actions because there was standby gas treatment caused a leakage that wouldn't have occurred here, or whatever.

So, my only thought is, I think the way you've structured the findings when you're working from the outside in is good, but looking ahead, now you're getting to the things that what they have or might not have, what they did or might not have done would really inform and influence your next step,

which is potential conclusions. I guess that's what I'm thinking about.

MEMBER ARMIJO: The details of the design.

MEMBER STETKAR: Well, I think from that sense of outside in, I think you need -- it's time to start working, if you can draw the analogy, from the inside out also, and see where those intersections are.

MEMBER CORRADINI: Because I guess the one thing that -- just an observation, which is that I remember the SAMGs being developed after the IPEs in terms of -- and after going through, essentially, the generic set of things for NUREG-1150, and then asking each of the plants to compare themselves to that with the IPEs for severe accidents. And then trying to decide how you're going to get water in there under various situations due to the symptoms.

It would seem to me that the natural thing here is to ask, as you said, if they're trained but they're not exercised, then who should do the training, who should do the exercise, and who's going to check the normalization of that? That's why I keep on going back to INPO to -- because you have in some sense -- I guess, philosophically, the Agency has, in some sense, given to INPO because of their ability to

do it certain things to look in terms of operation of plants to create some sort of uniformity of safety, and procedures, and training. So, this also is a possibility here.

MR. VIRGILIO: Right. And I think to supplement some of the things that we've been talking about earlier about what's voluntary, and what's not voluntary.

I would say, if we believed, and we over the years, including various Commissions, believed that something was necessary for adequate protection, without hesitation it was incorporated into our regulatory framework through rulemaking, or orders, or a part of a license. So, what we're talking about are things that are beyond what we thought we needed for adequate protection.

Now, that notion of what you need for adequate protection evolves as a function of time and with events like this. So, what we once thought was not necessary for adequate protection may, in fact, become necessary for adequate protection, as a result of our study of these issues.

MEMBER BLEY: Marty, is part of the investigation that the task force is doing going back and looking at our design basis for large external

events for station blackout, for the things that are really beyond design basis that are in our regulations to see if those were thorough and -- the electric power line station blackout especially comes to mind, because you said there was a particular event that that was designed to protect against. And there are many other cases like this, where if you went back and looked, should that design basis have been more broad? Are you looking at that sort of thing?

MR. VIRGILIO: Yes. The short answer is yes. I mean, should we have -- yes, have we considered it in a different way, with a different set of events? Yes.

MEMBER BLEY: And B5B the same thing, we looked at it for one thing, but if we had thought about the other kind of things of that nature that weren't big fire explosion, but could affect us that way.

MR. VIRGILIO: And that's what we're looking at today.

MEMBER BLEY: Okay. And that would be in the longer-term study.

MR. VIRGILIO: Some of it will be in the short-term, as well.

MEMBER BLEY: Okay. If there's anything

you can tell us about some of those, that would be nice. But we can wait for the report and details.

MR. VIRGILIO: Okay.

MEMBER SIEBER: Do you think there's any need to look at Mark I vent systems to determine that they're adequate? Because this is not strictly an SBO problem, this could happen any time; when you have fuel clad oxidation, you generate hydrogen. It also appeared, at least to me from the photographs, that there must have been leaks in the system because the links were destroyed along with the piping.

MR. VIRGILIO: Yes.

MEMBER SIEBER: And it's not obvious that you would get such massive destruction in four units under the circumstances. Do you think that the Staff's efforts would lead to examination of the design of so-called hardened vents at Mark I containments --

MR. VIRGILIO: Yes.

MEMBER SIEBER: -- regardless of its implication to the Fukushima event?

MR. VIRGILIO: Stimulated by the Fukushima event, yes, we're going to go back, and we're going to go look at the hardened vents.

MEMBER SIEBER: Right. And if you found,

for example, that Fukushima did not have hardened vents or they did have leaks, and that's why the buildings blew apart, I would be disappointed if you said oh, that's the reason, we don't have to examine our's.

MR. VIRGILIO: We're still examining our's.

MEMBER SIEBER: All right.

MR. VIRGILIO: But mindful of what was the sequence of events.

MEMBER SIEBER: Right. Because that really didn't help the accident situation.

MR. VIRGILIO: No. As a matter of fact, it contributed to the release.

MEMBER SIEBER: That's right.

MR. VIRGILIO: Slide 20, just shifting now to the third theme, which is Emergency Preparedness.

Our existing EP requirements like when we talked about the B5B, are really a single-unit event. And what Fukushima tells us is that you could involve more than one plant in an event. And all of what we have in EP in terms of staffing, facilities, equipment, dose projections, all this is primarily based on a single-unit event.

Slide 21, EP, and when you think about the

combination of EP and station blackout, there are a number of things, if you have the complete loss of offsite and onsite, and it goes beyond the coping times that we've established, what it makes you realize is that you have threatened communications and other essential functions that are necessary to respond to the event.

In the case of Fukushima, there was a lack of communications between the site and the decision makers. Under our framework and model in the United States, the decision makers for emergency preparedness and evacuation at that point is the states. So, are we comfortable that in that kind of event that we have the communications capabilities to allow the states to initiate the protective actions that they would need to initiate.

And also, KI, potassium iodide. I think that what we observed was a complete misunderstanding about what value it has, and under what circumstances one might want to recommend the use of KI. So, there's a significant issue there with respect to are we properly -- are the decision makers properly trained with respect to when they would call for the use of KI. And I think that's --

MEMBER RYAN: Before you leave that, it

was interesting to me that most of the data that we received, and that's we, the public, and from other sources that are public, doing a lot of sort of dose rate, or exposure rate information, but very little that would give you any insights at iodine or other radionuclide-specific --

MEMBER SIEBER: That's right.

MEMBER RYAN: -- measurements on which you could base estimates of other things. Can you comment on whether you're getting radionuclide-specific data, or is that available? All the newscasts were talking about iodine, and people were running around with survey meters, so that doesn't really add up. But Im trying to figure out what their sophistication is on getting radionuclide-specific information, which is very important to understand a lot of different things.

MR. VIRGILIO: During the accident, in the early days of the accident, we were relying on DOE flyovers for information.

MEMBER RYAN: Exposure rate only.

MR. VIRGILIO: Right. And then following the accident, we were relying on information that DOE, IAEA, and others were doing with ground surveys.

MEMBER RYAN: Again, no radionuclide-

specific data.

MR. VIRGILIO: We do have cesium-137, 134 specific data at specific locations.

MEMBER CORRADINI: That's the NNSA data that's on the web. Right?

MR. VIRGILIO: Yes.

MEMBER RYAN: From sampling, yes.

MR. VIRGILIO: Yes.

MEMBER CORRADINI: But I guess to follow Mike's point here, which I think is very important, because from the standpoint -- I mean, what we really look at is the public wants to know when they can reoccupy their abodes.

MEMBER SIEBER: Homestead.

MEMBER CORRADINI: Right? So, from -- I think to follow on Mike's point, I noticed that the NNSA site stopped on May 13th. And just to follow-on, is there any concerted effort either by IAEA or the Japanese with our federal government assisting to continue to monitor, or even to dissect it further, because that's important.

MR. VIRGILIO: The Japanese Government, it's my understanding, is doing additional monitoring, and they're actually starting to monitor the population, so they're developing the kind of

information that we're going to need for studies later on down the line with respect to the impacts of this accident.

MEMBER RYAN: I mean, even early on with the violent explosions it struck me that God forbid the fuel is damaged significantly, the plume it threw out could be floating around.

MR. VIRGILIO: It was.

MEMBER RYAN: It was. So, that -- and from a radiological impact standpoint, a survey meter doesn't get it.

MR. VIRGILIO: Right.

MEMBER RYAN: You need a lot more than that to understand what your risk profile is at any given time in the sequence of events. So, to bring it back home, are we thinking about those kinds of capabilities within the U.S. to be available, if needed?

MR. VIRGILIO: I think that there's a wide gap between the capabilities that existed in Japan at the time and what we have here in the United States, not to say that we're not going to look again.

MEMBER RYAN: Okay.

MR. VIRGILIO: But I think you have to look at it in that framework.

MEMBER RYAN: Oh, sure.

MR. VIRGILIO: They had no flyover capability. They didn't really have the kinds of capabilities that we would bring to bear here in the United States with respect to emergency preparedness and protective measures.

MEMBER RYAN: Okay.

MEMBER CORRADINI: Just one last thing to follow-on. I figured Mike was going to ask this. There was a couple of meetings in the past, I think we've seen each other at a couple of them where NRDC has done some interesting work, and I think kudos to them they did it, but I'm looking for a dose assessment. And NRCC has actually given testimony and done estimates, and I would expect the federal government or the Japanese in association with IAEA eventually is going to get some sort of dose assessment due to all of this.

Is that in the works, or is that left to the IAEA to do it with the Japanese?

MR. VIRGILIO: The Japanese have to make their own decisions with respect -- for example, we're still -- the Japanese Government is still evacuated 20 miles around the site out to 30 miles to the northwest.

MEMBER CORRADINI: Right.

MR. VIRGILIO: And they have a rationale that's very similar to our protective action guidelines with respect to reentry and return. So, they're doing that monitoring now, and conducting those assessments.

MEMBER CORRADINI: Okay.

MEMBER SIEBER: And I presume that one of the things that is a matter of concern is to make sure that we understand when we issue an evacuation order that we understand what the TEDE dose is, Total Effective Dose.

MR. VIRGILIO: And I think we've just yesterday provided you some additional information on the rationale for the 50-mile evacuation, including information that was derived from our RASCAL runs, our computer model runs --

MEMBER SIEBER: Right.

MR. VIRGILIO: -- as to what the dose might be at certain distances from the site.

MEMBER SIEBER: Yes, I haven't seen that yet, but one of the --

CHAIRMAN ABDEL-KHALIK: We are evaluating -- go ahead, I'm sorry.

MEMBER SIEBER: One of the things I

suspect that wasn't in the RASCAL runs was topography, local meteorology, all that stuff, even source term.

MR. VIRGILIO: Well, no, we did plug in the source term.

MEMBER SIEBER: I know you did, but is it the right source term?

MR. VIRGILIO: Well, it was the best estimate we had at the time. We were looking at the worst case to the best case at the time.

MEMBER SIEBER: Yes, I understand that.

MR. VIRGILIO: But the worst case at the time was you could have possibly had three reactor cores and four spent fuel pools --

MEMBER SIEBER: Right.

MR. VIRGILIO: -- fully involved.

MEMBER SIEBER: I understood what the rationale was. One of the things that is a difficulty for me is that when you make long distance recommendations, you can't possibly get all the information.

MR. VIRGILIO: I understand what you're saying. The topography does have an effect.

MEMBER SIEBER: Right, it certainly does have an effect.

MEMBER RYAN: One kind of detail question

is, how do you take a RASCAL run and -- I mean, surely there's some data available to help calibrate that run. Was any of that done to try and benchmark the calculations to see if the samples that you are taking match the calculations you were making?

MR. VIRGILIO: At one time, we were running both NARAC and RASCAL in parallel. And in a way it benchmarked by using the two different tools.

MEMBER RYAN: They're two different codes, though.

MR. VIRGILIO: Right.

MEMBER RYAN: I'm thinking about -- codes are great, but they are not reality.

MR. VIRGILIO: In the early days we were doing it based -- we were not -- there was no benchmarking on the ground or in the air data. We were making assumptions based on how damaged were the reactor cores and the spent fuel pools, and how much of the inventory could have possibly been released.

MEMBER RYAN: One sample removes an awful lot of confusion sometimes.

MR. VIRGILIO: If we could have gotten the sample --

MEMBER RYAN: When you do the flyovers you could have done airborne air sampling.

MR. VIRGILIO: At the time that -- yes, and I have to go back and look at the time history, but my recollection is the air flyovers didn't start until probably two weeks into the accident.

MEMBER RYAN: That may be a lessons learned right there.

MR. VIRGILIO: Yes.

CHAIRMAN ABDEL-KHALIK: Just for the record, the information that you referred to earlier as to the information you provided ACRS with regard to the 50-mile evacuation zone is a copy of a letter sent from Chairman Jaczko to Senator Webb. Is that correct?

MR. VIRGILIO: That is correct. The attachment to that is -- and we did not want to rework it and create confusion in any way, so we've provided you the letter and the attachment. And if you have additional questions --

CHAIRMAN ABDEL-KHALIK: Well, at this time we are going through the list of questions that were asked during the April 7th briefing by the Staff to ACRS to see which of those questions have actually been addressed by the information contained in that letter, and which information is still outstanding, for which we expect to receive a written response.

MR. VIRGILIO: It would help us to be able

to be responsive to that request for you to illuminate the delta as you see it. What information didn't you get?

CHAIRMAN ABDEL-KHALIK: Okay.

MR. VIRGILIO: And then we can provide that information.

CHAIRMAN ABDEL-KHALIK: Thank you.

MR. VIRGILIO: The end of the presentation was really the focus back on NRC programs. And that's Slide 22. And we operate under a set of principles as an NRC Staff to try to insure that we're consistent, coherent, reliable regulators. We address emerging issues as a function of time by adding specific requirements and endorsing voluntary initiatives where we feel that's appropriate.

This has resulted in variability. We acknowledge that, and that's a fact both with respect to the implementation by licensees, and with respect to NRC's own programs. And we've talked about the EOPs, the SAMGs, and B5B, and some of the other issues, so I won't go through that again.

CHAIRMAN ABDEL-KHALIK: Let me just go back to the issue of Backfit Rule, and the so-called Finality Rule. Is it correct that you say you will reexamine those?

MR. VIRGILIO: Yes.

CHAIRMAN ABDEL-KHALIK: Okay.

MR. VIRGILIO: In particular, I know that the Near-Term Task Force is looking at the Backfit Rule, and the regulatory analysis guidelines, and how we go about assessing whether there is a justification, or a rationale around the cost-benefit arguments, and whether the guidelines are complete.

CHAIRMAN ABDEL-KHALIK: Okay.

MR. VIRGILIO: Slide 23 gets us to Next Steps. Right now, the task force is finalizing its report. And, again, that report will be provided to the Commission on the 12th of July. And it's really a Commission decision as to when that report becomes publicly available, but I would hope that it would be available by the 19th when we have the Commission meeting. That would make the most sense to us, to make sure that the stakeholders have an opportunity to read that report before we have a discussion on it in the open Commission meeting.

Looking further down the line, what the Staff is now contemplating is a workshop probably within 10 days to two weeks after the Commission meeting, so that we can, in fact, have open dialogue with the stakeholders about the content of that

report, about what our findings, conclusions, and recommendations contain.

If you go to Slide 24, the Longer-Term Review, that will -- it's starting today. We're finalizing our charter for the long-term task force, and our thoughts are that it would be -- it would, primarily, be a line, NRC line organization function that would be overseen by a Steering Committee, and that Steering Committee would be constituted of our principal Program Office Directors and Regional Administrators. But it's really work that would be done within the offices, within the line organization.

Say, for example, that the short-term task force says that as part of its conclusions, we need a new rulemaking in a particular area, that would be done through the longer-term effort through the line organizations, but it would be overseen by the Steering Committee.

Another key feature of the longer-term effort is going to be stakeholder involvement. Our thoughts right now as part of the charter, that we're looking at forming some external stakeholder advisory group that would provide input to the process, so that we get their views on which direction we should be headed as a result of the fact-finding and

recommendations of the Near-Term Task Force.

And, finally, I would say that we want to make sure that we're including the ACRS in the longer-term efforts. That's clearly part of the charter that we're developing for the long-term review, is interactions with this body, recognizing that you'll be formulating your own recommendations to the Commission with respect to what activities the NRC ought to be conducting in light of the lessons learned from Fukushima.

MEMBER CORRADINI: Can I ask about that?

MR. VIRGILIO: Sure.

MEMBER CORRADINI: That sounds good. So, from a practical standpoint, what sorts of things are you mulling about in terms of our interaction? I mean, are we looking at just simply -- I guess I'll leave it that way. What are you -- what are some of the things you're envisioning in terms of how we can assist in that regard?

MR. VIRGILIO: I see it coming in two ways. One is that there could be interactions with the Steering Committee at the high level. And then on issues, specific issues, imagine we're working on a rulemaking, then I see that's another opportunity where the ACRS and the NRC Staff has well established

protocols for interaction and communication.

But I think that there would be value, also, in the Steering Committee meeting with you periodically, or myself as the Chair of the Committee meeting with you periodically to give you the overall view of where we're headed, and allow you an opportunity to interact, as well as interacting on each individual issue with the line organization.

MEMBER CORRADINI: Because I guess coming back to -- the reason I asked a question like that is, I'm kind of back to what John was asking relative from the outside in, and then also from a bottoms up and trying to see what's happening. I think a lot of us still have a lot of burning questions that we realize might be too early in the game to evaluate, but I do think some sort of building up of what occurred and the interactions is a way, is one of the things that, at least in my mind, is important.

MEMBER STETKAR: I kind of like that notion of our interacting with the Steering Committee, because I think one of the benefits that this group brings is more of an integrated perspective, because of our multi-disciplinary nature. That once you get into a specific topic, you get focused on rulemaking for a specific topic, you tend to go deep and rather

narrow. And some of these issues might be broader, better discussed at that higher level.

MEMBER SIEBER: Yes.

CHAIRMAN ABDEL-KHALIK: Will the recommendations made by the Near-Term Task Force be prioritized in any fashion in the Near-Term Task Force report?

MR. VIRGILIO: There'll be actions that the task force will recommend we take immediately, and then longer-term actions. For example, if there is a rulemaking or a study, I think there'll be this natural prioritization. If there is an issue that we believe needs to be dealt with sooner, the task force is going to recommend that we go with a bulletin or a generic letter.

So, in a way there is a prioritization. If you were to say that will we prioritize -- if the task force recommends that we work on three or four rules are they going to prioritize those three or four rules? I think not, but we may. I mean, it's just a little bit too soon to tell.

CHAIRMAN ABDEL-KHALIK: And how would you go about doing that prioritization?

MR. VIRGILIO: Impacts on safety.

CHAIRMAN ABDEL-KHALIK: And who will do

that prioritization?

MR. VIRGILIO: It would be the task force as the first cut, and then my office as the second cut, as the EDO's office our responsibility in terms of directing the Staff. And then if you got within an individual program office, we would look to Research, for example, if they were developing the technical basis to give us some insight as to prioritization. But it's going to be principally driven by the impacts on safety.

CHAIRMAN ABDEL-KHALIK: Would the interactions with the Steering Committee -- between the Steering Committee and the ACRS involve the evaluation of such prioritization?

MR. VIRGILIO: We would certainly seek your input, and value your input.

CHAIRMAN ABDEL-KHALIK: Okay.

MR. VIRGILIO: Because, again, I think it comes back to safety, your perception of what impacts it would have on safety.

CHAIRMAN ABDEL-KHALIK: Okay.

MEMBER SIEBER: I have a suggestion with regard to our interaction. I am confident that the Staff can solve problems that they're given in a professional kind of a way, and with the proper

technical expertise. My vision of this very complex situation, though, is that there may end up being pieces that people either downplay or leave out because they don't think that's as important as other pieces of it. And I think that this is where we can assist in trying to call attention to the pieces that people take for granted, or they feel no action is needed and so no analysis, or very little analysis takes place. So, I think participation at this level is a good idea.

MR. VIRGILIO: Thank you. I do, too. I think about the letters we get from the ACRS, and they often point to areas where more emphasis is needed.

MEMBER SIEBER: Right.

MR. VIRGILIO: I think that's a natural function for this group to help us in that regard.

CHAIRMAN ABDEL-KHALIK: Speaking of letters from ACRS, it may be worthwhile to read the March 12th, 1985 letter from ACRS regarding station blackout, particularly the comments added to the letter.

MR. VIRGILIO: Okay. Thank you.

MEMBER REMPE: I had a question about some of the issues that you brought up today about the status of the vessels, the spent fuel pool in Unit 4,

and what occurred or didn't occur. And sometimes, some of that information may not be available unless someone goes in and gets certain pieces of information. And, hopefully, that will be occurring in Japan.

Will NRC be -- do you have any plans to try to interact with our colleagues in Japan to try and influence what information is going to be given?

MR. VIRGILIO: Absolutely. Our team on the ground is doing that on a daily basis. Dave Skeen, who is managing the Headquarters effort for support to the team and I have a phone call with Chuck Casto, the Team Leader in Japan, once, twice, three times a day to make sure that we stay abreast of what new information they're identifying. And we feed that information, as appropriate, back into the Near-Term Task Force. And that information and that flow of information will help inform the longer-term efforts, as well.

MEMBER REMPE: For example, what caused the explosion, I think that --

MR. VIRGILIO: Right. We get insights from the report of the Government of Japan to IAEA. We get insights from the IAEA mission, but the day-to-day insights come from our team in Japan. That's why

it's been so valuable to have Chuck Casto and our team there. They've really provided us with realtime information about what's happening.

MEMBER REMPE: But I know after TMI we actually went into the vessel and took samples, and that type of longer effort, too. Has NRC started thinking about that?

MR. VIRGILIO: Yes. Yes, we have. And a lot of that longer-term -- I mean, eventually, I see our team coming out of Japan. I think when the conditions -- for a lot of reasons.

(Laughter.)

MR. VIRGILIO: But once the reactor is stable and we're comfortable that they have an implementable plan, and the Ambassador in Japan feels that he no longer needs our assistance for helping him with the citizens, the U.S. citizens in Japan, we will exit. But we have bilateral agreements in place, and through those bilateral agreements with the Government of Japan, we will maintain the knowledge that we need to inform the longer-term effort.

It's going to be -- if you look at TMI, I mean, it was 10 years.

MEMBER REMPE: Right.

MR. VIRGILIO: I hope that with robotics

and other things, advances in technology that we have today, that we'll be able to get a look inside the reactor vessel much quicker than we were in the 1980s with TMI. But it's still going to be years.

MEMBER SIEBER: Right.

MR. VIRGILIO: My last slide is the Conclusions. And the expectations for the short-term task force and the rest of the Staff I think are very clear, that if they found an issue that warranted immediate action, that they would bring it forward. And, thus far, that hasn't happened but for the TI where we needed additional information, the bulletin where we needed additional confidence. So, at the end of the day I would have to say that we continue to have confidence in the safety of the U.S. fleet without question.

We're continuing all our licensing activities. We've not stopped. We recognize that at some point in time new requirements will likely be imposed as part of this. But right now, the new reactor licensing, operating reactor licensing programs continue on.

We won't hesitate to make a change if we think it's necessary for adequate protection. And I think that our 35-year history has demonstrated that

over and over again.

And, finally, we welcome and appreciate your input. I know that there were some challenges associated with the way the Near-Term Task Force was structured, and we're trying to work through that. And we'll certainly make sure that the longer-term effort through, as we've talked today, the Steering Committee and through the individual actions will have more interactions with the ACRS.

CHAIRMAN ABDEL-KHALIK: I believe we have scheduled a briefing by the Near-Term Task Force sometime in August. Is that correct?

MR. HACKETT: We have. This is Ed Hackett, ACRS, right now, and Marty and I have been communication by email on this. We're anticipating August 16th for a briefing from representatives of the Near-Term Task Force to the ACRS.

CHAIRMAN ABDEL-KHALIK: Thank you. Are there any additional questions for Mr. Virgilio? Yes, sir?

MEMBER BROWN: Yes. It just occurred to me when you were talking about station blackout, and the two hours, four hours, eight hours coping capability, and from some of the other experience in the meetings, when you ask that question people frequently refer to

yes, we've got eight hours, but we've got the ability to bring in fuel oil, we've got the capability to bring in whatever in order to get us out of that station blackout condition; in other words, diesels ran out of gas, or diesel fuel, or what have you, and you've lost offsite power. But there are environmental circumstances that sometimes prevent that access, as we saw in Japan. And if you look at even some of the environmental circumstances we have in this country relative to flooding, could prevent access by four, two, three, four, five days.

And I guess my question is, is there some thoughts to go back and look at our guidelines for developing those coping strategies to see if they meet some of the experiences that are more pertinent, or at least we're seeing in realtime today?

MR. VIRGILIO: Yes. Without question, we want to insure that onsite they have sufficient equipment, including fuel for the diesels to last as long as necessary. And that's what's under consideration now.

MEMBER BROWN: As long as necessary is the question.

MR. VIRGILIO: Is the question. The other thing I would say is that I don't like to speak for

industry, but I really -- I understand today that one of the initiatives they have underway is to look at staging equipment in various locations around the country, and brining equipment to bear if there were a plant in distress, and if those onsite capabilities were, in fact, exceeded.

And I know that you're going to be speaking to INPO in the near future, and I'll let them speak a little bit, or to whatever extent they want to, about that initiative.

MEMBER BROWN: My understanding in Fukushima is one of the difficulties was the infrastructure destruction was so widespread they had difficulty bringing in additional equipment.

MEMBER SIEBER: Right.

MEMBER BROWN: They couldn't run power lines, they couldn't get trucks in there because there was no way to drive. And they eventually just ran out of power to do anything, whether it's car batteries or what have you, couldn't even recharge them. So, that was the reason for the question. If that's the case, you can stage it all you want to, but if you can't put it on site then that's another difficulty. And I just was hoping we'd go back and look at those to make sure we covered the circumstances where the sort of flood

like we're seeing in the Midwest right now, which has inundated large quantities of acreage, square hundreds of miles, and it's been there for days, many days that limits all kinds of access. So, that's another factor. That's the point of the question.

MR. VIRGILIO: I think there were infrastructure factors, and I also think there were decision making factors. I do believe that there were debates and questions around whether they wanted to accept additional support from outside the site, and from outside the country. We're wired much differently here.

There was a cultural issue around accepting support, I believe. That's my personal opinion now, that you don't have here. I mean, if you look at an event that occurs here, we can look at what's happening at Fort Calhoun and Cooper today. I mean, you have an entire industry rallying to provide support to those two facilities. And they have additional diesel generators, additional fuel, they have everything they need. All they have to do is ask for it.

I think it's a very different arrangement here in the United States.

MEMBER STETKAR: Even at Fukushima though,

Marty, didn't they have -- they airdropped diesel, spare diesels in there sometime within the first couple of days.

MR. VIRGILIO: Not exactly the first couple of days, is my memory. And it was also -- there were also opportunities for them to have better, more reliable sources of water for the core, and for the spent fuel pool.

(Simultaneous speech.)

MEMBER STETKAR: But the point of bringing external -- I don't know the exact time line.

MR. VIRGILIO: And there were things that were brought in from --

MEMBER STETKAR: But they couldn't hook them up is the problem.

MR. VIRGILIO: Right.

MEMBER STETKAR: They couldn't connect them.

MR. VIRGILIO: Right.

MEMBER STETKAR: But in terms of outside support, it might not have been quite as dire as was presented. You can bring things in, but if you can't connect --

MR. VIRGILIO: Yes. I think the situation in this country with respect to manpower and supplies

is going to be very -- it would have been very different than what occurred there.

CHAIRMAN ABDEL-KHALIK: Are there additional questions to Mr. Virgilio? Okay. Thank you very much.

MR. VIRGILIO: Thank you.

CHAIRMAN ABDEL-KHALIK: At this time, our schedule calls for us to get into a public comment period. And our first public speaker is Ms. Diane Curran.

MS. CURRAN: Good afternoon.

MS. CURRAN: Dr. Abdel-Khalik and Members of the Subcommittee. I very much appreciate the opportunity to talk to you this afternoon. I hope you all have a copy of the letter that I sent out yesterday on behalf of a significant number of environmental organizations, civic organizations, and individuals who are neighbors of nuclear reactors that are either existing or proposed.

We also submitted to you the emergency petition that these groups filed with the Commission in mid-April seeking suspension of all NRC licensing decisions pending evaluations of the lessons of the Fukushima accident, and the supporting declaration of Dr. Arjun Markhijani.

Dr. Markhijani would have liked to be here this afternoon. He had to go out of town, and he'd be very happy to come and talk to you at another time.

I also have with me today Dr. Edwin Lyman from the Union of Concerned Scientists who did not participate in the emergency petition, but I would like to give him a few minutes of my time to just supplement what I have to say to you this afternoon.

CHAIRMAN ABDEL-KHALIK: That would be fine.

MS. CURRAN: Okay. What I'd like to focus on today, I'm a lawyer, I'm not a nuclear engineer, but I worked with them, and I've been representing citizens groups in NRC licensing and enforcement cases for about 30 years. And I'd like to talk to you about the law and your responsibilities and authorities under the law, which I think have a potentially very important role to play in assessing and dealing with the lessons of the Fukushima accident.

I think you heard Mr. Virgilio's very last slide, said that the NRC is going on with its licensing decisions as though Fukushima had not happened. As a matter of fact, within weeks, one or two weeks after the Fukushima started, the NRC issued a license renewal decision for a reactor of virtually

identical design as the Fukushima reactors. That's the Vermont Yankee reactor, which my clients found absolutely appalling, just very, very difficult to understand.

Since then, the NRC has relicensed the Palo Verde reactor. The NRC has recently announced that it is going ahead with reissuance of the Generic Environmental Impact Statement for license renewal, which includes findings that spent fuel storage in high-density spent fuel pools poses no significant risk to public health or the environment. No consideration of what might have been learned from the Fukushima accident.

So, the question is, is anybody going to put the brakes on this process and make sure that licensing decisions, prospective licensing decisions of which there are at least 22 before the NRC, have the benefit of an understanding of what are the regulatory implications of this accident, this very serious accident. And I think in Mr. Virgilio's presentation today, you heard a great deal of significant information about how our concept of what constitutes a design basis accident is changing. That is absolutely critical to the licensing decisions that the NRC has to make for license renewal, new reactors,

design certifications.

What is the design basis? What's the difference between what should be required, and what's voluntary? You heard Mr. Virgilio say until the Fukushima accident, nobody in the NRC was paying too much attention as to how some of these voluntary measures were being carried out. Even now, right in the aftermath of the Fukushima accident, you also heard members of the NRC Commission telling the public we shouldn't worry about Fukushima, because we have measures in place to prevent that kind of an accident.

So, there's a tremendous amount of upheaval going on in terms of what ought to be required in a license. None of that has been resolved. No one has the answers to that yet. And we're here to submit to you that you have no way of carrying out your statutory responsibility to approve the issuance of new licenses, which is what you do. You sign off on them. Your report is required by federal statute, not just NRC regulations, Congress has given you the responsibility to make findings about the hazards posed by any new or relicensed nuclear reactor, or design certification rule.

And I just want to talk to you a little bit about why that's important. The NRC has decided

as a policy matter that the juncture that we're at with respect to these 22 reactors and design certification rules is not terribly important from the perspective of incorporating the lessons of the Fukushima accident, because those lessons can be incorporated later, and imposed as the NRC goes along. So, why not go ahead, issue these licenses, and then if something comes up, impose it in hindsight?

There's a couple of significant problems with that. The first one is that at this juncture, at the licensing juncture, the NRC is at the acme of its responsibility to justify its decisions. It doesn't get any greater than right at the licensing juncture. The NRC and the applicant have a burden of affirming that a proposed nuclear reactor operation poses no undue risk to public health and safety. And, also, the Agency has the responsibility to analyze the environmental risks, which go beyond just compliance with the regulations, but also include compliance with the regulations.

So, those have to be affirmative findings made at the time of licensing. That's also what you are doing at the time of licensing. You're analyzing are the requirements for this operation adequate; the requirements of the license, and also the requirements

of the regulations that have to be met as part of the licensed activity. And what you heard today was the NRC is not sure that the regulations are adequate.

We know the Station Blackout Rule did not consider external events, seismic events, floods, didn't consider that, so how can you make a decision that the issuance or renewal of a license for a new or existing reactor can be done safely, when you know that the Station Blackout Rule on which these operations rely is inadequate to deal with the kind of phenomenon that happened at Fukushima?

We submit to you, you haven't got the information that you need to carry out your responsibility under the law. And just as the ACRS did in 1956, when the Fermi license was proposed for the sodium-cooled reactor, the ACRS at that time said to the NRC you do not have enough information to license this reactor. And the NRC took that recommendation and made it non-public, didn't discuss it with the public, and ignored it.

So, don't let that happen here. You have the power, and you have the responsibility to say to the NRC we will not go along with the issuance of a license and then retrospectively add regulations out of the NRC's discretion, or add new enforcement

measures.

You heard about the B5B measures today. They started out as an enforcement measures. They weren't regulations. So, the ACRS had no say about those B5B measures when they were first proposed. They were imposed in enforcement letters against each licensee. You had nothing to say about that.

So, if the NRC is allowed to take actions in the context of retrospective enforcement actions, the ACRS has no authority to say that's not enough. You didn't look at this event, or that event. You should have done more. This isn't safe.

The licensing juncture is your opportunity, and your statutory responsibility. The other factors that make this juncture very important are that as we see with the severe accident mitigation measures, some measures the NRC imposes are voluntary. You don't get a say about that either.

And, also, as was stated here this morning, or this afternoon, each plant is different. So, there may be a regulation that is proposed that isn't adequate for the circumstances of a particular plant, such as a plant that's particularly vulnerable to flooding. So, if you don't make a finding about a particular proposed license now, you've lost your

opportunity do it later in the context of a proposed regulation.

I'd also like to just remind you of the history of the last major accident, radiological accident to which the NRC responded in a significant way, was the Three Mile Island accident. The NRC waited a year and a half after that accident to make any licensing decisions. During that time, hearings were not all suspended, hearings went on on issues that didn't have to do with the Three Mile Island accident, but no single license was approved until the NRC had completed its study of the lessons learned from the Three Mile Island accident.

That's what ought to be happening here today. And that's what we've asked the NRC Commissioners to do, and they have not responded to our request. The ACRS, as the independent agency, Congressionally created agency with the power to make recommendations, and to withhold recommendations from the Commission, we think has the authority and the responsibility to insure that that kind of care is taken with licensing decisions that are before the NRC today. Thank you.

CHAIRMAN ABDEL-KHALIK: Thank you. Are there any questions for Ms. Curran? Thank you. I

believe you had yielded some of your time to --

MS. CURRAN: Yes, to Dr. Lyman.

DR. LYMAN: Thank you. I appreciate the opportunity to make two brief comments. The first, we think there is a disconnect between the NRC's conclusion that there's no safety issue with the plants in the United States today that's been revealed by what happened in Fukushima. And there's a disconnect between that conclusion, and the findings with regard to the B5B measures, and the SAMG implementation.

The guidance for the B5B measures is public. It was not public until about a month ago. And I would just advise the Committee, if you haven't looked at that guidance to see what the B5B measures were actually intended to do, because the limitations of the guidance really indicate that even if the guidance was met to the letter, that those measures would not be adequate to cope with some of the situations that were encountered in Fukushima.

One example is, the guidance of the B5B says we can't possibly contemplate every possible accident that could occur, so we wanted the licensees to be flexible. But, as a result, there is a lack of specificity in that guidance. For instance, it does

not -- it says you don't have to worry about accessibility issues, or whether you can actually implement some of these measures realistically given the conditions before it actually happens. That that assessment will be made after the accident, and then you decide whether they can be implemented or not.

So, the licensees were not actually required to look at specific scenarios to evaluate the radiation levels that might occur in various parts of the plant where access might be required. That simply isn't required by the B5B. So, to take any credit for them at this point is questionable.

The second point I wanted to make, in the discussion of voluntary measures versus backfit, I want to point out one specific case study, which I think might shed some light on this issue. I've spoken to this Committee at least twice on Generic Safety Issue 189, which was the need for additional backup power for hydrogen igniters, ice condenser and containments.

Around 2000, the Office of Research recommended that backfit was appropriate for providing additional backup AC power to the hydrogen igniters because in the event of a station blackout, the risk of core damage and containment failure was very high.

And the backfit analysis did show that this was cost beneficial. The rule was never actually -- there was never a rule implemented to carry out that request.

Now, why did that happen? It turns out that the industry volunteered to add AC power, backup emergency diesel generators to power the igniters, again, as a voluntary measure. And the NRC redid the cost-benefit calculation, except the baseline was now the voluntary measures. And they found that if you assume the voluntary measures were in place that the additional requirement was no longer cost beneficial.

That seems to me -- I think that that was a violation of NRC's procedures. It's never been adequately explained. I don't know if there's been any other case where they've actually used voluntary measures as a baseline for doing the cost-benefit analysis, but I think if you analyze that case, it might shed some light on NRC's approach to voluntary measures versus requirements. That's all I have to say. Thank you.

CHAIRMAN ABDEL-KHALIK: Thank you, Dr. Lyman.

MEMBER ARMIJO: I have a question for Dr. Lyman. Dr. Lyman, are you party to this petition that Ms. Curran submitted?

DR. LYMAN: No, we're not.

MEMBER ARMIJO: You're not, so you're just --

DR. LYMAN: Yes.

MEMBER ARMIJO: Other issues you wanted to raise.

DR. LYMAN: That's correct.

MEMBER ARMIJO: Then I have a question for Ms. Curran that I'd like to ask.

CHAIRMAN ABDEL-KHALIK: Is Ms. Curran still here? Please go to the microphone.

MEMBER ARMIJO: Yes. We just received the document, at least I did, I think most of the members just received your document, and I just want to make sure I understand. You're requesting that we do two things, that we suspend our reviews of operating licenses, license renewals, design certifications until the issues and regulatory implications of Fukushima are understood. And you're also requesting that we reevaluate recommendations we've made previously that haven't gone through the entire licensing process, and perhaps withdraw that. Is that really what you want us to do because of Fukushima?

MS. CURRAN: That's right.

MEMBER ARMIJO: Okay. That's very clear.

So, the answer is yes?

MS. CURRAN: Yes.

MEMBER ARMIJO: That's what you would -- you're requesting. Okay. Thank you.

CHAIRMAN ABDEL-KHALIK: Thank you, Ms. Curran.

At this time, our next speaker is Mr. Paul Gunter.

MR. GUNTER: Should I take the front, or is the --

CHAIRMAN ABDEL-KHALIK: Yes, please.

MR. GUNTER: Okay. Thank you. My name is Paul Gunter, and I'm Director of Reactor Oversight at Beyond Nuclear. We're a public interest group here in Tacoma Park, Maryland. And I thank you all for the opportunity to briefly address you today.

I wanted to take us back to a much more fundamental level of public concern. We discussed the hardened vent, but I think that much more at the foundation of this problem is the recognition of the Mark I pressure suppression system. And when we talk about the whole idea of the evolution of thinking, and the maturity of thinking, I hope we can remember and give credit to people like Dr. Stephen Hanauer, who on September 20th, 1972 wrote a memo that encouraged the

Atomic Energy Commission to discourage all further use of the Mark I pressure suppression system.

And the response to Dr. Hanauer from Joseph Henry is quite controversial. I'm sure it's all a part of your awareness that a political decision was made, an economical decision was made. And, in fact, 16 Mark Is were issued operating licenses after Dr. Hanauer's warning, and three additional construction permits were issued by the Atomic Energy Commission following the advisement to discourage all further use of the Mark I.

Again, which brings us to this more fundamental issue about the whole idea of defense-in-depth. And our concern here is that containment has always been viewed as an essential and fundamental part of defense-in-depth. And that's backed up by the General Design Criteria 16, which basically says you shall have, essentially, leak-tight containment.

Now, I think that at least in terms of the public's understanding, there is a difference, or should be recognized a difference that a containment improvement program legitimately should seek to restore that containment to its licensed condition. And what we have now in this whole evolvement is a deliberate plan to compromise that criterion to save

the component for much longer-term view. But what was then instituted as a fix for a fundamentally flawed design, as Dr. Hanauer pointed out, was to compromise the essentially leak-tight criterion with the installed vents.

And it's our concern now that that experiment has demonstrated to be a failure. And we also understand that at least it's been discussed in the media that there is a tug-of-war going on within the Agency of those within the Agency that view containment as paramount, and those who view the issue of venting as paramount. And what we would like to see is that your body host that debate here in a public forum, and with your expert eye on this very fundamental issue right now.

So, when we talk about maturity of thinking, we have to consider that the warning was issued early on, and that containment was what was advised. And that as you've recognized, the venting system that was installed was put in under 10 CFR 50.59, this voluntary initiative, which said that the issue of installing this vent would not raise a safety issue above a minimum level.

I think that that's now been -- that's gotten a full airing now, that, in fact, the vent may

very well have complicated the accident. So, what we would like, again, in closing is that we'd like to see that debate on containment versus venting here before the ACRS. And we'd also like the ACRS' support that any further modifications, changes, or experiments to this controversial containment not be conducted by order or by voluntary initiative, but be given -- give the public its due process through full hearing rights to independently assess and participate in any further changes, tests, or modifications to the Mark I. Thank you.

CHAIRMAN ABDEL-KHALIK: Thank you, Mr. Gunter. Are there any questions for Mr. Gunter? Thank you.

The next speaker is Mr. Zeller. Is Mr. Zeller available?

MR. GUNTER: He's on the phone.

CHAIRMAN ABDEL-KHALIK: Okay.

MR. ZELLER: I'm here.

CHAIRMAN ABDEL-KHALIK: Mr. Zeller?

MR. ZELLER: Yes, I'm here.

CHAIRMAN ABDEL-KHALIK: Please go ahead.

MR. ZELLER: Thank you. Thank you, Dr. Abdel-Khalik.

On behalf of the Blue Ridge Environmental

Defense League, I make the following comments, which I've also emailed to your offices there in Rockville. I appreciate the Subcommittee's purpose of gathering information and formulating possible actions by the full Advisory Committee on Reactor Safeguards regarding the nuclear disaster at Fukushima.

I hereby enter into the record the document plant-specific safety review of German nuclear power plants in light of the events at Fukushima, the German Reactor Safety Commission's report, which informed the decision to phase out nuclear power.

Following the March 11 th earthquake and tsunami which caused Japan's Fukushima continuing disaster, Germany announced it would phase out all 17 of its nuclear power stations by 2022, and generate electricity from other sources. That decision was based on sound technical and legal bases.

The sequence of events, briefly, is as follows. March 17, less than a week after the earthquake, German Chancellor Angela Merkel spoke about the ongoing situation saying, "We cannot and must not simply return to business as usual when, as we have seen in Japan, the apparently unthinkable happens, the absolutely improbable becomes reality,

the situation changes. And, if in doubt, to come down on the side of safety."

Merkel pointed out that Germany's Atomic Power Act provides a legal basis for the temporary shutdown of older nuclear power plants. That day, also in reference to events at Fukushima, German Bundestag called upon the German Federal Government to conduct a comprehensive review of the safety requirements for German nuclear power plants, which would -- addressing the safety of the cooling systems, external infrastructure, as well as other extraordinary damage scenarios.

The Federal Environment Ministry ordered the Reactor Safety Commission, or RSK by its German acronym, to develop a plan to review the safety status of 22 operating nuclear power plants with regard to beyond design basis events.

On March the 30th, at a news conference Rudolf Wieland, the Reactor Safety Commission head, said Japan's safety experts had "clearly underestimated the consequences of natural disasters" on its nuclear reactors. The implications, Wieland added, were that Germany would revisit whether its reactor program provided adequate protection from terrorism, plane crashes, and earthquakes, even though

seismic activity in Germany is minor compared to Japan. Also, the impact of power failures longer than a few hours duration would be studied.

Germany's Environment Minister said the safety study would form the technical basis for political decisions expected in June.

On May 20, the Reactor Safety Commission issued its report, a few of the highlights. The RSK's determination of robustness was based on both deterministic criteria, as well as probabilistic criteria with regards to sources of failure at Fukushima. They said it's not possible to judge whether this was due to inadequate organizational structures, accident management procedures, or insufficient numbers of personnel due to the effects of the tsunami event, or other influences.

Regarding flooding, the RSK recommended plant safety be evaluated for longer lasting floods. Regarding earthquakes, information provided by the German Research Center for Geosciences in Popstan found that more recent curves are available for a determination of the probabilities that seismic acceleration loads may be exceeded at concrete sites. The RSK considers a discussion of this topic necessary.

Regarding backup of electric power supply with German nuclear power plants, the RSK found them more robust than at Fukushima with additional sources and emergency generators protecting against external impacts. However, the RSK recommended additional proof to confirm effectiveness of electric grid connections. Further, the Commission said that all licensees of pressurized water reactor and boiling water reactor plants have provided details about battery capacity. The information about the discharge times of the batteries is, so far, mostly insufficient.

The Reactor Safety Commission found other uncertainties, they said. However, in the opinion of the Commission, the precautionary measures to prevent load crashes in the area of primer systems and the fuel pool, which are also footed on administrative measures require further in-depth examination with regard to their consequences.

Regarding station blackout and accident mitigation measures, the Commission found the system needed further development. They said availability of three phase alternating current is a necessary prerequisite for the majority of the measures by which vital functions can be insured.

Against this background, accident management concepts should be developed further so that in a postulated station blackout, the supply of three phase alternating current can be reestablished with a plant-specifically determined grace period.

The Commission report concludes, "It follows from the insights gained through Fukushima with respect to the design of these plants that regarding electricity supply and the consideration of external flooding events, a higher level of precaution can or should be ascertained for German plants." The RSK recommended further analyses and safety measures based on the results of this plant-specific review.

And on May 30, Chancellor Angela Merkel announced Germany would decommission all 17 of its nuclear power plants by 2022.

The responsibility of the ACRS has already been alluded to. As you know, the U.S. Nuclear Regulatory Commission has undertaken its own review. On June the 21st, Chairman Jaczko said, "I believe there is a likelihood that the Agency will need to make some changes, although it is too early to say right now precisely what those changes might be. On the global front, this is truly a global issue. The real question is where to go from here."

The Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards has responsibility to fulfill its mandate, and provide independent assessment under the Atomic Energy Act implementing regulations.

I believe it's the duty of the Advisory Committee on Reactor Safeguards to provide the guidance to the Chairman he plainly needs for a thorough reassessment of the commercial nuclear power plant program in the United States, including the possible phase-out of all commercial nuclear power plants in the United States.

I have sent the longer form of my remarks this afternoon, and I appreciate the opportunity present these remarks. Attached to my letter there is the report, the German report, at least the introduction to it, to which I referred to during these remarks.

CHAIRMAN ABDEL-KHALIK: Thank you, Mr. Zeller. Are there any questions for Mr. Zeller? Thank you very much.

Are there any additional comments that members of the Committee would like to make?

MEMBER BLEY: Not at this time.

CHAIRMAN ABDEL-KHALIK: Okay. Are there

any other members of the public who wish to make a comment to the Committee who are currently present in the room? Okay.

MR. HIXSON: Can I come up to the microphone?

CHAIRMAN ABDEL-KHALIK: Yes, please.

MR. HIXSON: Good afternoon. My name is Lucas Hixson. I'm a Nuclear Researcher, and I've been gathering information on state-level departments in regards to the radiation detection and emergency planning guidelines.

To my knowledge, there's been little to no effort at the federal level to reach out to state organizations for input. By far, the most glaring issue that was expressed was the lack of information and coordination between federal and state organizations. The main difficulty was determining the most reliable source for the data, and who had the most up-to-date information. Another concern at the federal level was to not implement the National Response framework for the Japanese incident.

Many people would argue that a perceived public health emergency is, in fact, a public health emergency, and the NRF should have been activated. Because the NRF was not activated, there was no lead

federal agency identified, and no framework for coordination between the responding federal agencies.

Without a clear leader in the federal government providing information to the citizens and to the state radiation control programs, the public's perception in many cases was that the government was being secretive, and withholding information.

There was not a single reliable source of information state agencies could access to get information, data, plant status, or public information during the first days through the first weeks of this incident.

It was very difficult to ease the anxiety levels and calm the fears of the public with no real technical basis for these assessments as to the amount of radiation in drinking water and milk that the public was coming into contact with.

In regards to the DOE flyovers, the DOE began putting up the information and data from flyovers on their CN website at the outset of the response. Within days, that information was removed and was not made accessible to state radiological assessment staff. As the DOE continued to collect data over the next few weeks and months, that data was also not made available to the state agencies.

That concludes my comments. Thank you.

CHAIRMAN ABDEL-KHALIK: Thank you very much. Are there any additional comments from any members of the public? Thank you. Hearing none, are there any comments from members of the Committee? Mike?

MEMBER CORRADINI: No, I was putting on my glasses.

(Laughter.)

CHAIRMAN ABDEL-KHALIK: At this time, the meeting is adjourned.

(Whereupon, the proceedings went off the record at 3:20 p.m.)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Briefing to the Advisory Committee on Reactor Safeguards on the NRC Task Force and Actions Following the Events in Japan

Martin J. Virgilio
Deputy Executive Director for Operations
June 23, 2011

Agenda

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **NRC Actions to Date**
- **Reports**
  - **Japanese Government to the IAEA Ministerial Conference on Nuclear Safety**
  - **IAEA International Fact Finding Expert Mission**
- **NRC Task Force Actions and Longer Term Review**

Status of the 6 Daiichi Units

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Date of Event**
  - **Units 1-3 were in operation**
  - **Units 4 was completely defueled**
  - **Units 5-6 were in cold shutdown with the reactor head installed and torqued**
- **CURRENT**
  - **Units 1–3 in a static condition**
    - **Temperatures relatively stable with adequate injection through feedwater**
  - **Units 4 was completely defueled**
  - **Units 5 and 6 in cold shutdown**

Actions to Date

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Information Notices**
- **Temporary Instructions (TIs)**
- **Bulletin 2011-01, "Mitigating Strategies"**
- **Continued international interactions**

Japanese Report to the IAEA

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Report provides extensive information and will enhance our understanding of the event**
- **NRC preliminary review indicates that nothing in the report calls into question the safety of operating U.S. reactors**

IAEA Expert Mission Report

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Fact Finding Mission**
  - **May 24 – June 2**
- **Identified Lessons Learned**
- **Areas of Assessment**
  - **External Hazards**
  - **Severe Accident Management**
  - **Emergency Preparedness**
- **15 Conclusions/16 Lessons**

Tasking Memorandum and Charter

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Tasking Memorandum/COMGBJ-11-002**
  - **NRC Actions Following the Events in Japan**
- **Task Force Charter**
  - **Formulate recommendations for near-term action**
  - **Identify a framework and topics for longer-term review**
  - **Provide Report in July 2011**

Task Force Actions

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Discussions with NRC staff on technical topics**
- **Site visits**
- **Developing background and evaluation of focus areas**
- **Reviewing results of TIs**
- **Reviewing input from various stakeholders**

Areas of Focus

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Using defense-in-depth approach**
  - **Protection**
  - **Mitigation**
  - **Emergency preparedness (EP)**
- **NRC programs**

Themes

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Protection of equipment from the appropriate external hazards is a key foundation of safety**
- **Mitigation equipment and strategies that prevent core or spent fuel damage provide additional defense-in-depth**

Themes (Cont'd)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **EP provides further defense-in-depth by minimizing public dose should radiological releases occur**
- **Principles of Good Regulation promote a consistent, coherent, and reliable regulatory framework**

Protecting Safety Equipment From Natural Phenomena

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Protection of equipment from the appropriate external hazards is a key foundation of safety**
- **Rules and guidance have evolved**
  - **State of knowledge of hazards**
  - **State of the art of analysis methods**

Protection From Natural Phenomena (Cont'd)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Plants have different licensing bases and associated safety margins**
- **Regulatory initiatives to address vulnerabilities**
  - **Plant specific actions have enhanced margins without necessarily changing the design basis external hazards**

Mitigating Long-Term Station Blackout

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Mitigation equipment and strategies that prevent core or spent fuel damage provide additional defense-in-depth**
- **Long-term SBO**
  - **Requires multiple concurrent equipment failures**
  - **Can result from beyond design basis external events**

Coping with SBO

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Current requirements do not address common cause failure of all onsite and offsite AC power sources and distribution**
- **Current coping requirement assumes near-term restoration of AC power**

10 CFR 50.54(hh)(2)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **10 CFR 50.54(hh)(2) requires mitigation capability for large fires and explosions**
- **Capability could be useful for other events such as long-term SBO, if available**

Availability of 10 CFR 50.54(hh)(2) Equipment

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- Equipment may not be protected for other initiating events
- NRC inspections revealed deficiencies in:
  - Maintenance/availability of equipment
  - Procedures
  - Training

Severe Accident Management Guidelines (SAMGs)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **SAMGs address plant response during a severe accident to:**
  - **Terminate core damage progression**
  - **Maintain containment integrity**
  - **Minimize radioactive releases**
- **Spent fuel cooling not included**
- **SAMGs were implemented as a voluntary initiative in the 1990s**

Hardened Vents

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Provided to protect BWR Mark I containments from overpressure during a severe accident**
- **Implemented at all Mark I plants following Generic Letter 89-16**
- **Not included in regulations**
- **Plant-specific designs varied**

Emergency Preparedness

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **EP provides further defense-in-depth by minimizing public dose should radiological releases occur**
- **Existing EP requirements focus on single-unit events**
  - **Staffing, facilities, equipment, dose projection capability**

Emergency Preparedness (Cont'd)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Challenges during long-term SBO**
  - **Emergency notification**
  - **Communication**
  - **Data transmission**
- **Public and decision maker knowledge of radiation safety principles**

NRC Programs

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Principles of Good Regulation promote a consistent, coherent, and reliable regulatory framework**
- **Past agency decisions for beyond design basis events have led to variability in licensee and NRC programs**

Next Steps

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Near-term task force will recommend actions and topics for longer-term review**
- **Task force report will be provided to Commission in July in a notation vote paper**
- **July 19, 2011 Commission meeting**

Longer Term Evaluation

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Steering Committee**
- **Will address areas identified by near-term task force**
- **Applicability of lessons to other licensed facilities**
- **Engage internal and external stakeholders**

Conclusions

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- **Continuing confidence in safety of U.S. fleet**
- **We are continuing with license renewal and new reactor licensing activities**
- **We will not hesitate to make changes to our regulatory and oversight activities, as appropriate**
- **We welcome and appreciate ACRS input**

June 22, 2011

Dr. Said Abdel-Khalik, Chair
Advisory Committee on Reactor Safeguards
Fukushima Subcommittee
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: ACRS Role in Review of NRC Licensing Decisions Post-Fukushima

Dear Dr.Abdel-Khalik:

We are representatives of organizations and individuals who are neighbors of existing or proposed reactors in the U.S. and who are extremely concerned that the radiological accident at the Fukushima Daiichi nuclear reactors and spent fuel pools has revealed significant unaddressed safety risks in the operation of existing and proposed U.S. nuclear power plants. Our emergency petition to suspend all U.S. Nuclear Regulatory Commission ("NRC") licensing decisions (including new reactor license issuance, renewal of existing reactor licenses, and design certifications) pending the NRC's evaluation and application of the lessons learned from the Fukushima accident has been before the NRC Commissioners since April 18, 2011.[1]

As discussed in detail in the expert declaration by Dr. Arjun Makhijani which supports our Emergency Petition, the Fukushima accident has raised many questions about the adequacy of NRC regulations and operating license terms to ensure that new and renewed reactor operations do not pose unacceptable risks to public health and safety and the environment.[2] We also note that the Advisory Committee on Reactor Safeguards ("ACRS") itself and its Fukushima Subcommittee have raised many questions that have yet to be fully answered by the Staff.[3]

As you are aware, under Section 29 of the Atomic Energy Act ("AEA"), 42 U.S.C. § 2039, the ACRS has the authority and the responsibility to evaluate the "hazards" of all proposed reactor operations before the NRC may issue or renew a license. We respectfully submit that, in light of

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[1] Emergency Petition to Suspend All Pending Reactor Licensing Decisions and Related Rulemaking Decisions Pending Investigation of Lessons Learned from Fukushima Daiichi Nuclear Power Station Accident (April 16-19, 2011) ("Emergency Petition"). The Emergency Petition is supported by the Expert Declaration of Dr. Arjun Makhijani of the Institute for Energy and Environmental Research (submitted April 19, 2011) ("Makhijani Declaration"). The Emergency Petition and Makhijani Declaration are attached and are also available online at http://www.nuclearbailout.org.

[2] Dr. Makhijani was not able to attend this meeting because he is away on business that was scheduled before the notice of this meeting was posted in the Federal Register on June 14, 2011. He has informed us, however, that he would be happy to meet with the ACRS Subcommittee at a mutually convenient time.

[3] Transcripts of ACRS meeting on April 7, 2011 and ACRS Fukushima subcommittee meeting on May 26, 2011.

the questions raised by the Fukushima accident regarding reactor safety and environmental risks, the ACRS currently lacks an adequate factual basis on which to make its statutorily-required evaluation of the "hazards" posed by proposed or existing reactors prior to licensing or relicensing. *Id.* Therefore we are writing to urge you to delay issuing your opinion regarding the hazards of all proposed nuclear reactor operations and design certification rulemakings until you have enough information to make a reasoned analysis. We also urge you to revoke your previously-issued opinion letters with respect to all licensing decisions that have not yet been made because any licenses issued from this point should incorporate the lessons learned from Fukushima. Not only would these actions enhance reactor safety, they are also necessary to enable the ACRS to fulfill its statutory duties under Sections 29 & 182b of the AEA, 42 U.S.C. §§ 2039 and 2232b respectively.

Factual Background

Fukushima Accident

On March 11, 2011, a massive accident began in the six-unit nuclear power plant at the Fukushima Daiichi complex in Japan. The accident involved the reactors and the spent fuel pools at all four reactors and led to radiation releases that are now acknowledge by the Japanese authorities to warrant a Level 7 rating on the international scale, the same rating assigned to the Chernobyl accident. *See* http://www.iaea.org/newscenter/news/2011/fukushima120411.html Three months later accident conditions persist: while the NRC has reported that the situation has improved significantly to the point of being "static," it believes that "full stability might be several months away." Transcript of June 15, 2011, Task Force Briefing at 5.

NRC Response

In response to the Fukushima reactor accident, the NRC announced the formation of a "senior level task force to conduct a methodical and systematic review" of NRC processes and regulations. COMGBJ-11-0002, Memorandum from Chairman Jaczko to Commissioners, re: NRC Actions Following the Events in Japan (March 23, 2011). The purpose of the task force is to "determine whether the agency should make additional improvements to our regulatory systems and make recommendations to the Commission for its policy direction." *Id.*

The Commission instructed the task force to undertake both a near-term review and a longer-term review. For the near-term review, the Commission required the task force to evaluate issues "affecting domestic operating reactors of all designs" in areas that include "protection against earthquakes, tsunamis, flooding, and hurricanes; station blackout and a degraded ability to restore power; severe accident mitigation; emergency preparedness; and combustible gas control." *Id.* at 1. The Commission instructed the task force to complete the report in 90 days. In the meantime, the task force was instructed to provide a 30-day "quick look report" and another "status" report in 60 days. *Id.*

The Commission directed the task force to begin a "longer term" review "as soon as NRC has sufficient technical information from the events in Japan with the goal of no later than the completion of the 90 day near term report." *Id.* at 2. The longer-term study should "evaluate all technical and policy issues related to the event to identify additional research, generic issues, changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be conducted by the NRC." *Id.* For the longer-term effort, the Commission instructed the task force to "receive input from and interact with all key stakeholders." *Id.* The Commission specified that within 60 days after commencing the longer-term study, the task force should "provide a report with recommendations, as appropriate, to the Commission." *Id.* The Task Force was established in early April.

The Commission also directed the ACRS to evaluate and report on the Task Force's final report. *Id.* at 2.

Emergency Petition

In its various memoranda related to the Fukushima accident, the NRC Commissioners took no steps to ensure that imminent reactor licensing decisions would be informed by the new and significant information revealed by the Fukushima accident. Instead, soon after the accident began, the NRC renewed the operating licenses for two reactors, Vermont Yankee and Palo Verde. The Commission's decision to renew the Vermont Yankee reactor license was especially astounding, in light of the fact that the Vermont Yankee reactor has a design that is virtually identical to the reactors that failed in the Fukushima accident.

Therefore, between April 14 and 18, 2011, a total of 45 groups and individuals from across the U.S. submitted an Emergency Petition to the NRC Commissioners, asking the NRC to comply with the AEA and the National Environmental Policy Act ("NEPA") by halting all licensing decisions pending completion by the NRC's Task Force of its investigation of the near-term and long-term lessons of the Fukushima accident and the issuance of any proposed regulatory decisions and/or environmental analyses of those lessons. Licensing decisions that should be suspended include license renewal decisions for six existing reactors (Columbia, Davis-Besse, Diablo Canyon, Indian Point, Pilgrim, and Seabrook); 13 new reactor construction permit/operating license decisions (Bellefonte Units 3 and 4, Bell Bend, Callaway, Calvert Cliffs, Comanche Peak, Fermi, Levy County, North Anna, Shearon Harris, South Texas, Turkey Point, Vogtle, and William States Lee); and an operating license decision (Watts Bar Unit 2). In addition, the petition asks the NRC to halt proceedings to approve the standardized AP1000 and ESBWR reactor designs.

The Emergency Petition also asks the Commission to suspend all proceedings with respect to hearings or opportunities for public comment on any reactor-related or spent fuel pool-related issues that have been identified for investigation by the NRC's accident investigation Task Force. In addition, the Petitioners ask the NRC to seek the appointment of an independent investigatory commission, similar to the Kemeny Commission that was established after the Three Mile Island accident.

The Emergency Petition further requests the NRC to establish procedures for ensuring that the public can participate in any decisions regarding the application of Fukushima lessons learned to reactor licensing cases. For instance, the NRC should establish procedures and a timetable for raising new issues relevant to the Fukushima accident in pending licensing proceedings. The NRC should also allow all current intervenors in NRC licensing proceedings, all petitioners who seek to re-open closed licensing and relicensing proceedings, and all parties who seek to comment on design certification proposed rules, a period of 60 days following the publication of proposed regulatory measures or environmental decisions, in which to raise new issues relating to the Fukushima reactor accidents. The Commission should suspend requirements to justify the late-filing of new issues if their relevance to the Fukushima accident can be demonstrated.

Makhijani Declaration

The Emergency Petition is supported by the expert declaration of Dr. Arjun Makhijani. The declaration explains the technical reasons for Dr. Makhijani's opinion that although the causes, evolution, and consequences of the Fukushima accident are not yet fully clear, the accident is already presenting new and significant information regarding the risks to public health and safety and the environment posed by the operation of nuclear reactors.

Dr. Makhijani's declaration also explains the basis for his belief that if the significant new information emanating from the Fukushima Daiichi accident is taken into consideration in NRC safety and environmental analyses, it is likely to fundamentally alter the outcome of those analyses in important ways. In the safety arena, consideration of this new information is likely to result in more rigorous regulation with respect to issues such as loss of offsite power, hydrogen explosion prevention, the siting of more than one reactor at a single site, spent fuel accident and reactor accident probabilities, the re-racking of spent fuel pools, permitting extended storage of spent fuel in pools after decommissioning, and emergency planning. *Id.,* par. 34.

In the environmental and health arenas, Dr. Makhijani believes that consideration of this significant new information is likely to result in higher accident probability estimates, new accident mechanisms for spent fuel pools, higher accident cost estimates, and higher estimates of the health risks posed by light water reactor accidents. These increased risk and cost estimates will lead to much more serious consideration of alternatives for avoidance or mitigation of environmental risks. For instance, although the Commission has long rejected low-density pool storage combined with dry onsite storage as an alternative for mitigating the effects of catastrophic pool fires, that option may now prove to be very cost-beneficial. Present policy also does not require the transfer of all spent fuel from pools into dry casks at closed sites, as soon as safely possible after closure. A change of policy would be indicated by the scale of the disaster at Fukushima. In view of the large variation in potential damage and differences in emergency response needs, a plant-specific analysis will also be needed. *Id.,* par. 35.

Therefore, as stated in his declaration, Dr. Makhijani believes it is reasonable and necessary for the NRC to suspend licensing and re-licensing decisions and standardized design certifications

until the NRC completes its review of the regulatory implications of the Fukushima accident. *Id.,* par. 37.[4]

Task Force and ACRS Work

Both the Task Force and the ACRS have held several meetings regarding the Fukushima accident. During these meetings, questions and concerns have been raised about the adequacy of the NRC's regulatory program with respect to a number of substantive issues, including station blackout, spent fuel pool integrity, seismic risks, hydrogen explosion, and preparedness for beyond design basis accidents. *See, e.g.,* transcripts of Task Force briefings on May 12, 2011 and June 15, 2011; transcripts of ACRS briefings on April 7, 2011 and May 26, 2011. In addition, Commissioners and the Staff have raised concerns about the lack of ongoing NRC oversight of voluntary safety improvements, such as Severe Accident Mitigation Guidelines and the venting systems retrofitted to Mark I containment. Transcript of June 15, 2011 Task Force briefing at 16-17, 31-32. As the Chair of the NRC recently acknowledged, the early work following the Fukushima accident suggests that there is room for improvement in NRC regulations in a number of areas, including station blackout, spent fuel pools, seismic issues, and contingency planning for beyond design basis accidents. *See* Remarks of NRC Chairman Gregory Jaczko at the IAEA Ministerial Conference in Vienna, Austria (June 21, 2011).

Discussion

As you know, the ACRS is an independent body whose purpose is to advise the Commission regarding hazards posed by the granting of licenses for reactors and the adequacy of proposed safety standards. 42 U.S.C. § 2039. Consistent with this purpose, the NRC has requested the ACRS to participate in the process of evaluating the lessons to be learned from the Fukushima accident by commenting on the Task Force's long-term recommendations.

In addition, as you have recognized, the ACRS has other responsibilities under its Charter. Transcript of May 26, 2011, ACRS Subcommittee Meeting at 5. These responsibilities include

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[4] A more recent analysis of the new and significant information revealed by the Fukushima accident has also been prepared by Dr. Gordon Thompson of the Institute for Resource and Security Studies. *See* Thompson, *New and Significant Information from the Fukushima Daiichi Accident in the Context of Future Operations of the Pilgrim Nuclear Power Plant* (June 1, 2011) (NRC ADAMS Accession No. ML111530339). Like Dr. Makhijani's declaration, Dr. Thompson's report sets out technical aspects of the Fukushima accident that raise significant safety and environmental concerns regarding the proposed re-licensing of the Pilgrim nuclear power plant.

Dr. Thompson's report was submitted by the Commonwealth of Massachusetts in the Pilgrim license renewal case in support of a new contention, Commonwealth of Massachusetts' Contention Regarding New and Significant Information Revealed by the Fukushima Accident (June 2, 2011) (NRC ADAMS Accession No. ML111530343).

the conduct of a review and issuance of a report on all reactor license applications. 42 U.S.C. § 2232b; 10 C.F.R. §§ 50.58, 54.25. The scope of this review includes applications for early site permits, combined operating licenses, and design certification regulations. 10 C.F.R. §§ 52.23, 52.53 and 52.87.

We respectfully submit that in light of the significant questions raised by the Fukushima accident regarding the risks posed by existing and proposed nuclear reactor operations, as discussed in Dr. Makhijani's declaration, Dr. Thompson's report, and the transcripts of the various meetings that have been held by the Fukushima Task Force and the ACRS to date, the ACRS does not currently have an adequate basis for issuing any report on the adequacy of operating license terms or governing regulations for any reactors that are now the subject of new reactor licensing decisions, license renewal decisions, or design certification rulemakings. The accident has raised significant questions with respect to numerous aspects of nuclear reactor operation which were previously thought by the NRC to be adequately addressed by its regulations, including loss of offsite power, hydrogen explosion prevention, the siting of more than one reactor at a single site, spent fuel accident and reactor accident probabilities, the re-racking of spent fuel pools, permitting extended storage of spent fuel in pools after decommissioning, and emergency planning.

Under the circumstances, it is abundantly clear that in order for the ACRS to meet its responsibility to provide a well-reasoned and supported analysis about the hazards and the adequacy of safety standards in your reports on each licensing decision, you require significantly more information about the Fukushima disaster and its lessons about current safety deficiencies. Therefore you should suspend your review of proposed operating licenses, licenses renewals and design certifications until you have sufficient information to evaluate the regulatory implications of the Fukushima accident with respect to the safe operation of new and re-licensed reactors. Delaying those reviews is not only rational and required by the law, but it is consistent with the approach taken by the NRC after the Three Mile Island accident, when the NRC suspended all licensing decisions for 18 months while it studied the lessons to be learned from that accident. *See Statement of Policy: Further Commission Guidance for Power Reactor Operating Licenses,* CLI-80-42, 12 NRC 654 (1980).

In addition, we respectfully submit that you must re-evaluate the recommendations that you previously made with respect to renewal of reactor licenses that have not yet been approved by the NRC, because they are no longer supportable. These reactors include Crystal River, Indian Point, Pilgrim, and Prairie Island.

Thank you for your consideration.

Sincerely,

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Attachments: Emergency Petition and Makhijani Declaration

Corrected April 18, 2011
(Original version submitted April 14-18, 2011)

UNITED STATES OF AMERICA
U.S. NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of AmerenUE (Callaway Plant Unit 2)	)))	Docket No. 52-037-COL
In the Matter of AP1000 Design Certification Amendment 10 CFR Part 52	)))	NRC-2010-0131 RIN 3150-A18
In the Matter of Calvert Cliffs 3 Nuclear Project, L.L.C. (Calvert Cliffs Nuclear Power Plant, Unit 3)	)))	Docket No. 52-016-COL
In the Matter of Detroit Edison Co. (Fermi Nuclear Power Plant, Unit 3)	)))	Docket No. 52-033-COL
In the Matter of Duke Energy Carolinas, L.L.C. (William States Lee III Nuclear Station, Units 1 and 2)	))))	Docket Nos. 52-018 and 52-019
In the Matter of Energy Northwest (Columbia Generating Station)	)))	Docket No. 50-397-LR
In the Matter of Entergy Nuclear Generation Co. And Entergy Nuclear Operations, Inc. (Pilgrim Nuclear Power Station)	))))	Docket No. 50-293-LR
In the Matter of Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Station, Units 2 and 3)	))))	Docket Nos. 50-247-LR and 50-286-LR
In the Matter of ESBWR Design Certification Amendment 10 CFR Part 52	)))	NRC-2010-0135 RIN-3150-AI85

In the Matter of FirstEnergy Nuclear Operating Co. (Davis-Besse Nuclear Power Station, Unit 1)	))))	Docket No. 50-346-LR
In the Matter of Florida Power & Light Co. (Turkey Point Units 6 and 7)	)))	Docket Nos. 52-040-COL and 52-041-COL
In the Matter of Luminant Generation, Co., L.L.C. (Comanche Peak Nuclear Power Plant, Units 3 and 4)	))))	Docket Nos. 52-034-COL and 52-035-COL
In the Matter of Nextera Energy Seabrook, L.L.C. (Seabrook Station, Unit 1)	)))	Docket No. 50-443-LR
In the Matter of Pacific Gas and Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2)	))))	Docket Nos. 50-275-LR and 50-323-LR
In the Matter of PPL Bell Bend, L.L.C. (Bell Bend Nuclear Power Plant)	)))	Docket No. 52-039-COL
In the Matter of Progress Energy Carolinas, Inc. (Shearon Harris Nuclear Power Plant, Units 2 and 3)	))))	Docket Nos. 52-022-COL and 52-023-COL
In the Matter of Progress Energy Florida, Inc. (Levy County Nuclear Power Plant, Units 1 and 2)	))))	Docket Nos. 52-029-COL and 52-030-COL
In the Matter of South Carolina Electric and Gas Co. And South Carolina Public Service Authority (Also Referred to as Santee Cooper) (Virgil C. Summer Nuclear Station, Units 1 and 2)	)))))	Docket Nos. 52-027-COL and 52-028-COL

In the Matter of	)	
Southern Nuclear Operating Co.	)	Docket Nos. 52-025-COL
(Vogtle Electric Generating Plant,	)	and 52-026-COL
Units 3 and 4)	)	
In the Matter of	)	
South Texas Project Nuclear Operating Co.	)	Docket Nos. 52-012-COL
(South Texas Project,	)	and 52-013-COL
Units 3 and 4)	)	
In the Matter of	)	
Tennessee Valley Authority	)	Docket Nos. 52-014-COL
(Bellefonte Nuclear Power Plant,	)	and 52-015-COL
Units 3 and 4)	)	
In the Matter of	)	
Tennessee Valley Authority	)	Docket No. 50-0391-OL
(Watts Bar Unit 2)	)	
In the Matter of	)	
Virginia Electric and Power Co.	)	
d/b/a/ Dominion Virginia Power and	)	Docket No. 52-017-COL
Old Dominion Electric Cooperative	)	
(North Anna Unit 3)	)	

EMERGENCY PETITION TO SUSPEND ALL PENDING REACTOR LICENSING DECISIONS AND RELATED RULEMAKING DECISIONS PENDING INVESTIGATION OF LESSONS LEARNED FROM FUKUSHIMA DAIICHI NUCLEAR POWER STATION ACCIDENT

I. INTRODUCTION

Pursuant to the Atomic Energy Act ("AEA") and the National Environmental Policy Act ("NEPA"), Petitioners hereby request the U.S. Nuclear Regulatory Commission ("NRC" or "Commission") to exercise its supervisory jurisdiction over all pending proceedings for the consideration of applications for construction permits, new reactor licenses, combined construction permit and operating licenses ("COLs"), early site permits ("ESPs"), license renewals ("LRs"), and standardized design certification rulemakings for nuclear reactors (hereinafter collectively "licensing and related rulemaking proceedings"), to ensure the consideration in those proceedings of new and significant information regarding the safety and environmental implications of the ongoing catastrophic radiological accident at the Fukushima Daiichi Nuclear Power Station, Units 1-6 ("Fukushima"), in Okumu, Japan.

This Petition is filed by Petitioners in each of the above-captioned licensing and rulemaking proceedings now pending before the Commission. The Petition will be filed in each of the above-captioned proceedings between April 14 and April 18, 2011.[1]

Petitioners request the Commission to take the following immediate actions:

- Suspend all decisions regarding the issuance of construction permits, new reactor licenses, COLs, ESPs, license renewals, or standardized design certification pending completion by the NRC's Task Force to Conduct a Near-Term Evaluation of the Need for

[1] This Petition is complementary to the Petition to Suspend AP1000 Design Certification Rulemaking Pending Evaluation of Fukushima Accident Implications on Design and Operational Procedures and Request for Expedited Consideration that was filed by the Bellefonte Efficiency and Sustainability Team and other organizations on April 6, 2011.

Agency Actions Following the Events in Japan ("Task Force") of its investigation of the near-term and long-term lessons of the Fukushima accident and the issuance of any proposed regulatory decisions and/or environmental analyses of those issues;

- Suspend all proceedings with respect to hearings or opportunities for public comment, on any reactor-related or spent fuel pool-related issues that have been identified for investigation in the Task Force's Charter of April 1, 2011 (NRC Accession No. ML11089A045). These issues include external event issues (i.e., seismic, flooding, fires, severe weather); station blackout; severe accident measures (e.g., combustible gas control, emergency operating procedures, severe accident management guidelines); implementation of 10 C.F.R. § 50.54(hh)(2) regarding response to explosions or fire; and emergency preparedness. *Id.* The Commission should also suspend all licensing and related rulemaking proceedings with regard to any other issues that the Task Force subsequently may identify as significant in the course of its investigation. The proceedings should be suspended pending completion of the Task Force's investigation into those issues and the issuance of any proposed regulatory decisions and/or environmental analyses of those issues;
- Conduct an analysis, as required by NEPA, of whether the March 11, 2011 Tohoku-Chihou-Taiheiyo-Oki earthquake and ensuing radiological accident poses new and significant information that must be considered in environmental impact statements to support the licensing decisions for all new reactors and renewed licenses;
- Conduct a safety analysis of the regulatory implications of the March 11, 2011 Tohoku-Chihou-Taiheiyo-Oki earthquake and ensuing radiological accident and publish the results of that analysis for public comment;

- Establish procedures and a timetable for raising new issues relevant to the Fukushima accident in pending licensing proceedings. The Commission should allow all current intervenors in NRC licensing proceedings, all petitioners who seek to re-open closed licensing or re-licensing proceedings, and all parties who seek to comment on design certification proposed rules, a period of at least 60 days following the publication of proposed regulatory measures or environmental decisions, in which to raise new issues relating to the Fukushima accident.
- Suspend all decisions and proceedings regarding all licensing and related rulemaking proceedings, as discussed above, pending the outcome of any *independent* investigation of the Fukushima accident that may be ordered by Congress or the President or instigated by the Commission to complement or supersede the work of the Task Force.
- Request that the President establish an independent investigation of the Fukushima accident and its implications for the safety and environmental impacts of U.S. reactors and spent fuel pools similar to the President's Commission on the Accident at Three Mile Island, chaired by John G. Kemeny.

Petitioners respectfully submit that granting of the relief requested above is required by the AEA and NEPA, which forbid the NRC from issuing licenses for which it lacks reasonable assurance of safe operation or for which it has failed to consider all information significantly bearing on the environmental impacts of reactor operation. *See* discussion in Section V.B. below. By establishing the Task Force and ordering the investigation of the regulatory implications of the Fukushima accident for U.S. reactors, the Commission has identified the new information coming out of the Fukushima accident as new and potentially significant; and therefore it is legally obligated to consider the environmental implications of that new

information in all prospective licensing decisions. *Marsh v. Oregon Natural Resources Council,* 490 U.S. 360, 370-71 (1989). Suspension of licensing decisions pending investigations of lessons learned also would be consistent with the course followed by the Commission following the Three Mile Island accident, when the Commission delayed new licensing actions for a year and a half. *See Statement of Policy: Further Commission Guidance for Power Reactor Operating Licenses,* CLI-80-42, 12 NRC 654 (1980) ("TMI Policy Statement").[2]

Finally, emergency action by the Commission is necessary because a number of the pending licensing proceedings are approaching completion (e.g.., the Pilgrim license renewal proceeding, the AP1000 design certification proceeding, the Vogtle Units 3 and 4 COL proceeding, and the Economic Simplified Boiling Water ("ESBWR") design certification rulemaking proceeding). For these reasons, Petitioners therefore request a decision on this Petition within thirty (30) days.

II. DESCRIPTION OF PETITIONERS

Petitioners are organizations and individuals who seek, through this Petition, to ensure that they will have an opportunity to raise new safety and environmental issues emerging from

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[2] Petitioners believe that by establishing the Task Force and charging it with the task of investigating the implications of the Fukushima Daiichi accident with respect to its regulatory program, the Commission has, as a matter of law, bound itself to evaluate the significance of the information yielded by its investigation under NEPA and to analyze any information that is new and significant in supplemental environmental impact statements for all pending licensing decisions. Therefore, Petitioners do not believe it is necessary to submit an expert declaration in support of this petition.

In any event, Petitioners expect to submit additional expert support for this Petition early next week, in the form of a declaration by Dr. Arjun Makhijani, President of the Institute for Energy and Environmental Research in Takoma Park, Maryland. Because of other conflicting obligations, Dr. Makhijani was unable to complete his declaration in time to submit it by April 14, 2011. Due to the fact that some of the licensing decisions affected by this petition are imminent, however, the majority of the Petitioners are submitting their legal brief and request for relief at their earliest opportunity, starting today.

the Fukushima nuclear accident in licensing and related rulemaking proceedings. Some of the Petitioners have already intervened in pending NRC licensing proceedings and seek an opportunity to participate with respect to the application of new information regarding "lessons learned" from Fukushima to those proceedings. Other petitioners seek a renewed opportunity to participate in licensing proceedings that have been closed to public participation but that are still pending before the agency. Petitioners also seek to ensure that the NRC will not give final approval to the AP1000 and ESBWR standardized designs proposed by the NRC Staff until the agency has considered whether design modifications are necessary in light of the Fukushima accident.

Petitioners are the following individuals and organizations:

AP1000 Group[3]

Beyond Nuclear, Inc.

Blue Ridge Environmental Defense League, Inc. ("BREDL")

BREDL Chapters Bellefonte Efficiency and Sustainability Team, Peoples Alliance for Clean Energy and Concerned Citizens of Shell Bluff

Center for a Sustainable Coast, Inc.

Citizens Allied for Safe Energy, Inc.

Citizens Environmental Alliance of Southwestern Ontario, Inc.

Don't Waste Michigan, Inc.

Ecology Party of Florida

[3] The AP1000 Oversight Group consists of the Bellefonte Efficiency and Sustainability Team, BREDL, Citizens Allied for Safe Energy, Friends of the Earth, Georgia Women's Action for New Directions, Green Party of Florida, Mothers Against Tennessee River Radiation, North Carolina Waste Awareness and Reduction Network, Nuclear Information and Resource Service, Nuclear Watch South, South Carolina Chapter - Sierra Club, and SACE.

Friends of the Earth, Inc.

Friends of the Coast, Inc.

Georgia Women's Action for New Directions, Inc.

Green Party of Florida

Green Party of Ohio

Hudson River Sloop Clearwater, Inc.

Keith Gunter

Michael J. Keegan

Dan Kipnis

Leonard Mandeville

Frank Mantei

Marcee Meyers

Edward McArdle

National Parks Conservation Association, Inc.

Henry Newnan

Mark Oncavage

Missouri Coalition for the Environment, Inc.

Missourians for Safe Energy

Mothers Against Tennessee River Radiation

New England Coalition, Inc.

North Carolina Waste Reduction and Awareness Network, Inc.

Northwest Environmental Advocates, Inc. ("NWEA")

Nuclear Information and Resource Service, Inc.

Nuclear Watch South, Inc.

Public Citizen, Inc.

San Luis Obispo Mothers for Peace, Inc.

Savannah Riverkeeper, Inc.

Seacoast Anti-Pollution League, Inc.

Sierra Club, Inc. (Michigan Chapter)

Sierra Club (South Carolina Chapter)

George Steinman

Shirley Steinman

Southern Alliance for Clean Energy, Inc.

Gene Stilp

Harold L. Stokes

Southern Maryland CARES, Inc. (Citizens Alliance for Renewable Energy Solutions)

Sustainable Energy and Economic Development ("SEED") Coalition, Inc.

Marilyn R. Timmer

Village of Pinecrest, Florida

III. DESCRIPTION OF PENDING PROCEEDINGS IN WHICH PETITIONERS HAVE AN INTEREST IN APPLICATION OF LESSONS LEARNED FROM FUKUSHIMA NUCLEAR FACILITY ACCIDENT.

As discussed above in Section II, Petitioners are organizations and individuals with an interest in pending licensing decisions regarding new or existing nuclear reactors, including rulemakings for certification of standardized designs. A description of those pending proceedings and the Petitioners' interests in those proceedings follows. These descriptions of Petitioners' interests are not intended to be a complete representation of those interests nor are

they intended to limit Petitioners in raising safety or environmental concerns related to the Fukushima accident in any on-going or future proceedings.

A. Construction Permit Proceedings

B. Part 50 Operating License Proceedings

Watts Bar Unit 2. TVA has attempted to resurrect the Watts Bar 2 reactor, which was all-but-abandoned in 1985. SACE was admitted as an intervenor to the operating license proceeding that commenced in 2009. While a contention regarding aquatic impacts was admitted, the ASLB rejected contentions regarding the inadequacy of TVA's SAMA analysis, including its analysis of the reliability of AC power backup for resolution of GSI-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Failure From Hydrogen Combustion During a Severe Accident." SACE is very concerned about the implications of the Fukushima accident with respect to the issues of backup power adequacy, hydrogen explosions, and the vulnerability of the proposed Watts Bar reactor's ice condenser containment.

C. Part 50 License Renewal Proceedings

Columbia Generating Station. The license renewal proceeding for the Columbia Generating Station is now pending before the NRC Staff. Under the schedule posted on the NRC's website, publication of a Draft Environmental Impact Statement ("EIS") is scheduled for June 2011. *See* http://www.nrc.gov/reactors/operating/licensing/renewal/applications/columbia.html#schedule.

Petitioner Northwest Environmental Advocates ("NWEA") is extremely concerned about the implications of the Fukushima accident with respect to the safety of operating the Columbia Generating Station. They are particularly concerned about the implications of the Fukushima accident in light of earthquake risks to the Columbia Generating Station based on new findings of a structural zone that kinematically connects faults in central Washington with faults in the

Puget Sound, the entirety of which may be seismically active. These findings are scheduled for publication later this year. The Fukushima accident also highlights the hazards associated with facility mismanagement which has been a chronic problem at the Columbia Generating Station.

Davis-Besse Nuclear Power Station, Unit 1. Beyond Nuclear, Citizens Environment Alliance of Southwestern Ontario, Don't Waste Michigan, and the Green Party of Ohio have submitted four contentions challenging the proposed extension of the Davis-Besse license, including inadequate treatment of alternative of potential for commercial-scale wind power and commercial-scale photovoltaic power generation in the Environmental Report ("ER), and inadequate Severe Accident Mitigation Alternatives ("SAMA") analysis.

Davis-Besse, a Babcock & Wilcox reactor, has a remarkable history of operational problems, the most recent being the infamous 2002 discovery of a massive corrosion hole in the reactor head the size of a loaf of bread, where a 3/16" stainless steel liner was all that was holding back the pressurized radioactive water in the vessel.

Diablo Canyon Nuclear Power Plant, Units 1 and 2. The Diablo Canyon license renewal proceeding is now pending before the ASLB. San Luis Obispo Mothers for Peace ("SLOMFP") has intervened and gained admission of safety and environmental contentions, including contentions which challenge Pacific Gas and Electric's failure to adequately address earthquake risks to the reactor and the spent fuel pools. The ASLB has also referred to the Commission SLOMFP's petition for a waiver of NRC regulations precluding consideration of the environmental impacts of pool storage of spent fuel, based on a footnote in the 2009 Draft Revised Generic Environmental Impact Statement for Nuclear Power Plant License Renewal which excludes Diablo Canyon and other western reactors from the NRC's finding that pool

storage of spent fuel does not pose significant environmental risks with respect to earthquake vulnerability.

SLOMFP is extremely concerned about the implications of the Fukushima reactor accident for the Diablo Canyon reactors and spent fuel pools, including the reactors' vulnerability to severe earthquakes and tsunamis, the lack of reliable and adequate backup power capability for the site, and the infeasibility of emergency evacuation following an earthquake.

Indian Point Nuclear Generating Station, Units 2 and 3. The Indian Point proceeding concerns the relicensing of two pressurized water reactors approximately 35 miles north of New York City. This proceeding has become the most complicated relicensing proceeding ever heard due to the large number of parties and admitted contentions. Hudson Sloop Clearwater, Riverkeeper, and New York State all have multiple contentions admitted in the proceeding. A number of other municipal entities are participating as interested parties. Clearwater's admitted contention concerns the need to assess the environmental justice implications of severe accidents. Clearwater and Riverkeeper have recently moved to add both environmental and safety contentions regarding waste storage, based upon the recent waste confidence update. In addition, Clearwater, Riverkeeper, and New York State have moved to add environmental contentions based upon the publication of the FSEIS. Initial testimony regarding admitted contentions is now due in approximately 65 days.

Pilgrim Nuclear Power Station. The on-going Pilgrim Nuclear Power license renewal proceeding began in 2006. Two Pilgrim Watch contentions were admitted; one challenged the adequacy of the aging management program for buried pipes/tanks within scope containing radioactive liquids; the other challenged the applicant's SAMA analysis. Although the buried pipe contention was dismissed on summary disposition, the SAMA contention is still before the

ASLB. In late 2010, Pilgrim Watch filed two Requests for New Hearings regarding the inadequacy of Entergy's aging management of submerged non-environmentally qualified electric cables and the lack of measures for cleanup after a severe nuclear reactor accident. The contentions are before the ASLB. Given the relevance of these issues to the Fukushima accident, and given the fact that the Pilgrim reactor shares the same boiling water reactor ("BWR") design as the Fukushima reactors, Pilgrim Watch seeks to ensure that it will have an opportunity to raise accident-related issues during the Pilgrim re-licensing proceeding.

Seabrook Station, Unit 1. In the license renewal proceeding for Seabrook Station Unit 1, the ASLB in this proceeding granted standing and admitted contentions submitted by Beyond Nuclear, Seacoast Anti-Pollution League, Sierra Club-New Hampshire Chapter, Friends of the Coast and New England Coalition. Admitted contentions that are relevant to the Fukushima accident include Beyond Nuclear's contention challenging the licensee's apparent failure to adequately consider the availability of more environmentally benign and less risk-laden alternatives for the proposed period of extended operation. Early reports from Japan indicate that unanticipated costs to the environment and the regional economy resulting from the release of radiological fission products, activation products, and heavy radioactive elements to the environment from the Fukushima reactors and spent fuel pools will dwarf those risks considered in NRC's Generic Environmental Impact Statement for License Renewal, NRC site specific evaluations or in the license renewal application. Other contentions that appear relevant to the Fukushima accident relate to failure to provide for aging management of transformers, failure to provide for adequate aging management of non-qualified safety-related electrical cables susceptible to wetting or submergence, and inadequate and non-conservative Severe Accident Mitigation Alternatives ("SAMA") analysis.

The flooding phenomena at Fukushima also raise questions about the potential for tsunami impact at Seabrook, something dismissed in the LRA documents. Friends of the Coast and New England Coalition found that tsunamis have indeed occurred in adjacent waters of the North Atlantic; the most pertinent and striking example being a tsunami generated by a 7.2 earthquake epi-centered on Georges Bank at the northeast extreme of the Gulf of Maine. That tsunami, when funneled in to the bays and inlets of Newfoundland, crested at 90 feet. *See* http://www.maine.gov/doc/nrimc/mgs/explore/hazards/tsunami/jan05.htm

Clearly, the implications of such examples from recent history, coupled with the Japanese experience, should no longer be ignored when evaluating accident prospects in license renewal proceedings.

D. Part 52 Combined Licensing Proceedings

Bell Bend Nuclear Power Plant. In 2009, Gene Stilp requested a hearing on Pennsylvania Power and Light Co.'s application for a COL for the Bell Bend reactor, to be built adjacent to the two existing Susquehanna reactors. Although the ASLB found that Mr. Stilp had standing, it rejected his contentions as inadmissible. Among Mr. Stilp's rejected contentions was his concern about the safety and environmental risks of storing Bell Bend's spent fuel adjacent to the existing spent fuel storage pools at the Susquehanna site. Mr. Stilp would seek reconsideration of that issue in light of the events at the multi-unit Fukushima facility.

Bellefonte Nuclear Power Plant, Units 3 and 4. BREDL and Southern Alliance for Clean Energy ("SACE") won the admission of four contentions in the COL proceeding regarding the Tennessee Valley Authority's ("TVA's") COL application for Bellefonte Units 3 and 4. There is considerable uncertainty regarding TVA's COL application which continues to delay the NRC's safety and environmental review schedule. In the wake of the Fukushima accident, the

organizations are concerned about seismic risks to the proposed reactors: the Bellefonte site is near the Eastern Tennessee Seismic Zone, which is considered to be one of the most active seismic areas east of the Rocky Mountains. Recent studies have indicated that this seismic zone may have the potential to produce large magnitude earthquakes.

Callaway Plant Unit 2. The Missouri Coalition for the Environment and Missourians for Safe Energy intervened in the COL proceeding for Callaway Unit 2. The case was suspended after the applicant was unable to obtain construction work in progress funding from the state.

Calvert Cliffs Nuclear Power Plant, Unit 3. Calvert Cliffs Nuclear Power Plant, Unit 3. Nuclear Information and Resource Service, Public Citizen, Beyond Nuclear and Southern Maryland CARES are intervenors in this COL proceeding. Contentions on foreign ownership of the Calvert Cliffs-3 project and on the failure of the NRC's Draft Environmental Impact Statement to adequately consider alternatives to Calvert Cliffs-3 are pending, with no hearing date yet established.

Comanche Peak Nuclear Power Plant, Units 3 and 4. Public Citizen, Inc. and the Sustainable Energy and Economic Development (SEED) Coalition, Inc. were admitted as Intervenors and raised several contentions in this COL proceeding for two new reactors on the site of the existing Comanche Peak Units 1 and 2. All of the contentions have been dismissed by the ASLB on motions for summary disposition. Intervenors have filed a petition for review of the ASLB's dismissal of contentions regarding mitigation strategies for loss of large area (LOLA) incidents caused by fires and explosions under 10 C.F.R. 50.54(hh)(2), an issue that is the subject of the Task Force's investigation.

Fermi Nuclear Power Plant, Unit 3. In July 2009, intervenors Don't Waste Michigan, Inc., Citizens for Alternatives to Chemical Contamination, Beyond Nuclear, Citizens Environmental

Awareness of Southwestern Ontario, Keith Gunter, Michael J. Keegan, Edward McArdle, Leonard Mandeville, Frank Mantei, Marcee Meyers, Henry Newnan, Sierra Club (Michigan Chapter),George Steinman, Shirley Steinman, Harold L. Stokes, and Marilyn R. Timmer were granted standing and won the admission of five contentions in the COL proceeding for Fermi Unit 3. Three of those contentions are still pending.

Levy County Nuclear Power Plant, Units 1 and 2. Nuclear Information and Resource Service, The Green Party of Florida and The Ecology Party of Florida have been admitted as joint interveners in the COL proceeding for Progress Energy Florida's proposal to build two reactors on top of the recharge zone for some of the most pristine freshwater springs on the planet. The ASLB has two contentions before it and a hearing is currently set for January 2012.

North Anna Unit 3. BREDL and its chapter People's Alliance for Clean Energy have been admitted as intervenors in the COL proceeding for two proposed reactors on the site of the existing two-unit North Anna nuclear power plant. One of the original proposed plants was cancelled and the application for the other was replaced with one for a pressurized water reactor. On April 6, 2011, in LBP-11-10, the ASLB denied two additional contentions on water use and ability to withstand seismic incidents.

Shearon Harris Nuclear Power Plant, Units 2 and 3. NC WARN was admitted as an iIntervenor to this COL proceeding and submitted safety and environmental contentions on plant design, fire safety, aircraft attacks, spent fuel and emergency planning. One of the contentions on the underestimate of cost for the plants was settled when the applicant revised its cost estimates. The ASLB dismissed all of the other contentions and was affirmed by the Commission in CLI-10-05. The COL application is still pending before the NRC Staff.

South Texas Project, Units 3 and 4. Public Citizen and the SEED Coalition were admitted as intervenors and gained admission of a number of contentions, including contentions regarding mitigation strategies for loss of large area (LOLA) incidents caused by fires and explosions under 10 C.F.R. 50.54(hh)(2). Although those contentions were dismissed by the ASLB, Intervenors believe they should now be subject to reconsideration based on the Fukushima accident and the Task Force investigation.

Turkey Point Units 6 and 7. SACE, the National Parks Conservation Association, Dan Kipnis and Mark Oncavage have been admitted as joint intervenors in the COL proceeding for proposed new Units 6 and 7 at the Turkey Point Nuclear facility in Homestead, Florida. While the ASLB admitted contentions regarding groundwater impacts, it refused to admit the joint intervenors' eight other contentions, including one regarding sea level rise. That contention, which concerned the potential environmental impact caused by construction and operation of new reactors in a region threatened by a predicted sea level rise of 1.5 to 5 feet by 2050, has particular relevance in light of the Fukushima disaster. Turkey Point is located less than 25 miles south of Miami on Biscayne Bay along Florida's southeastern coast. The lessons learned from the Task Force's investigation on external events should be applied to these coastal reactors.

V.C. Summer Units 2 and 3. Friends of the Earth and the Sierra Club were granted standing in the V.C. Summer COL case but no contentions were admitted. The COL application is still pending before the NRC Staff.

Vogtle Electric Generating Plant, Units 3 and 4. BREDL, Center for a Sustainable Coast, Georgia Women's Action for New Directions, Savannah Riverkeeper, and SACE (collectively, "Vogtle Intervenors") intervened in the COL proceeding for Plant Vogtle Units 3 and 4 and gained admission of a contention regarding the onsite storage of low level radioactive waste. In

May 2010, the ASLB ruled that the issue was resolved and dismissed the case. New contentions regarding the flaws in AP1000 containment were subsequently raised, dismissed by the ASLB and are under appeal to the Commission.

In April 2011, the NRC Staff issued a Final Supplemental Environmental Impact Statement for the COL, and the Staff plans to release the Final Safety Evaluation Report in June. According to the current schedule, the Plant Vogtle COL may be issued at the end of this year, making Vogtle Units 3 and 4 the first AP1000 reactors to be licensed.

Before the license is issued, and in light of the Fukushima disaster, the following issues must be assessed at Plant Vogtle: the safety and environmental impacts of onsite spent fuel storage at multiple units; the impact of a power failure on the reactor cooling systems for the multiple units; and earthquake risks to the reactors, which lie in an area prone to seismic activity. *See* NUREG-1923, Vogtle ESP Final Safety Evaluation Report, Chapter 2.5 (2009). Because Plant Vogtle will serve as the "reference" project for future AP1000 plants, the Vogtle Intervenors concern about the implications of the Fukushima disaster is heightened. If the lessons learned from Fukushima are not applied to Plant Vogtle, the repercussions will be multiplied by all plants referencing the Plant Vogtle COL in future applications.

William States Lee III Nuclear Station, Units 1 and 2. In 2008, BREDL petitioned for leave to intervene in the COL proceeding for Duke Energy Carolinas, LLC's application to construct and operate two AP1000 pressurized water reactors at the William States Lee III Nuclear Station site. On September 22, 2008, in LBP-08-17, the ASLB ruled that BREDL had standing to intervene but admitted no contentions. Among the contentions dismissed by the ASLB was a contention challenging the adequacy of the proposed reactor's seismic design, an issue now under investigation by the Task Force.

F. Standardized Design Certification Rulemakings

AP1000 Design Certification Amendment (NRC-2010-0131, RIN 3150-A18). On April 6, 2011 the AP1000 Oversight Group filed a petition to suspend the rulemaking on the certification of the AP1000 design and operational procedures which was noticed on February 24, 2011, at 76 Fed. Reg. 10,269. Currently, the comment period for the AP1000 design certification rulemaking is scheduled to close on May 10, 2011, long before the NRC concludes even its initial inquiry into the implications of the Fukushima accident.

The Petitioners requested suspension of the AP1000 design approval process while the NRC investigates the implications of the ongoing catastrophic accident in Fukushima, Japan, and decides what "lessons learned" must be incorporated into the AP1000 design and operational procedures to ensure that they do not pose an undue risk to public health and safety or unacceptable environmental risks.

ESBWR Design Certification Amendment (NRC-2010-01325, RIN 3150-AI85). The NRC issued a proposed rule for the Economic Simplified Boiling Water Reactor ("ESBWR") standardized design certification on March 24, 2011, at 76 Fed. Reg. 16,549. The comment period closes on June 7, 2011. The ESBWR design has a particularly troublesome feature in common with the Mark I BWR design, which is the design of the Fukushima reactors: elevated spent fuel pools. Nevertheless, the Commission went ahead with the proposed rulemaking, even as the Fukushima accident unfolded.

IV. FACTUAL BACKGROUND

A. Fukushima Accident

Although many details about the Fukushima accident remain unclear, the general contours of the accident are described in NRC in Information Notice No. 2011-08 (March 31,

2011) (NRC Accession No. ML 110830824) as follows:

> On March 11, 2011, the Tohoku-Taiheiyou-Oki earthquake occurred near the east coast of Honshu, Japan. This magnitude 9.0 earthquake and the subsequent tsunami caused significant damage to at least four of the six units of the Fukushima Daiichi nuclear power station as the result of a sustained loss of both the offsite and onsite power systems. Efforts to restore power to emergency equipment were hampered and impeded by damage to the surrounding areas due to the tsunami and earthquake.
>
> Units 1, 2 and 3 were operating at the time of the earthquake. Following the loss of electric power to normal and emergency core cooling systems and the subsequent failure of backup decay heat removal systems, water injection into the cores of all three reactors was compromised, and reactor decay heat removal could not be maintained. The operator of the plant, Tokyo Electric Power Company, injected sea water and boric acid into the reactor vessels of these three units, in an effort to cool the fuel and ensure that the reactors remained shut down. However, the fuel in the reactor cores became partially uncovered. Hydrogen gas built up in Units 1 and 3 as a result of exposed, overheated fuel reacting with water. Following gas venting from the primary containment to relieve pressure, hydrogen explosions occurred in both units and damaged the secondary containments. *Id.*
>
> Units 3 and 4 were reported to have low spent fuel pool (SFP) water levels.
>
> Fukushima Daiichi Units 4, 5 and 6 were shut down for refueling outages at the time of the earthquake. *Id.* The fuel assemblies for Unit 4 had recently been offloaded from the reactor core to the SFP. The SFPs for Units 5 and 6 appear to be intact. Emergency power is available to provide cooling water flow through the SFPs for Units 5 and 6.
>
> The damage to Fukushima Daiichi nuclear power station appears to have been caused by initiating events beyond the design basis of the facilities.

Id. at 1-2.

In a March 21, 2011, briefing, NRC Chairman also stated that the NRC believes that an accumulation of hydrogen which exploded on March 15 in Units Two and Four originated from overheated fuel in the spent fuel pool. Briefing on NRC Response to Recent Nuclear Events in Japan, Transcript at 11 (NRC ADAMS Accession No. ML110321).

According to Chairman Jaczko's March 21 statement, the NRC believes that Units One, Two, and Three have had some degree of core damage. Cooling systems for the reactors have

not been restored. At the outset of the emergency, large volumes of sea water were used to cool the reactors and the spent fuel pools. The salt water injections have now been replaced by fresh water injections.

B. NRC Response to Fukushima Accident

1. Formation of Task Force

In response to the Fukushima reactor accident, the NRC announced the formation of a "senior level task force to conduct a methodical and systematic review" of NRC processes and regulations. COMGBJ-11-0002, Memorandum from Chairman Jaczko to Commissioners, re: NRC Actions Following the Events in Japan (March 21, 2011). The purpose of the task force is to "determine whether the agency should make additional improvements to our regulatory systems and make recommendations to the Commission for its policy direction." *Id.*

The Commission instructed the task force to undertake both a near-term review and a longer-term review. For the near-term review, the Commission required the task force to evaluate issues "affecting domestic operating reactors of all designs" in areas that include "protection against earthquake tsunami, flooding, hurricanes; station blackout and a degraded ability to restore power; severe accident mitigation; emergency preparedness; and combustible gas control." *Id.* at 1. The Commission instructed the task force to complete the report in 90 days. In the meantime, the task force was instructed to provide a 30-day "quick look report" and another "status" report in 60 days. *Id.*

The Commission directed the task force to begin a "longer term" review "as soon as NRC has sufficient technical information from the events in Japan with the goal of no later than the completion of the 90 day near term report." *Id.* at 2. The longer-term study should "evaluate all technical and policy issues related to the event to identify additional research, generic issues,

changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be conducted by the NRC." *Id.* For the longer-term effort, the Commission instructed the task force to "receive input from and interact with all key stakeholders." *Id.* The Commission specified that within 60 days after commencing the longer-term study, the task force should "provide a report with recommendations, as appropriate, to the Commission." *Id.* The Task Force was established in early April.

2. Task Force Charter

The Task Force charter states that the group's "objective" is to:

- Evaluate currently available technical and operational information from the events that have occurred at the Fukushima Daiichi nuclear complex in Japan to identify potential or preliminary near-term/immediate operational or regulatory actions affecting domestic reactors of all designs, including their spent fuel pools. The task force will evaluate, at a minimum, the following technical issues and determine priority for further examination and potential agency action:

  - External event issues (e.g. seismic, flooding, fires, severe weather)

  - Station blackout

  - Severe accident measures (e.g., combustible gas control, emergency operating procedures, severe accident management guidelines)

  - 10 CFR 50.54 (hh)(2) which states, "Each licensee shall develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire, to include strategies in the following areas: (i) Fire fighting; (ii) Operations to mitigate fuel damage; and (iii) Actions to minimize radiological release." Also known as B.5.b.

  - Emergency preparedness (e.g., emergency communications, radiological protection, emergency planning zones, dose projections and modeling, protective actions)

- Develop recommendations, as appropriate, for potential changes to NRC's regulatory requirements, programs, and processes, and recommend whether generic communications, orders, or other regulatory actions are needed.

With respect to the longer-term review, the charter states that the Task Force will make:

"[r]ecommendations for the content, structure, and estimated resource impact."

3. NRC Brief to Third Circuit U.S. Court of Appeals

By letter dated March 21, 2011, in the context of an appeal of the NRC's decision to re-license the Oyster Creek reactor, the U.S. Court of Appeals for the Third Circuit directed the NRC to "advise the Court what impact, if any, the damages from the earthquake and tsunami at the Fukushima Daiichi Nuclear Power Station have on the propriety of granting the license renewal application for the Oyster Creek Generating Station." *New Jersey Environmental Federation et al. v. NRC* (No. 09-2567). The NRC responded that it is:

> carefully monitoring those events, and assisting the Japanese government in understanding, controlling and limiting plant damage. NRC is also evaluating the information from these events for planning both short-term and longer-term responses to ensure the safety of United States reactors. In support of these tasks, NRC is gathering and absorbing data from the Fukushima Daiichi site that will enable NRC, with appropriate public participation, to put in place any new safety measures necessary to protect public health and safety in the United States.

Federal Respondents' Memorandum on the Events at the Fukushima Daiichi Nuclear Power Station, No. 09-2567 (April 4, 2011) ("NRC Memorandum").

In its Memorandum to the Third Circuit, the NRC also described its past "lessons learned" approach to significant events. *Id.* at 8. Following the 1979 accident at the Three Mile Island Unit 2 reactor, for example, the Commission established a "Lessons Learned Task Force." A Task Force "steering group" took recommendations from within *and outside* the NRC and developed a "comprehensive and integrated plan for all actions necessary to correct or improve the regulation and operation of nuclear facilities." In the course of that process, the NRC conducted a number of rulemakings "to update licensing requirements on the basis of TMI 'lessons learned.'" *Id.* at 9. In response to the attacks of September 11, 2001, the NRC also

responded by ordering security improvements at all nuclear power plants, and eventually enacted many of those orders as formal regulations. *Id.* at 10.

The Commission's Memorandum to the Third Circuit does not describe one very important feature of the agency's response to the TMI accident: it suspended all licensing decisions until conclusion of the lessons learned process. TMI Policy Statement, 12 NRC 654. The Memorandum merely states that in this case the NRC has "not suspended reactor operations or licensing activity," and points out that the NRC issued a renewed license for the Vermont Yankee Nuclear Power Plant – a boiling water reactor ("BWR") of the same design as the Fukushima reactors – on March 21, 2011, during the accident. According to the NRC, "this decision reflects NRC's confidence in the robust and redundant safety design and construction of currently operating U.S. nuclear reactors . . ." Memorandum at 13. The Memorandum also omits any discussion of NEPA or its requirement that agencies must consider new and significant information before they take actions that could significantly affect the human environment.

V. THE COMMISSION SHOULD EXERCISE ITS SUPERVISORY JURISDICTION TO STAY ALL PENDING LICENSING DECISIONS AND ALL PROCEEDINGS RELATED TO FUKUSHIMA ACCIDENT ISSUES PENDING INVESTIGATION OF REGULATORY IMPLICATIONS OF THE ACCIDENT.

A. Exercise of the Commission's Supervisory Jurisdiction is Appropriate.

This petition invokes the Commission's supervisory authority under the AEA to "oversee all aspects of the regulatory and licensing process and its overriding responsibility for assuring public health and safety in the operation of nuclear power facilities." *Consolidated Edison Co. of N.Y., Inc.* (Indian Point, Units 1, 2 and 3), CLI-75-8, 2 NRC 173 (1975). *See also* 42 U.S.C. §§ 2233(d), 2236(a), 2237. In the extraordinary circumstances of the Fukushima accident, it is appropriate for the Commission to establish clear and uniform procedures for the application of "lessons learned" to pending licensing and rulemaking decisions. Only the Commission has the

authority to establish a consistent and broadly applicable set of procedures that comply with NEPA and AEA requirements for consideration of significant new information and that also provides legally required opportunities for public participation.

To leave the establishment of that process entirely to the separate ASLB panels that are now presiding over at least twenty-five separate licensing cases would invite uncertainty and chaos, especially in the administration of the general rule of thumb that significant new issues and information must be raised within thirty days of discovering them. *See, e.g., Shaw Areva MOX Services, Inc.* (Mixed Oxide Fuel Fabrication Facility), LBP-08-11, 67 NRC 460, 493 (2008) and cases cited therein. As illustrated by a recent New York Times article, the NRC's theories about what exactly has occurred during the Fukushima accident are continuing to change. Matthew L. Wald, "Japan's Reactors Still Not Stable" (New York Times, page A6, April 13, 2011) (Attachment 1). And, there is extremely little in the way of official documentation from any source upon which Petitioners can rely in order to make a case before an individual ASLB that the unfolding events at Fukushima are relevant to individual licensing or rulemaking proceedings. Therefore it will be very difficult for intervenors or the ASLB panels that must judge motions to re-open the record and new contentions to judge the timeliness of those submissions.

The Commission should also exercise its supervisory jurisdiction to establish an ordered process for the application of "lessons learned" in licensing proceedings and related rulemaking proceedings, because it is the Commission that bears the ultimate legal responsibility for evaluating new and significant information, and it is the Commission that has the resources to carry out that responsibility. If the Commission fails to establish such a process, intervenor groups will be placed in the position of rushing to file contentions, rulemaking comments, and

motions to re-open closed hearing records, based on whatever evaluations they are able to make of slowly-emerging and ever-evolving information from the accident. Such a process would not only be cumbersome, but its effectiveness would be limited by whatever limitations the intervenors or petitioners had on their resources for making a technical evaluation of the information yielded by the accident. It would place an unfair burden on intevenors and petitioners by forcing them to perform analyses that should be performed by the government in the first instance. And It would leave open the possibility of inconsistent ASLB decisions, which the Commission eventually would have to resolve.

Finally, the Commission should exercise its supervisory jurisdiction here because this petition seeks action in the non-adjudicatory context as well as the context of pending adjudications. The rulemaking proceedings for certification of the AP1000 and ESBWR designs are being conducted by the NRC Staff, over which only the Commission has authority. In addition, the Staff will be responsible for preparing the environmental and safety analyses requested by this petition.

B. The NRC Must Comply With NEPA and the AEA in Considering The Lessons Learned From the Fukushima Accident.

Both the AEA and NEPA place a burden on the NRC to address safety and environmental issues before issuing licensing decisions for nuclear reactors. These statutes preclude the NRC from issuing licenses or approving standardized reactor designs until it has completed its investigation of the Fukushima accident and considered the safety and environmental implications of the accident with respect to its regulatory program. In order to comply with those statutes, the Commission should suspend all licensing decisions, including certification of standardized design applications, pending conclusion of its investigation and issuance of proposed safety measures and environmental decision-making documents. In

addition, it should suspend all pending hearings and rulemakings with respect to issues that are related to the Fukushima accident.

1. AEA

Under the AEA, the NRC may not issue a license for a reactor if it would pose an "undue risk" to public health and safety or the common security. 42 U.S.C. § 2311. "[P]ublic safety is the first, last, and a permanent consideration in any decision on the issuance of a construction permit or a license to operate a nuclear facility." *Power Reactor Development Corp. v. International Union of Electrical, Radio and Machine Workers,* 367 U.S. 396, 402 (1961). The list of issues identified for investigation in the Task Force Charter demonstrates that the Fukushima accident raises significant questions about the adequacy of the NRC's regulatory program on a wide range of important safety issues, including the safety of spent fuel storage, seismic and flooding risks, station blackout, emergency planning, and severe accident management guidelines. In addition the Fukushima accident once more raises longstanding questions about the effectiveness of the GE Mark 1 containment. Even taking into account the degree of discretion granted by federal courts to the NRC, to proceed with reactor licensing without concluding the Task Force's investigation would constitute a abuse of the NRC's discretion in its interpretation of the "adequate assurance" standard, because in the current climate of uncertainty, it would be almost impossible for the NRC to reach the "definitive finding" on safety required by *Power Reactor Development Corp*. It is also grossly inconsistent with the Commission's previous approach to the Three Mile Island accident, where the Commission prudently suspended all licensing actions while it considered the lessons to be learned from the accident.

2. NEPA

While the NRC may have some discretion in determining whether to increase its safety regulation of reactors under the Atomic Energy Act, NEPA deprives the NRC of any discretion to consider the environmental impacts of its proposed actions. *Silva v. Romney,* 473 F.2d 287, 292 (1st Cir. 1973) (holding that an agency's NEPA duties are "not discretionary, but are specifically mandated by Congress, and are to be reflected in the procedural process by which agencies render their decisions.") *See also Public Service Co. of New Hampshire v. NRC,* 582 F.2d 77, 81 (1st Cir. 1978) ("NEPA's mandate has been given strict enforcement in the courts, with frequent admonitions that it is insufficient to give mere lip service to the statute and then proceed in blissful disregard of its requirements.")

Even where the NRC has concluded that a proposed reactor operation meets its basic safety regulations, NEPA still requires the NRC to consider cost-effective alternatives for avoiding or mitigating environmental impacts that are reasonably foreseeable and yet not covered by safety regulations. *Limerick Ecology Action v. NRC,* 869 F.2d 730-31 (3rd Cir. 1989) (holding that the NRC could not rely on the sufficiency of a reactor license application under its safety regulations to avoid considering the cost-effectiveness of severe accident mitigation alternatives under NEPA). *See also* 40 C.F.R. § 1502.22(b)(1) (requiring consideration of "reasonably foreseeable" impacts which have "catastrophic consequences, even if their probability is low.")

NEPA's requirement to consider the environmental impacts of proposed actions continues even after a final EIS has been prepared, if new and significant information arises which could affect the outcome of the environmental analysis. 10 C.F.R. § 51.92(a). *See also Marsh,* 490 U.S. at 370-71. Here, by its own admission, the NRC has new information that concededly could have a significant effect on its regulatory program and the outcome of its

licensing decisions for individual reactors. For the NRC to go ahead with licensing decisions and certification of standardized designs, ignoring the potential significance of this new information, would constitute a gross violation of NEPA. Even if the NRC ultimately concludes that the information does not have a significant effect on its licensing decisions, it must nevertheless follow NEPA's procedures for considering the information, including preparation of an environmental assessment. *Marsh,* 490 U.S. at 385 ("NEPA's mandate applies "regardless of [the agency's] eventual assessment of the significance of [the] information.")

Therefore, the position taken by the Commission in its Memorandum to the Third Circuit, that it may continue with the issuance of licenses and apply the lessons of the Fukushima accident retrospectively, is fundamentally inconsistent with both NEPA and the AEA. Instead, the Commission must take all necessary measures to protect the integrity of the NEPA decision-making process, by immediately suspending all pending licensing and related design-certification rulemaking decisions until it has addressed the significance of the new information revealed by the Fukushima accident in environmental assessments and/or EISs.[4]

C. Licensing Decisions and Hearings on Issues Related to the Fukushima Accident Must be Suspended and Should be Suspended Pending Completion of the Task Force Investigation and Publication of Proposed Decisions.

As discussed above, in order to ensure that it complies with the AEA and NEPA in responding to the regulatory implications of the Fukushima accident, the Commission must take action to delay issuance of licensing decisions while it studies and proposes to implement the lessons learned from the Fukushima accident. And even assuming for purposes of argument that such relief is not legally mandated, it is prudent and appropriate for the Commission to delay

[4] Petitioners recognize that the NRC has the discretion to choose between site-specific and generic analyses in evaluating the environmental significance of the new information. *See, e.g., Baltimore Gas and Electric Co. v. Natural Resources Defense Council,* 462 U.S. 87, 101 (1983). The Commission completely lacks discretion, however, to ignore the requirements of NEPA.

making licensing decisions until it has studied and proposed measures to implement the lessons of the Fukushima accident. The Commission should suspend its licensing actions, just as it did after the Three Mile Island accident – an event that was much less serious than the Fukushima accident.

Therefore Petitioners respectfully request the Commission to take the following actions:

- The Commission should suspend all decisions regarding the issuance of construction permits, new reactor licenses, COLs, ESPs, license renewals, or standardized design certification pending completion by the NRC's Task Force of its investigation of the near-term and long-term lessons of the Fukushima accident and the issuance of any proposed regulatory decisions and/or environmental analyses of those issues;
- The Commission should suspend all proceedings with respect to hearings or opportunities for public comment, on any reactor-related or spent fuel pool-related issues that have been identified for investigation in the Task Force's Charter of April 1, 2011 , including external event issues (i.e., seismic, flooding, fires, severe weather); station blackout; severe accident measures (e.g., combustible gas control, emergency operating procedures, severe accident management guidelines); implementation of 10 C.F.R. § 50.54(hh)(2) regarding response to explosions or fire; and emergency preparedness. The Commission should also instruct ASLB panels that are considering contentions to permit the parties an opportunity to make arguments regarding the relevance of their concerns to the Fukushima accident.
- The Commission should suspend all licensing and related rulemaking proceedings with regard to any other issues that are identified by the Task Force as the subject of its investigation. The proceedings should be suspended pending completion of the Task

Force's investigation into those issues and the issuance of any proposed regulatory decisions and/or environmental analyses of those issues.

- The Commission should conduct an analysis, as required by NEPA, of whether the March 11, 2011 Tohoku-Chihou-Taiheiyo-Oki earthquake and ensuing radiological accident poses new and significant information that must be considered in environmental impact statements to support the licensing decisions for all new reactors and renewed licenses. All environmental assessments should be published in draft form for public comment.
- The Commission should conduct a safety analysis of the regulatory implications of the March 11, 2011 Tohoku-Chihou-Taiheiyo-Oki earthquake and ensuing radiological accident. While emergency safety measures that arise from that analysis may be issued as enforcement orders, any long-term requirements should be issued as proposed rules, with appropriate opportunities for comment.
- The Commission should establish procedures and a timetable for raising new issues relevant to the Fukushima accident in pending licensing proceedings. The Commission should allow all current intervenors in NRC licensing proceedings, all petitioners who seek to re-open closed licensing proceedings, and all parties who seek to comment on design certification proposed rules, a period of 60 days following the publication of proposed regulatory measures or environmental decisions, in which to raise new issues relating to the Fukushima reactor accidents. The Commission should suspend requirements to justify the late-filing of new issues if their relevance to the Fukushima accident can be demonstrated.

D. Emergency Action is Needed in Order to Ensure Compliance with AEA and NEPA.

Petitioners request the Commission to grant the requested relief on an emergency basis, because several licensing proceedings are scheduled to conclude in the near future, including the COL proceeding for Vogtle Units 3 and 4, the license renewal proceeding for Pilgrim, and the rulemaking proceedings for the AP1000 standardized design and the ESBWR standardized design. In addition, the Commission has signaled its intent to continue with reactor licensing in spite of the emergence of new information from the Fukushima accident, by approving the renewal of the Vermont Yankee license on March 21, 2011. Petitioners urgently request the Commission to reconsider that policy because of its fundamental inconsistency with NEPA and the AEA.

VII. CONCLUSION

For the foregoing reasons, Petitioners request the Commission to grant the above-requested relief on an emergency basis.

Respectfully submitted,

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April 14-18, 2011
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April 12, 2011

Japan's Reactors Still 'Not Stable,' U.S. Regulator Says

By MATTHEW L. WALD

WASHINGTON — The condition of the damaged Fukushima Daiichi reactors in Japan is "static," but with improvised cooling efforts they are "not stable," the chairman of the Nuclear Regulatory Commission told a Senate committee on Tuesday.

"We don't see significant changes from day to day," the chairman, Gregory B. Jaczko, said, while adding that the risk of big additional releases gets smaller as each day passes.

Long-term regular cooling of the reactors has not been re-established, nor has a regular way of delivering water to the spent-fuel pools, he told the Senate Environment and Public Works Committee. And when an aftershock hit the site and cut some offshore power supplies, he said, some pumps failed and cooling stopped for 50 minutes.

The situation is "not stable" and will remain so until "that kind of situation would be handled in a predictable manner," he said.

Mr. Jaczko also offered a new theory about the cause of the explosions that destroyed the secondary containment structures of several of the reactors. The prevailing theory has been that hydrogen gas was created when the reactor cores overheated and filled with steam instead of water; the steam reacts with the metal, which turns into a powder and then gives off hydrogen.

The Tokyo Electric Power Company, which operates the nuclear plant, intended to vent the excess steam as well as the hydrogen outside of the plant, but experts have suggested that when operators tried this, the vents ruptured, allowing the hydrogen to enter the secondary containments.

But Mr. Jaczko said Tuesday that the explosions in the secondary containments might have been caused by hydrogen created in the spent-fuel pools within those containments.

If true, that would mean that the introduction of hardened vents at reactors at nuclear plants in the United States — cited as an improvement that would prevent such an explosion from happening — would not in fact make any difference.

That theory also raises the possibility that it may be safer to move some of the spent fuel out of the pools in the containment structures and into dry storage, an idea that is attracting some support in Congress. Spent nuclear fuel must remain in water for the first five years or so to cool but can then can be stored in small steel-and-concrete silos with no moving parts.

The industry uses these "dry casks" only when its pools are full. And so far the regulatory commission has said that pool and cask storage are equally safe. Still, some industry executives would like to tap the Nuclear Waste Fund, federal money set aside for a permanent waste repository, to pay for cask storage, an idea that is also favored by some environmentalists.

Mr. Jaczko's statement on the possible source of the hydrogen is the third big reversal in commission statements on the nuclear crisis at Fukushima.

Commission officials have also seemed less certain after stating that the spent-fuel pool in the No. 4 reactor was empty or close to empty, a situation that was evidently the basis for recommending a 50-mile evacuation for Americans in the plant's vicinity. Commission experts also said that radiation readings suggested that core material had slipped out of the vessel of the No. 2 reactor and entered a drywell in the primary containment, only to retreat again on whether that was in fact the case.

Mr. Jaczko also signaled that the regulatory commission itself was shifting from an extreme alert mode to a more sustainable long-term effort to monitor Japan's crisis. Staffing in the commission's round-the-clock emergency center at its headquarters in Rockville, Md., has been reduced, he said, with many staff members returning to their regular duties but available for consultation when events warrant.

He drew praise from the committee's chairwoman, Senator Barbara Boxer, a California Democrat, but criticism as well. She is seeking an especially high level of scrutiny for two twin-reactor plants in her state, the only ones that the commission says are in zones of high seismic activity. Mr. Jaczko said that all reactors were being evaluated.

She countered by saying that those two plants, Diablo Canyon and San Onofre, were at the highest risk. Mr. Jaczko said they were not, explaining that they were designed with the earthquake risk in mind and that risks to American plants generally were small.

Ms. Boxer replied that the Japanese had said the same thing, at least until the March 11 accident. "It's eerie to me," she said. "I don't sense enough humility from all of us here."

Another witness, Charles G. Pardee, the chief operating officer of Exelon Generation, the largest nuclear operator in the United States, also testified that the nation's nuclear plants were designed for the worst natural disaster observed in their areas, plus a substantial margin.

Thomas B. Cochran, a physicist at the Natural Resources Defense Council, gave some credit to American operators. Worldwide, he said, reactors are "not sufficiently safe," but "the next nuclear power plant disaster is more likely to occur abroad than in the U.S."

But the industry will have to rethink its practices nonetheless, he said. "If the nuclear power industry is to have a long-term future, attention must be paid to existing operating reactors," Mr. Cochran said. He ticked off a long list of factors, including American reactors that share Fukushima's basic design, that would be grounds for phasing them out.

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DECLARATION OF DR. ARJUN MAKHIJANI IN SUPPORT OF EMERGENCY PETITION TO SUSPEND ALL PENDING REACTOR LICENSING DECISIONS AND RELATED RULEMAKING DECISIONS PENDING INVESTIGATION OF LESSONS LEARNED FROM FUKUSHIMA DAIICHI NUCLEAR POWER STATION ACCIDENT

I, Arjun Makhijani, declare as follows:

Introduction and Statement of Qualifications

1. I am President of the Institute for Energy and Environmental Research ("IEER") in Takoma Park, Maryland. Under my direction, IEER produces technical studies on a wide range of energy and environmental issues to provide advocacy groups and policy makers with sound scientific information and analyses as applied to environmental and health protection and for the purpose of promoting the understanding and democratization of science. A copy of my curriculum vitae is attached.

2. I am qualified by training and experience as an expert in the fields of plasma physics, electrical engineering, nuclear engineering, the health effects of radiation, radioactive waste management and disposal(including spent fuel), estimation of source terms from nuclear facilities, risk assessment, energy-related technology and policy issues, and the relative costs and benefits of nuclear energy and other energy sources. I am the principal author of a report on the 1959 accident at the Sodium Reactor Experiment facility near Simi Valley in California, prepared as an expert report for litigation involving radioactivity emissions from that site. I am also the principal author of a book, *The Nuclear Power Deception – U.S. Nuclear Mythology from Electricity "Too Cheap to Meter" to "Inherently Safe' Reactors"* (Apex Press, New York, 1999, co-author, Scott Saleska), which examines, among other things, the safety of various designs of nuclear reactors.

3. I have written or co-written a number of other books, reports, and publications analyzing the safety, economics, and efficiency of various energy sources, including nuclear power. I am also the author of *Securing the Energy Future of the United States: Oil, Nuclear and Electricity Vulnerabilities and a Post-September 11, 2001 Roadmap for Action* (Institute for Energy and Environmental Research, Takoma Park, Maryland, December 2001). In 2004, I wrote "Atomic

Myths, Radioactive Realities: Why nuclear power is a poor way to meet energy needs," *Journal of Land, Resources, & Environmental Law,* v. 24, no. 1 at 61-72 (2004). The article was adapted from an oral presentation given on April 18, 2003, at the Eighth Annual Wallace Stegner Center Symposium entitled, "Nuclear West: Legacy and Future," held at the University of Utah S.J. Quinney College of Law. In 2008, I prepared a report for the Sustainable Energy & Economic Development (SEED) Coalition entitled *Assessing Nuclear Plant Capital Costs for the Two Proposed NRG Reactors at the South Texas Project Site.*

4. I am generally familiar with the basic design and operation of U.S. nuclear reactors and with the safety and environmental risks they pose. I am also generally familiar with materials from the press, the Japanese government, the Tokyo Electric Power Company, the French government safety authorities, and the U.S. Nuclear Regulatory Commission ("NRC") regarding the Fukushima Daiichi accident and its potential implications for the safety and environmental protection of U.S. reactors.

5. The purpose of my declaration is to explain the reasons I believe that although the causes, evolution, and consequences of the Fukushima accident are not yet fully clear, the accident is already presenting new and significant information regarding the risks to public health and safety and the environment posed by the operation of nuclear reactors. I will also explain why I believe that integration of this new information into the NRC's licensing process could affect the outcome of safety and environmental analyses for reactor licensing and relicensing decisions by resulting in either the denial of licenses or license extensions or the imposition of new conditions and/or new regulatory requirements. It could also affect the NRC evaluation of the fitness of new reactor designs for certification. It is therefore reasonable and necessary to suspend licensing and re-licensing decisions and standardized design certifications until the NRC completes its review of the safety and regulatory implications of the Fukushima accident.

Statement of Facts

6. Although many details about the Fukushima reactor accident remain unclear, the general contours of the accident are described in NRC Information Notice No. 2011-08 (March 31, 2011) (NRC Accession No. ML 110830824) as follows:

> On March 11, 2011, the Tohoku-Taiheiyou-Oki earthquake occurred near the east coast of Honshu, Japan. This magnitude 9.0 earthquake and the subsequent tsunami caused significant damage to at least four of the six units of the Fukushima Daiichi nuclear power station as the result of a sustained loss of both the offsite and onsite power systems. Efforts to restore power to emergency equipment were hampered and impeded by damage to the surrounding areas due to the tsunami and earthquake.
>
> Units 1, 2 and 3 were operating at the time of the earthquake. Following the loss of electric power to normal and emergency core cooling systems and the subsequent failure of backup decay heat removal systems, water injection into the cores of all three reactors was compromised, and reactor decay heat removal could not be maintained. The operator of the plant, Tokyo Electric Power Company, injected sea water and boric acid into the reactor vessels of these three units, in an effort to cool the fuel and ensure that the

reactors remained shut down. However, the fuel in the reactor cores became partially uncovered. Hydrogen gas built up in Units 1 and 3 as a result of exposed, overheated fuel reacting with water. Following gas venting from the primary containment to relieve pressure, hydrogen explosions occurred in both units and damaged the secondary containments.

Units 3 and 4 were reported to have low spent fuel pool (SFP) water levels.

Fukushima Daiichi Units 4, 5 and 6 were shut down for refueling outages at the time of the earthquake. The fuel assemblies for Unit 4 had recently been offloaded from the reactor core to the SFP. The SFPs for Units 5 and 6 appear to be intact. Emergency power is available to provide cooling water flow through the SFPs for Units 5 and 6.

The damage to Fukushima Daiichi nuclear power station appears to have been caused by initiating events beyond the design basis of the facilities.

7. In a March 21, 2011, briefing, Bill Borchardt, the NRC's Executive Director for Operations, stated that the NRC believes that hydrogen explosions occurred on March 12, 14, and 15 in the reactors of Units 1, 3, and 2 respectively, in that order. He also stated that the NRC believed that a hydrogen explosion had occurred at spent fuel pool of Unit 4 on March 15 due to overheated spent fuel in the pool. Briefing on NRC Response to Recent Nuclear Events in Japan, Transcript at 11.

8. According to Mr. Borchardt, the NRC believes that Units 1, 2, and 3 have likely sustained some degree of core damage. *Id.* Further, he stated that the loss of emergency AC power was caused by the tsunami and not the earthquake. Therefore, he concluded that the NRC believes that the "damage in Fukushima was not really caused by the earthquake; it was the tsunami that came afterwards." *Id.*

9. At the outset of the emergency, large volumes of sea water were used to cool the reactors. The salt water injections were then replaced by fresh water injections. While judgments have changed over time, and much remains uncertain, we note here that as of March 21, Mr. Borchardt also stated that "[t]he radiation releases and the dose rates that we've seen on site, I think, were primarily influenced by the condition of the Units Three and Four spent fuel pools." *Id.* at 21.

10. The French authorities also reported that sea water was used to cool spent fuel pools Units 3 and 4. *Communiqué de presse n°17 du mardi 22 mars 2011 à 10h00 Séisme au Japon - L'ASN fait le point sur la situation de la centrale nucléaire de Fukushima Daiichi : Les travaux en vue de rétablir l'alimentation électrique se poursuivent mais la mise sous tension n'est pas réalisée Paris, le 22/03/2011 10:27*, http://japon.asn.fr/index.php/Site-de-l-ASN-Special-Japon/Communiques-de-presse (March 22, 2011). They also reported that three spent fuel pools (of Units 2, 3, and 4) appear to have experienced boiling at some point. *Note d'information : Situation des réacteurs nucléaires au Japon suite au séisme majeur survenu le 11 mars 2011 : Point de situation du 18 mars 2011 à 14 heures*, Institut de Radioprotéction et de Sûreté Nucléaire (March 18, 2011),

http://www.irsn.fr/FR/Actualites_presse/Actualites/Documents/IRSN_Seisme-Japon_Point-situation-18032011-14h.pdf -- hereafter IRSN March 18, 2011)

11. In response to the Fukushima reactor accident, the NRC announced the formation of a "senior level agency task force to conduct a methodical and systematic review" of NRC processes and regulations. COMGBJ-11-0002, Memorandum from Chairman Jaczko to Commissioners, re: NRC Actions Following the Events in Japan at 1 (March 21, 2011) (NRC Accession No. ML110800456). The purpose of the task force is to "determine whether the agency should make additional improvements to our regulatory systems and make recommendations to the Commission for its policy direction." *Id.*

12. Chairman Jaczko's memorandum specifies both a near-term review and a longer-term review. For the near-term review, the Commission required the task force to evaluate issues "affecting domestic operating reactors of all designs" in areas that include "protection against earthquake tsunami, flooding, hurricanes; station blackout and a degraded ability to restore power; severe accident mitigation; emergency preparedness; and combustible gas control." *Id.* at 1. The Commission instructed the task force to complete the report in 90 days. In the meantime, the task force was instructed to provide a 30-day "quick look report" and another "status" report in 60 days. *Id.*

13. The "longer term" review would begin "as soon as NRC has sufficient technical information from the events in Japan with the goal of no later than the completion of the 90 day near term report." *Id.* at 2. The longer-term study should "evaluate all technical and policy issues related to the event to identify additional research, generic issues, changes to the reactor oversight process, rulemakings, and adjustments to the regulatory framework that should be conducted by the NRC." *Id.* For the longer-term effort, the Commission instructed the task force to "receive input from and interact with all key stakeholders." *Id.* The Commission specified that within six months after commencing the evaluation, the task force should "provide a report with recommendations, as appropriate, to the Commission." *Id.*

14. The "Task Force to Conduct a Near-term Evaluation of the Need for Agency Actions Following the Events in Japan" ("Task Force") has formed and its charter has been approved. The Task Force aims to accomplish the following:

- "Evaluate currently available technical and operational information from the events that have occurred at the Fukushima Daiichi nuclear complex in Japan to identify potential or preliminary near-term/immediate operational or regulatory actions affecting domestic reactors of all designs, including their spent fuel pools. The task force will evaluate, at a minimum, the following technical issues and determine priority for further examination and potential agency action:
    - External event issues (e.g. seismic, flooding, fires, severe weather)
    - Station blackout
    - Severe accident measures (e.g., combustible gas control, emergency operating

procedures, severe accident management guidelines)

- 10 CFR 50.54 (hh)(2) which states, "Each licensee shall develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire, to include strategies in the following areas: (i) Fire fighting; (ii) Operations to mitigate fuel damage; and (iii) Actions to minimize radiological release." Also known as B.5.b.

    - Emergency preparedness (e.g., emergency communications, radiological protection, emergency planning zones, dose projections and modeling, protective actions)

- Develop recommendations, as appropriate, for potential changes to NRC's regulatory requirements, programs, and processes, and recommend whether generic communications, orders, or other regulatory actions are needed."

Charter for the Nuclear Regulatory Commission Task Force to Conduct a Near-Term Evaluation of the Need for Agency Actions Following the Events in Japan at 1 (April 1, 2011) (NRC Accession No. ML11089A045).

15. With respect to the longer-term review, the Charter states that the short-term report will make: "[r]ecommendations for the content, structure, and estimated resource impact…." *Id.* at 1.

Statement of Professional Opinion

16. I agree with the Commission's approach of conducting a long-term investigation of the regulatory implications of the Fukushima accident, in addition to its short-term investigation of whether immediate actions are needed. In my opinion, the longer-term investigation is necessary to address a number of respects in which the Fukushima accident is unprecedented in the sense that its characteristics are not anticipated in NRC safety regulations or environmental analyses. Thus, it is providing new and significant insights into the inadequacy of NRC regulations to protect public health and safety and the inadequacy of NRC environmental analyses to evaluate the potential health, environmental and economic costs of reactor and spent fuel pool accidents. This significant new information covers the following major topics:

- Unanticipated compounding effects of simultaneous accidents at multiple co-located reactor units, including spent fuel pools.
- Unanticipated risks of spent fuel pool accidents, including explosions.
- Frequency of severe accidents and explosions.
- Inadequacy of safety systems to respond to long-duration accidents.
- Nuclear crisis management with contaminated control and turbine buildings that have lost power
- Unanticipated aggravating effects of some emergency measures.
- Health effects and costs of severe accidents

- The hydrogen explosions at Fukushima and their implications for aircraft crash evaluations.

Unanticipated compounding effects of simultaneous accidents at multiple co-located reactor units, including spent fuel pools.

17. Perhaps the most unprecedented feature of the Fukushima accident is that three reactors and four spent fuel pools have been stricken at the same site. In the entire history of nuclear power, there has not been another major accident (level 5 or above) that has involved multiple major sources of radioactivity -- including multiple reactors and multiple spent fuel pools. For instance, the Fukushima Daiichi complex is the first to have experienced multiple hydrogen explosions in various facilities, all as part of the same event.

18. The NRC has long followed the practice of allowing new reactors to be built at existing sites, without examining the consequences of simultaneous failure of existing and new reactors through common mode failures such as complete station blackouts and loss of fresh water supply. The NRC also proposes to co-locate a significant number of new reactors at existing reactor sites. Examples include Bellefonte, Calvert Cliffs, Comanche Peak, Fermi, North Anna, Shearon Harris, Turkey Point, the South Texas Project, and Vogtle.

19. But the Fukushima accident graphically demonstrates that NRC's failure to evaluate the safety and environmental implications of co-locating multiple reactors was incorrect. Specifically, when a new reactor is to be sited at a location where there are existing reactors, the entire system at the site should be re-examined in addition to whatever additional impacts the new unit(s) might create. The EISs for these new reactors and the designs on which they rely should consider the significant new information revealed by the Fukushima accident about the potential for simultaneous multiple failures and accidents in existing and new reactors and/or spent fuel pools.

Unanticipated risks of spent fuel pool accidents, including explosions.

20. Another unprecedented feature of the Fukushima accident is that an explosion occurred in Unit 4 despite the fact that there was no fuel in the reactor. The entire core had been unloaded into the spent fuel pool prior to March 11, 2011; the reactor was down for maintenance. A loss of cooling apparently led to boiling and to hydrogen generation, which appears to be the likely cause of the major explosion and ensuing damage to the reactor building of Unit 4. Further, as noted above the spent fuel pools of Units 2 and 3 also appear to have experienced boiling of the cooling water at some point. It should be noted that much detail remains to be learned about all three spent fuel pools, especially as to what went on in the first week of the accident.

21. The apparent occurrence of spent fuel pool accidents at Fukushima significantly undermines the NRC's conclusion that high-density pool storage of spent fuel poses a "very low risk." *The Attorney General of Commonwealth of Massachusetts; the Attorney General of California; Denial of Petitions for Rulemaking,* 73 Fed. Reg. 46,204, 46,207 (August 8, 2008). That conclusion is all the more subject to question in light of the fact that spent fuel in U.S. pools is typically packed more tightly than in the pools at Fukushima. U.S. reactors, including reactors

that are candidates for license renewal, use high-density pool storage for spent fuel. Fukushima indicates that the NRC policy that allows such storage needs to be revisited. Given that onsite storage of spent fuel may continue for decades, these circumstances also call for a thorough reexamination of the spent fuel storage capacity, spent fuel pool location, and configuration of new reactor designs. For instance, should the construction and use of above ground-level spent fuel pools in reactor buildings be allowed, as is the case with the advanced boiling water reactor ("ABWR")? The NRC should examine the potentially exacerbating relationship between reactor core accidents and spent fuel pool accidents, for both existing reactor designs and new reactor designs. In addition, environmental impact statements ("EISs") for license renewal and new reactor licensing should reexamine the relative costs and benefits of measures to mitigate the environmental impacts of pool fires and/or explosions. Measures would include reducing the density at which fuel is stored in pools, using dry storage for as much of each reactor's inventory of spent fuel as safety will allow, and dry storage of all spent fuel at closed reactors, a few years after closure.

Frequency of severe accidents and explosions

22. The NRC must also re-examine the frequency per reactor per year of spent fuel pool accidents as well as the frequency of core damage events. The NRC's current spent fuel damage assessments are based on a best estimate of a spent fuel pool fire probability of about $2x10^{-6}$ per reactor-year, including the probability of structural failure during a seismic event NUREG-1353, *Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools"*, at 5-5 and Table 5.1.3 (1989). This means one such accident for every 500,000 reactor-years. The NRC's estimate of the frequency of spent fuel pool loss of cooling from all causes other than earthquake-induced structural failure is even lower: $1.5x10^{-7}$. The conditional probability of a fire in the event of a loss of cooling is estimated to be 1.0 for a PWR and 0.25 for a BWR. *Id.* at 4-36. Based on this, the overall probability estimate in NUREG-1353 for a non-seismic-induced spent fuel pool fire for a PWR is $1.5x10^{-7}x1.0 = 1.5x10^{-7}$; for a BWR it is $1.5x10^{-7}x0.25 = 4x10^{-8}$ for a BWR – in the latter case is it one spent fuel pool fire every 25 million reactor-years. Hydrogen explosions originating in the spent fuel pool were not considered. Further, at least two spent fuel pools at Fukushima (Units 3 and 4) that seem to have experienced boiling as well as the destruction of the portions of the reactor building that are a barrier between the pool surface and the environment. According to the French safety authorities, the spent fuel pool in Unit 2 also experienced boiling. IRSN March 18, 2011 *op. cit.* One reactor building, that of Unit 4, appears to have experienced a hydrogen explosion, with the hydrogen apparently emanating from the spent fuel pool (see Paragraph 7 above). The explosion destroyed a good part of the reactor building. Any damage to the spent fuel pool structures and equipment, to the fuel assemblies in the pools, as well as to the racks remains to be fully assessed. It appears that the only way that a significant amount of hydrogen could originate in a spent fuel pool is through uncovering of the spent fuel and the reaction of the zirconium in the fuel rods with steam. Explosions destroyed substantial portions of the reactor buildings of Units 1 and 3 as well; it appears that there were also significant releases of radioactivity from the spent fuel pool of Unit 3. In view of these facts, the NRC's estimate of loss of cooling probability accompanied by a fire is far too low, probably by orders of magnitude. It appears that the overall principal initiating event in the station blackout and failure of emergency core cooling was not the earthquake but the tsunami, though the earthquake may have caused equipment damage that

led to or contributed to some of the spent fuel pool problems. This indicates that the non-earthquake station blackout probabilities will need to be revisited. Further, the NRC's list of events leading to spent fuel structural failure does not include hydrogen explosions due to loss of emergency core cooling in the reactor (NUREG-1353, *op. cit.*, Table 4.7.1 at 4-36), which appears to have been the cause of the damage to the structures of reactor buildings 1 and 3 and possibly to the spent fuel pool of Unit 3. It may be that many details of the analysis will be different for each of the four spent fuel pools. Whatever the details, the events so far make it quite clear that the NRC needs to thoroughly reevaluate the probability of severe spent fuel pool accidents as well as the kinds of events that could initiate damage and major releases of radioactivity from spent fuel pools. Further, in view of the fact that three BWRs appear to have had core damage, the NRC also needs to evaluate whether presently operating reactors, notably (but not only) BWRs, meet the Commission's target of limiting annual core damage frequency to the 10^{-4} to $5x10^{-5}$ per reactor-year range for reactors (NUREG-1353, *op. cit*., at ES-2 and ES-3).

23. In conducting its review, the NRC needs to thoroughly revisit its methods for estimating the probabilities and mechanisms of hydrogen explosions and fires in spent fuel pools (with and without a natural disaster component) as well as the methods for estimating hydrogen explosions, and meltdowns in existing and new light water reactor designs. For instance, the computer code used in evaluating the accidents assumes that "[t]he geometry of the fuel assemblies and racks remains undistorted." NUREG-1353, *op cit*. at 4-8. To judge by the photographs and videos of the damage, this assumption is unlikely to be correct at least for spent fuel pools in Units 3 and 4. As another example, hydrogen generation due to partial uncovering of spent fuel but with water still remaining in the pool is not included. Rather, the computer program assumes that "[t]he water drains instantaneously from the pool." *Id.* This is important because if the investigation confirms that hydrogen was indeed generated in the spent fuel pool of Unit 4, the exothermic zirconium-steam reaction that creates it would be an additional source of heat for causing the accident to develop more rapidly and destructively than assumed by the NRC.

24. More generally, the events at three reactors and four spent pools have drastically changed the underlying frequency data that should go into the estimation of the probability of severe accidents at light water reactors. As a result, integration of the Fukushima data into NRC analyses of risks could lead to significant changes in design of new reactors and also lead to modifications at existing reactors, as would be required for protection of public health and safety under 10 CFR 50.109. Specifically, the Fukushima accident indicates that the basis of the NRC's conclusion in NUREG-1353 that dense storage of spent fuel in pools is safe and that dry storage is not warranted is incorrect.

Inadequacy of safety systems to respond to long-duration accidents

25. U.S. reactors appear to have insufficient backup power capacity to maintain safety equipment during a prolonged severe accident. The Fukushima accident, in which the emergency diesel generation system started but then failed very soon after the tsunami and the battery backup ran out of power in eight hours. The accident illustrates the serious environmental risk posed by insufficient backup power when catastrophic events destroy both offsite power supplies and onsite infrastructure. These risks need to be taken into account in safety and environmental analyses for all prospective NRC licensing decisions. The fact that

there was a complete station blackout at Fukushima accompanied by a failure of fresh water supply that forced sea water use for days (*Communiqué de presse n°17 du mardi 22 mars 2011 à 10h00 Séisme au Japon - L'ASN fait le point sur la situation de la centrale nucléaire de Fukushima Daiichi : Les travaux en vue de rétablir l'alimentation électrique se poursuivent mais la mise sous tension n'est pas réalisée Paris, le 22/03/2011 10:27*, http://www.asn.fr/index.php/Haut-de-page/Presse/Actualites-ASN/Communique-de-presse-n-17-du-mardi-22-mars-2011-a-10h00) clearly points to the need for a full review of the depth (in terms of number of levels) of backup systems, the length of time of emergency power supply operability, the location of these power supplies, and the relation of the power supplies to ad hoc emergency pumping and emergency water supplies, including in the context of potential major damage to multiple units at a single site.

Nuclear crisis management with contaminated control and turbine buildings that have lost power

26. Another critical and unanticipated feature of the Fukushima accident is that the control rooms of Units 1, 2, and 3 became highly contaminated in the course of the first week of the accident, according to the French safety authorities. IRSN March 18, 2011 *op. cit*.. This has made re-establishment of normal cooling more difficult, apart from the question of on-site or offsite power supply. Turbine buildings also became contaminated with radioactive water in the course of the accident. *Fukushima Daiichi Nuclear Power Station: the result of measurement of sub drain*, http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/110331e18.pdf and *The detection of radioactive materials in the water on 1st basement of turbine building at the site of Fukushima Daiichi Nuclear Power Station: Press Release* (Mar 31,2011), http://www.tepco.co.jp/en/press/corp-com/release/11033112-e.html.

27. The loss of power in and radioactive contamination of the control rooms and turbine buildings points to the need to review the piping and ventilation arrangements of these facilities, and the likely need to isolate them more thoroughly from contaminated air and water during beyond-design-basis accidents. Based on the information available so far about the Fukushima event, the risks of turbine building contamination would appear to be greater for boiling water reactors than for pressurized water reactors since steam generated from primary water is used to directly drive the turbines; in PWRs the heated primary water is routed to steam generators and not to the turbines.

Unanticipated aggravating effects of some emergency measures

28. Light water reactors are not designed to be cooled by sea water. Thus, the fact that TEPCO was forced to use sea water for emergency cooling for an extended period is a critical feature of the accident that needs evaluation. For instance, salt from sea water deposited on the fuel rods may have blocked or partially blocked some cooling channels during the accident. This raises the question of whether the use of sea water may have aggravated the fuel damage. It also raises the question of whether salt deposits may have interfered with the neutron absorption capacity of the control rods thereby increasing the likelihood of an accidental criticality. An understanding of these issues is important to the understanding of the accident and to any design and or emergency operations changes that may be needed.

Health effects and costs of severe accidents

29. While a detailed evaluation will take time and more data, the Fukushima accident indicates that the health consequences of a severe reactor accident and/or spent fuel pool fire could be significantly greater than estimated by the NRC in EISs for license renewal and new reactor licensing. For instance, the NRC estimates an average population risk (population dose multiplied by probability) in a 50-mile radius of only 16 person-rem per year per spent fuel pool – or 480 rem in 30 years. The dose estimate was recently used in the 2009 draft Generic Environmental Impact Statement ("GEIS") by the NRC. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Appendices*, Draft Report for Comment, NUREG-1437, Volume 2, Rev. 1 at E-35 (July 2009). *See also* NUREG-1353, *op. cit.*, at ES-3. The estimate of 480 rem in 30 years translates into a probability of just 0.27 fatal cancers over 30 years in a population of more than 2.5 million (using a risk factor of 0.000575 fatal cancers per rem). The NRC's best estimate of the total population dose dose in the event of an accident was 8 million person-rem (NUREG-1353, *op cit*. at 5-4, Table 5.1.2) – which translates into 4,600 excess cancer deaths in a fifty-mile radius. The NRC put the worst case population dose estimate at just over three times the best estimate – 26 million person-rem. NUREG-1353, *op cit*. Table 5.1.2 at 5-4. But if the probability is much higher for a single failure and if multiple failures can happen at the same site, then the number of expected fatal cancers would be higher, all other things being equal. Further, it is necessary to consider that the spent fuel pools in the United States are more typically full than the ones at Fukushima. In its review of Fukushima, the NRC should revisit the higher of the health damage estimates for spent fuel pool accidents at closed power plants in a 1997 study by Brookhaven National Laboratory. R.J. Travis, R.E. Davis, E.J. Grove, M.A. Azarm, *A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants,* BNL-NUREG-52498, NUREG/CR-6451 (Brookhaven National Laboratory, 1997), http://www.osti.gov/bridge/product.biblio.jsp?osti_id=510336. NUREG-/CR6451 estimated the worst case population dose in a 50 mile radius at 81 million person-rem for both BWRs and PWRs. *Id*. at Tables 4-1 and 4-2. This is more than three times higher than in the estimate in NUREG-1353 cited above.

30. The Fukushima accident also indicates that the economic costs of a spent fuel pool accidents may be much higher than the current estimates used by the NRC. In NUREG-1353, the worst case property damage was estimated at $30 billion (1988 dollars) in a 50-mile radius. *Id.* at Table 5.1.2. That amount is about $50 billion in 2010 dollars (constant 2010 dollar estimates calculated using the Gross Domestic Product deflators of the U.S. Department of Commerce, as published by the St. Louis Federal Reserve at http://research.stlouisfed.org/fred2/data/GDPDEF.txt and rounded to the nearest $10 billion). But in the Brookhaven study, the worst-case property damage in a 50-mile radius was estimated at $280 billion for BWRs (*Id*. at Table 4-2), which would be about $370 billion in 2010 dollars – or more than seven times the NUREG-1353 estimate cited above. The worst case damages in a 500-mile radius were estimated at $546 billion for U.S. boiling water reactors ("BWRs") plus 138,000 excess cancer deaths (*Id*. at Table 4-2) with a high population density. The damage amount would be about $720 billion in 2010 dollars. Results were slightly higher for pressurized water reactor spent fuel pools. *Id*. at Table 4-1. The overall 500-mile population density

assumed in the Brookhaven study was lower than the population density near several U.S. reactors, notably in the Northeast. Further, the Brookhaven study itself notes its calculations would not "reasonably envelope" the situation (including projected population growth) at certain locations where there are reactors close to major metropolitan centers. "There are several existing plant sites (i.e., Indian Point, Limerick, and Zion) that precede the issuance of R.G. 4.7 and exceed the site population distributions generally considered acceptable by current NRC policy.") *Id.* at 3-4 and footnote at 3-4. Moreover, certain assumptions of the 1997 Brookhaven study may prove optimistic especially in densely populated areas. For instance, the study assumes that the population could be evacuated in one day, should evacuation become necessary. *Id.* at 3-8. As another example, the relocation radius was only 10 miles, as per NUREG-1150. *Id*. at 3-8 and NUREG-1150, *An Assessment for Five Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants: Final Summary Report*, U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research Vol. 1 at 2-20 (December 1990), http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1150/v1/sr1150v1-intro-and-part-1.pdf. The relocation radius around Fukushima is greater than 10 miles. Moreover the U.S. advised its citizens early on to evacuate within a 50-mile radius of Fukushima Daiichi. This indicates that emergency management criteria and procedures need to be revisited.

31. In view of the severe crisis with multiple units at Fukushima in a densely populated industrialized country where there has been both direct and indirect economic damage, the 1997 Brookhaven study provides a reasonable starting point for a reevaluation of spent fuel accident consequences. Of course, Fukushima shows that the results of the Brookhaven study must be reviewed in the context of the potential for multiple failures at a single site in both reactors and spent fuel pools. Evacuation and population assumptions will likely need to be changed. As a result, both the monetary damages and health effects estimates may have to be revised upwards, possibly by substantial amounts in densely populated areas. Further, Fukushima is showing that there has already been indirect economic damage in industries like shipping and manufacturing that are not directly affected by fallout. While, the long-term and overall direct and indirect costs of the reactor and spent fuel damages from the Fukushima accident will take time to be tallied, it is clear that they will be enormous.

Hydrogen explosions and implications for aircraft crash evaluations

32. The Fukushima accident has revealed significant new information about the potential effects of hydrogen explosions. The estimated Unit 1 generation of hydrogen was 300 to 600 kg; for Units 2 and 3 it was 300 to 1,000 kg. Estimates were by an expert commissioned by AREVA. Matthias Braun, *The Fukushima Daiichi Incident*, AREVA, April 15, 2011, at 18, http://www.wdr.de/tv/monitor//sendungen/2011/0407/pdf/areva-fukushima-report.pdf. This indicates an urgent need to revisit the issue of aircraft crashes, deliberate or accidental, at existing reactors and spent fuel pools. The energy of the estimated amounts of hydrogen involved in the Fukushima explosions is far smaller than fuel in fully-loaded commercial jetliner – a type of crash that must be evaluated under NRC regulations. Five thousand gallons of jet fuel (not at all unusual for larger passenger jets -- the largest ones have much larger fuel capacities) have an energy content about four times as large as the largest estimate of the hydrogen explosions (1,000 kilograms of hydrogen gas) at Fukushima. Indeed, in light of Fukushima even a smaller, regional jet crash needs to be taken into account, especially for older

BWRs. Such damage needs to be evaluated both in the safety and environmental analyses. For instance, the Fukushima accident has demonstrated that evacuation planning in the circumstances of a natural disaster that is combined with a reactor accident is far more challenging than assumed by NRC emergency planning regulations.

Conclusions

33. As discussed above in pars. 16 through 32, the Fukushima accident has already revealed an enormous amount of new information regarding the safety vulnerabilities and environmental risks that need to be taken into account in licensing of new reactors, the re-licensing of existing reactors, early site permits, emergency procedures for protecting the civilian population, and approval of standardized reactor designs in rulemakings.

34. I believe that if the significant new information emanating from the Fukushima Daiichi accident is taken into consideration in NRC safety and environmental analyses, it is likely to fundamentally alter the outcome of those analyses in important ways. In the safety arena, consideration of this new information is likely to result in more rigorous regulation with respect to issues such as loss of offsite power, hydrogen explosion prevention, the siting of more than one reactor at a single site, spent fuel accident and reactor accident probabilities, the re-racking of spent fuel pools, permitting extended storage of spent fuel in pools after decommissioning, and emergency planning.

35. In the environmental and health arenas, consideration of this significant new information is likely to result in higher accident probability estimates, new accident mechanisms for spent fuel pools, higher accident cost estimates, and higher estimates of the health risks posed by light water reactor accidents. These increased risk and cost estimates will lead to much more serious consideration of alternatives for avoidance or mitigation of environmental risks. For instance, although the Commission has long rejected low-density pool storage combined with dry onsite storage as an alternative for mitigating the effects of catastrophic pool fires, that option may now prove to be very cost-beneficial. Present policy also does not require the transfer of all spent fuel from pools into dry casks at closed sites, as soon as safely possible after closure. A change of policy would be indicated by the scale of the disaster at Fukushima. In view of the large variation in potential damage and differences in emergency response needs, a plant-specific analysis will also be needed, including for all reactors in the Northeast.

36. It is likely that more (and more expensive) protective features will be needed to ensure a level of safety and security that will avoid the kinds of disastrous consequences occurring at Fukushima Daiichi. It is also likely that additional measures involving significant costs will have to be taken to reduce the likelihood and consequences of multi-reactor and/or spent fuel disasters. In light of this new information, a comparison between the economic attractiveness of a proposed new nuclear reactor or a proposed re-licensing of an existing reactor that might need modifications with other less risky and less expensive energy sources (such as wind, solar, and storage technologies such as compressed air) may well result in a decision that licensing of new reactors and re-licensing of existing reactors is not cost-effective.

37. Therefore, I believe it is reasonable and necessary for the NRC to suspend licensing and re-licensing decisions and standardized design certifications until the NRC completes its review of the regulatory implications of the Fukushima accident.

The facts presented above are true and correct to the best of my knowledge, and the opinions expressed therein are based on my best professional judgment.

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19 April 2011
Date

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A recognized authority on energy issues, Dr. Makhijani is the author and co-author of numerous reports and books on energy and environment related issues, including two published by MIT Press. He was the principal author of the first study of the energy efficiency potential of the US economy published in 1971. He is the author of *Carbon-Free and Nuclear-Free: A Roadmap for U.S. Energy Policy* (2007).

In 2007, he was elected Fellow of the American Physical Society. He was named a Ploughshares Hero, by the Ploughshares Fund (2006); was awarded the Jane Bagley Lehman Award of the Tides Foundation in 2008 and the Josephine Butler Nuclear Free Future Award in 2001; and in 1989 he received The John Bartlow Martin Award for Public Interest Magazine Journalism of the Medill School of Journalism, Northwestern University, with Robert Alvarez. He has many published articles in journals and magazines as varied as *The Bulletin of the Atomic Scientists, Environment, The Physics of Fluids, The Journal of the American Medical Association,* and *The Progressive*, as well as in newspapers, including the *Washington Post*.

Dr. Makhijani has testified before Congress, and has appeared on ABC World News Tonight, the CBS Evening News, CBS 60 Minutes, NPR, CNN, and BBC, among others. He has served as a consultant on energy issues to utilities, including the Tennessee Valley Authority, the Edison Electric Institute, the Lawrence Berkeley Laboratory, and several agencies of the United Nations.

Education:

- Ph.D. University of California, Berkeley, 1972, from the Department of Electrical Engineering. Area of specialization: plasma physics as applied to controlled nuclear fusion. Dissertation topic: multiple mirror confinement of plasmas. Minor fields of doctoral study: statistics and physics.
- M.S. (Electrical Engineering) Washington State University, Pullman, Washington, 1967. Thesis topic: electromagnetic wave propagation in the ionosphere.
- Bachelor of Engineering (Electrical), University of Bombay, Bombay, India, 1965.

Current Employment:

- 1987-present: President and Senior Engineer, Institute for Energy and Environmental Research, Takoma Park, Maryland. (part-time in 1987).
- February 3, 2004-present, Associate, SC&A, Inc., one of the principal investigators in the audit of the reconstruction of worker radiation doses under the Energy Employees Occupational Illness Compensation Program Act under contract to the Centers for Disease Control and Prevention, U.S. Department of Health and Human Services.

Other Long-term Employment

- 1984-88: Associate Professor, Capitol College, Laurel, Maryland (part-time in 1988).
- 1983-84: Assistant Professor, Capitol College, Laurel, Maryland.
- 1977-79: Visiting Professor, National Institute of Bank Management, Bombay, India. Principal responsibility: evaluation of the Institute's extensive pilot rural development program.
- 1975-87: Independent consultant (see page 2 for details)
- 1972-74: Project Specialist, Ford Foundation Energy Policy Project. Responsibilities included research and writing on the technical and economic aspects of energy conservation and supply in the U.S.; analysis of Third World rural energy problems; preparation of requests for proposals; evaluation of proposals; and the management of grants made by the Project to other institutions.
- 1969-70: Assistant Electrical Engineer, Kaiser Engineers, Oakland California. Responsibilities included the design and checking of the electrical aspects of mineral industries such as cement plants, and plants for processing mineral ores such as lead and uranium ores. Pioneered the use of the desk-top computer at Kaiser Engineers for performing electrical design calculations.

Professional Societies:

- Institute of Electrical and Electronics Engineers and its Power Engineering Society
- American Physical Society (Fellow)
- Health Physics Society
- American Association for the Advancement of Science

Awards and Honors:

- The John Bartlow Martin Award for Public Interest Magazine Journalism of the Medill School of Journalism, Northwestern University, 1989, with Robert Alvarez
- The Josephine Butler Nuclear Free Future Award, 2001
- Ploughshares Hero, Ploughshares Fund, 2006
- Elected a Fellow of the American Physical Society, 2007, "*For his tireless efforts to provide the public with accurate and understandable information on energy and environmental issues"*
- Jane Bagley Lehman Award of the Tides Foundation, 2007/2008

Invited Faculty Member, Center for Health and the Global Environment, Harvard Medical School: Annual Congressional Course, *Environmental Change: The Science and Human Health Impacts*, April 18-19, 2006, Lecture Topic: An Update on Nuclear Power - Is it Safe?

Consulting Experience, 1975-1987
Consultant on a wide variety of issues relating to technical and economic analyses of alternative energy sources; electric utility rates and investment planning; energy conservation; analysis of energy use in agriculture; US energy policy; energy policy for the Third World; evaluations of portions of the nuclear fuel cycle.

Partial list of institutions to which I was a consultant in the 1975-87 period:

- Tennessee Valley Authority
- Lower Colorado River Authority
- Federation of Rocky Mountain States
- Environmental Policy Institute
- Lawrence Berkeley Laboratory
- Food and Agriculture Organization of the United Nations
- International Labour Office of the United Nations
- United Nations Environment Programme
- United Nations Center on Transnational Corporations
- The Ford Foundation
- Economic and Social Commission for Asia and the Pacific
- United Nations Development Programme

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June 23, 2011

Dr. Said Abdel-Khalik, Chairman
US Nuclear Regulatory Commission Charter Advisory Committee on Reactor Safeguards
Fukushima Subcommittee Meeting

RE: Recent Events at Fukushima, Japan

Dear Dr. Abdel-Khalik:

On behalf of the Blue Ridge Environmental Defense League, I make the following comments. I appreciate the subcommittee's purpose of gathering information and formulating possible actions by the full Advisory Committee on Reactor Safeguards regarding the nuclear disaster at Fukushima. I hereby enter into the record the document, *Plant-specific safety review (RSK-SÜ) of German nuclear power plants in the light of the events in Fukushima-1 (Japan),*[1] the German Reactor Safety Commission's report which informed the decision to phase out nuclear power (attached).

Following the March 11, 2011 earthquake and tsunami which caused Japan's Fukushima continuing nuclear disaster, Germany announced that it would phase out all 17 of its nuclear power stations by 2022 and generate electricity from other sources. The decision was based on sound legal and technical bases. The sequence of events is as follows.

March 17

Less than a week after the earthquake, German Chancellor Angela Merkel spoke about the ongoing situation, saying, "We cannot and must not simply return to business as usual….When, as we have seen in Japan, the apparently unthinkable happens, the absolutely improbable becomes reality, the situation changes….if in doubt to come down on the side of safety"[2] Merkel pointed out that Germany's Atomic Power Act provides a legal basis for the temporary shut-down of older nuclear power plants.

That day, also in reference to the events at Fukushima, the German Bundestag called upon the German Federal Government to:[3]

> [C]onduct a comprehensive review of the safety requirements for the German nuclear power plants. For this purpose, an independent expert commission is to be tasked with carrying out a new risk analysis of all German nuclear power plants and nuclear installations with consideration of the knowledge available

[1] *Anlagenspezifische Sicherheitsüberprüfung (RSK-SÜ) deutscher Kernkraftwerke unter Berücksichtigung der Ereignisse in Fukushima-I (Japan)*
[2] "Germany stands by Japan," *Germany.info*, German Embassy's Department for Press, Information and Public Affairs, March 17, 2011, http://www.germany.info/Vertretung/usa/en/Impressum.html
[3] 96th sitting of the German Bundestag on 17-03-2011; motion for a resolution of the CDU/CSU and FDP fractions on the issue of a government policy statement by the Federal Chancellor on the current situation in Japan, printed paper 17/5048

> about the events in Japan – especially also with respect to the safety of the cooling systems and the external infrastructure – as well as of other extraordinary damage scenarios;

The Federal Environment Ministry ordered the Reactor Safety Commission (RSK by its German acronym) to develop a plan to review the safety status of 22 operating nuclear power plants with regard to beyond design-basis events.

March 30

At a news conference, Rudolf Wieland, the reactor safety commission's head, said Japan's safety experts had "clearly underestimated the consequences of natural disasters" on its nuclear reactors. The implications, Wieland added, were that Germany would revisit whether its reactor program provided adequate protection from terrorism, plane crashes and earthquakes even though seismic activity in Germany is minor compared to Japan's. Also, the impact of power failures longer than a few hours duration would be studied. Germany's Environment Minister, Norbert Roettgen, said the safety study would form the technical basis for political decisions expected in June.[4]

May 20

The Reactor Safety Commission issued its *Plant-specific safety review* report.[5] Below are some highlights:

The RSK's determination of robustness was based on both deterministic criteria, such as increase of the hazard, diversity and redundancy requirements, and probabilistic criteria, the occurrence frequency of events. However, the review found considerable uncertainty with regard to the source of failure at Fukushima:

> With the current level of information, it is not possible to judge whether this was due to inadequate organisational structures, accident management procedures or insufficient numbers of personnel due to the effects of the tsunami or event to other influences.

Regarding flooding, the RSK recommended plant safety be evaluated for longer-lasting floods. The current state of the art is the 10,000-yearly flood.

Regarding earthquakes, information provided by GFZ German Research Centre for Geosciences in Potsdam found:

> More recent curves are available for the determination of the probabilities that seismic acceleration loads may be exceeded at concrete sites…The RSK considers a discussion of this topic necessary.

[4] "Germany to raise, redefine nuclear safety rules," *Thomson-Reuters*, March 31, 2011, http://www.reuters.com/article/2011/03/31/germany-energy-idUSLDE72U2H420110331
[5] *Op. cit.*

Regarding back-up electric power supply of German nuclear power plants, RSK found them more robust than at Fukushima I, with additional sources and emergency generators protected against external impacts. However, the RSK recommended additional proof to confirm the effectiveness of electric grid connections. Further,

> All licensees of PWR and BWR plants have provided details about battery capacities, process-based measures for core cooling, and emergency measures to re-establish electricity supply. The information about the discharge times of the batteries is so far mostly insufficient to allow an assessment of whether it is possible to maintain vital safety-related functions with their help in combination with process-based measures in the event of a complete loss of the AC power supply over a longer period of time, i.e. for 10 hours and more.
>
> (Emphasis added)

The Reactor Safety Commission found other uncertainties:

> However, in the opinion of the RSK, the precautionary measures to prevent load crashes in the area of the primary system and the fuel pool, which are also footed on administrative measures, require further in-depth examination with regard to their consequences.

Regarding station black-out and accident mitigation measures, the RSK found the system needed further development:

> The availability of three-phase alternating current is a necessary prerequisite for the majority of the AMM by which vital functions can be ensured or re-established. Against this background, the accident management concept should be developed further so that in a postulated SBO the supply of three-phase alternating current can be re-established within a plant-specifically determined grace period.

The RSK report concludes:

> It follows from the insights gained from Fukushima with respect to the design of these plants that regarding the electricity supply and the consideration of external flooding events, a higher level of precaution can be ascertained for German plants.

The RSK recommended further analyses and safety measures based on the results of this plant-specific review.

May 30

Chancellor Angela Merkel announced Germany will decommission all of its 17 nuclear power plants by 2022.

Responsibility of the ACRS

As you know, the US Nuclear Regulatory Commission has undertaken its own review. On June 21st NRC Chairman Jaczko stated, [6]

> "I believe there is a likelihood that the agency will need to make some changes, although it is too early to say right now precisely what those changes might be. On the global front – and this is a truly global issue – the real question is where to go from here?"

The Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards has responsibility to fulfill its mandate and provide independent assessment. According to the US Atomic Energy Act,

> The Committee shall review safety studies and facility license applications referred to it and shall make reports thereon, shall advise the Commission with regard to the hazards of proposed or existing reactor facilities and the adequacy of proposed reactor safety standards.[7]

The Advisory Committee on Reactor Safeguards is statutorily mandated by the Atomic Energy Act of 1954, as amended to: 1) review and report on safety studies and reactor facility license and license renewal applications; 2) advise the Commission on the hazards of proposed and existing production and utilization facilities and the adequacy of proposed safety standards; 3) initiate reviews of specific generic matters or nuclear facility safety-related items; and 4) provide advice in the areas of health physics and radiation protection.

I believe it is the duty of the Advisory Committee on Reactor Safeguards to provide the guidance to the Chairman plainly needs for a thorough re-assessment of the commercial nuclear power program in the United States, including the possible phase-out of all commercial nuclear power plants in the United States.

Thank you for the opportunity to present our concerns.

Respectfully,

Louis A. Zeller

Attachment

[6] Remarks of NRC Chairman Gregory Jaczko as prepared for delivery, Press Conference, IAEA Ministerial Conference, Vienna, Austria, June 21, 2011, NRC Office of Public Affairs, Press Release No. 11-113

[7] Section 29 of the Atomic Energy Act of 1954

Note:
This is a translation of Chapter 1 of the document entitled " STATEMENT - Anlagenspezifische Sicherheitsüberprüfung (RSK-SÜ) deutscher Kernkraftwerke unter Berücksichtigung der Ereignisse in Fukushima-I (Japan)".
In case of discrepancies between the English translation and the German original, the original shall prevail.

Plant-specific safety review (RSK-SÜ) of German nuclear power plants in the light of the events in Fukushima-1 (Japan)

(…)

1 Summarising assessment and recommendations

In connection with the events in the Japanese Fuhkushima-1 plant, the German Bundestag called upon the German Federal Government on 17-03-2011 to

...

conduct a comprehensive review of the safety requirements for the German nuclear power plants. For this purpose, an independent expert commission is to be tasked with carrying out a new risk analysis of all German nuclear power plants and nuclear installations with consideration of the knowledge available about the events in Japan – especially also with respect to the safety of the cooling systems and the external infrastructure – as well as of other extraordinary damage scenarios; [1]

…

On 17-03-2011, the Federal Environment Ministry (BMU) called upon the Reactor Safety Commission (RSK) at its 433th meeting to draft a catalogue of requirements for a safety review of the German nuclear power plants and to assess the results of the review carried out on this basis. Here, the insights gained from the accident sequence in Japan are to be considered in particular with respect to whether the current design limits have been defined correctly and how robust the German nuclear power plants are regarding beyond-design-basis events. According to the task given by the BMU, the report by the RSK was to be presented on 15-05-2011.

Within the framework of the plant-specific safety review of German nuclear power plants hereby presented, the RSK has performed a robustness assessment for selected essential aspects. The RSK has not yet carried out a review of to what extent the current design limits have been defined correctly.

Essential insights gained from the accident sequence in Japan

The Reactor Safety Commission has gained the following provisional insights from the accident in Japan, which affected plants that were in operating as well as plants that were shut down for refuelling and overall maintenance inspection. Here, it has to be stated that until this day, there is not yet full clarity about all

[1] 96th sitting of the German Bundestag on 17-03-2011; motion for a resolution of the CDU/CSU and FDP fractions on the issue of a government policy statement by the Federal Chancellor on the current situation in Japan, printed paper 17/5048

aspects of the accident sequence, the design requirements (application of the Japanese regulations), the method of updating the plants to new levels of knowledge, and the scope and content of accident management procedures at Fukushima I. However, it appears that the following points in particular are important with regard to an assessment of the robustness of a defence-in-depth concept.

The earthquake event in Japan caused damage to the infrastructure and thus also power system failures in wide areas. According what is known so far, the safety systems of the nuclear reactor units at Fukushima I initially maintained their functions to ensure the supply of emergency power and cooling water.

Upon the impact of the tsunami approximately one hour later, the emergency power supply – with the exception of the batteries – as well as the service water system failed; in addition, there was further damage to the infrastructure. According to the information available, this was due to the inadequate design of these plants to withstand tsunami impacts. The tsunami loads led to grave consequences at Fukushima I as important safety systems such as the emergency power generation system and the service water system had not been laid out sufficiently flood-protected. At Fukushima I, the two emergency power generators of each reactor unit are accommodated in the basement of the turbine building, so that when the plant area and the turbine building were flooded, the failure of the emergency power generators was inevitable.

The depressurisation of the reactor coolant systems carried out to allow injection by means of fire pumps was performed clearly too late for a prevention of core damage. With the current level of information, it is not possible to judge whether this was due to inadequate organisational structures, accident management procedures or insufficient numbers of personnel due to the effects of the tsunami or event to other influences. The fact that the depressurisation and injection with fire pumps came too late was then essential for the core damage that occurred at Fukushima I, Units 1 to 3, with the consequence of hydrogen formation and the loss of at least one activity barrier in several units. Several explosions destroyed barrier functions and possibly also further safety installations, contributing to the aggravation of the accident sequence. Regarding the organisation and effectiveness of accident management measures, the destruction of the infrastructure had not been adequately considered.

Obviously, installations and measured to prevent hydrogen explosions in the buildings (venting, recombiners, leaktightness of the systems, barriers) were not effective or did not exist.

The unavailability of the emergency power and service water supplies led furthermore to the loss of cooling of spent fuel assemblies in the fuel pools, with the consequence of further activity releases from fuel assemblies of which some had already been removed from the reactor pressure vessel for a very long time.

Procedure of the robustness assessment

The RSK prepared a "Catalogue of requirements for plant-specific reviews of German nuclear power plants in the light of the events in Fukushima-I (Japan)". To classify the results of the safety review, the RSK defined graded criteria regarding robustness for the review topics mentioned in this catalogue and applied these criteria for the assessment (referred to in the following as assessment criteria).

Such a review of the plants with respect to their behaviour in the event of impacts beyond the design basis and upon postulated unavailabilities of safety system in terms of a stress test is carried out for the first time. The assessment criteria established by the Reactor Safety Commission serve solely for a topic-specific differentiation with regard to the existing safety margins and do not represent any regulatory requirements. With the time available, it was not possible to generate these assessment criteria with regard to the quantitative approaches on the basis of scientific limit analyses for this first statement by the Reactor safety Commission, but they could generally only be postulated.

Similarly, the different approaches in the assessment criteria could not be systematically reviewed with regard to their consistency with each other nor with regard to their relevance for the existing defence-in-depth concept of the plants. The different backgrounds will thus always have to be assessed specific to the particular topic. Hence the RSK considers summarising or compensatory assessments to be methodically incorrect.

Moreover, the assessment criteria were prepared for the first time and within a very narrow time frame and were thus not yet available at the start of the review. Due to these circumstances, the catalogues of questions generated at the start are not in all cases in tune with the assessment criteria. This is why at the time of the assessment, licensee's answers were not available with respect to all basement criteria, or the answers did not address the assessment criteria sufficiently.

The RSK was given a large amount of information in heterogeneous form. On the basis of this array of information it was not possible to achieve at this point in time a consistently reliable allocation to the robustness levels or degrees of protection. Hence the present results of the robustness assessment often also include indications regarding the need for further analysis and assessment.

A graduation was applied to the assessment criteria. The higher the safety margins that can be demonstrated against impacts on the plant regarding the fulfilment of the safety objectives, the higher is the degree of robustness. Here, within the framework of the robustness assessment, a differentiation is made between **robustness levels** regarding natural hazards, postulates, precautionary measures and accident management measures and **degrees of protection** for the man-made hazards to be additionally considered according to the RSK Catalogue of Requirements.

The concept of the design of German nuclear power plants is based as a priority on the prevention of events or of any safety-relevant consequences of events. This means that regarding redundancy, diversity and barriers, designs of more recent reactor generations tend to fulfil stricter requirements. This is why the technical realisations in the plants with respect to the robustness below the assessment criteria described here are also different. This is not generally addressed in the assessment.

As a basis for the robustness assessment, the RSK presupposes that the plants correspond to their current licensed condition and that the improvement measures identified as safety-relevant in the safety reviews regularly carried out in accordance with the Atomic Energy Act (AtG) or as a result of other regulatory processes have been implemented and any possible deficits regarding safety demonstrations have been removed. These assumptions also include that preventive and mitigative accident management measures

according to the recommendations of the RSK and the state of the art in Germany are implemented and that corresponding procedures are provided in the accident management manual and are regularly exercised. The RSK did not verify as part of this robustness assessment whether these conditions are actually fulfilled. Confirmation of the fulfilment of these conditions is one of the regular tasks of the licensing and supervisory authorities.

As a statement on the robustness of the plants quite substantially also depends on to what extent these conditions are actually fulfilled, the Reactor Safety Commission recommends that the competent supervisory authorities demonstrate the state of implementation in the individual plants.

As regards the assessment criteria, there are generally – specific to each topic – three levels or degrees of protection each defined. The aim is here to query the assurance of the requisite function to avoid "cliff edge" conditions (e.g. with the consequence of massive fuel assembly damage, releases requiring evacuation).

With the differentiated representation of the degrees of robustness, not only deterministic criteria, such as increase of the hazard, diversity and redundancy requirements, but also probabilistic criteria, such as the occurrence frequency of events, are used as far as these represent reliable criteria. At the highest level, i.e. Level 3, a violation of the safety objectives is practically excluded.

The assessment of the robustness of the plants is based on the fulfilment of basic levels defined specifically for each topic. In the case of man-made hazards, degrees of protection were defined for the criteria. The term "degree of protection" was already introduced by the RSK in 2001 for the assessment of safety against the crash of a commercial aircraft. This definition, which differs from the other events/postulates, is also useful since internationally and throughout Europe, man-made hazards are assessed separately, especially taking terrorist hazards into account.

Assessment

Considering the information available and the scope of the topics considered, the following can generically be stated for the German nuclear power plants when drawing a direct comparison with the causes and consequences of the accidents at Fukushima I:

Initiating events that may lead to such tsunamis are practically excluded for Germany according to current knowledge. At Fukushima I, the design of the plants was inadequate for a tsunami with an occurrence frequency of approx. 10^{-3}/a to be considered on the basis of the literature available. In the area of external natural hazards, the effects to be considered according to the state of the art in science and technology in connection with occurrence frequencies of approx. 10^{-3}/a, especially those that may lead to "cliff edge" effects, are taken into account throughout in the designs of German nuclear power plants.

The electricity supply of the German nuclear power plants is more robust throughout than at Fukushima I. All German plants have at least one additional assured incoming supply and more emergency power generators, with at least two of them being protected against external impacts.

Natural hazards

The RSK is of the opinion that regarding the **seismic design** there partly exist considerable safety margins and that the arguments put forward by the licensees in this respect are principally plausible. This judgement is base i.a. on the conservativities in the calculation chains and the knowledge gained from the seismic PSAs performed so far for the individual plants. The RSK sees the potential for safety margins in the magnitude of one intensity level.

It could not be explicitly seen from the documents whether all conditions of low-power and shutdown operation were considered (e.g. flooded reactor cavity during refuelling). The RSK considers a discussion of this topic necessary. It shall add this point to its working programme and deal with the resulting issues.

More recent curves are available for the determination of the probabilities that seismic acceleration loads may be exceeded at concrete sites; these result from a service provided on the Internet by the GFZ German Research Centre for Geosciences in Potsdam. The RSK considers a discussion of this topic necessary. It shall add this point to its working programme and deal with the resulting issues.

As for the fulfilment of the robustness criteria regarding impacts caused by **flooding,** the assessment by the RSK showed for all plants that there are significant design margins with respect to the 10,000-yearly flood postulated according to the current state of the art in science and technology. The extent of these margins differs from plant to plant. A final judgement of what relevance these differences have is not possible in this first step of the safety review as site-specific conditions for an increase in the volume of water flowing or a rise in the water level, especially also taking the transgression probabilities into account, are not considered in the criteria.

The accessibility of the premises of several plants is restricted in the case of the water levels considered here. In the case of some plants, their premises will already be flooded if the design flood occurs. The RSK recommends in these cases that the assurance of the safety of the plant during the course of a longer-lasting flood be reviewed as part of the supervisory procedure.

Owing to a lack of information, the RSK could not consider the protection of canals and the floating resistance of building structures under these increased impacts.

The Biblis A and B plants as well as the Emsland plant are classified by the Reactor Safety Commission as having the highest robustness level (Level 3) due to their topographical location and plant layout. The Isar 2 and Krümmel plants achieve Level 2 in the assessment. The Isar 1 plant reaches Level 1. All other plants can reach Level 1 or higher if corresponding demonstrations are provided. According to the documents presented, the Unterweser plant cannot fulfil the criteria to reach Level 1.

As **other natural hazards** are largely covered by other external hazards considered and by the consideration of extended postulates with regard to their effects on the safety-relevant building structures and the vital functions, the RSK is of the opinion that the analysis and assessment need not be performed as part of this safety review and is therefore not an object of this statement.

Postulates

Accident control and the limitation of the accident consequences at the Japanese Fukushima I nuclear power plant have been considerably hampered by the loss initially of the grid supply and all emergency diesels (Station Blackout – SBO) and later on of the DC voltage supply via the batteries as well as by the long-lasting loss of the service water supply.

In the plant-specific safety review (stress test), the RSK has therefore examined the robustness of the German plants in the event of an the occurrence of a SBO or in a long-lasting (> 2 hours) SBO as well as in a assumed loss of the service water supply. It has furthermore examined how robust the plants are in the case of a long-lasting (> 72 hours) loss of offsite power.

In its assessment of the answers of the licensees to the question s relating to a "long-lasting SBO" by means of the robustness criteria, the RSK has confined itself to power operation as initial plant state.

Regarding the Biblis A and B, GKN 1, Isar 1 as well as the Krümmel plant, it is considered possible that these can fulfil the criteria for Levels 1 if further proof is furnished. This concerns especially additional proof to confirm the effectiveness of further grid connections or a cross-connection to the neighbouring unit.

Apart from the D1 diesels (basic level), the Konvoi pre-Konvoi plants have diverse and redundant D2 emergency diesels for steam generator feeding and for the electricity supply needed to maintain further vital functions. The D2 emergency diesels are protected against external impacts, including aircraft crash. Hence these plants fulfil the robustness criteria according to Level 2.

All other plants fulfil the robustness criteria according to Level 2 by diverse, redundant emergency diesels or by emergency systems for residual-heat removal in combination with an emergency electricity supply from the neighbouring unit or a further grid connection. The protection against external hazards, including aircraft crash, is also achieved in these cases by structural measures or by physical separation of the various emergency power supply installations.

All licensees of PWR and BWR plants have provided details about battery capacities, process-based measures for core cooling, and emergency measures to re-establish electricity supply. The information about the discharge times of the batteries is so far mostly insufficient to allow an assessment of whether it is possible to maintain vital safety-related functions with their help in combination with process-based measures in the event of a complete loss of the AC power supply over a longer period of time, i.e. for 10 hours and more.

The evaluation of the licensees' answers to the questions relating to the **"long-lasting loss of offsite power"** shows that according to the licensees, written contracts or oral agreements exist on the supply of and operating materials. There are mostly no statements on the delivery times of and operating materials nor on the consideration of damage caused by natural hazards.

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The licensees account for sometimes considerable oil and fuel stocks on the plant premises. For some plants, this allows the operation of emergency diesels over several weeks. There is no information about the protection of these materials against natural hazards and about their safe transport. With a few exceptions, all plants have access to mobile emergency power generators in the vicinity of the plant. In these cases, the times until the availability of the mobile emergency power generators lies clearly below 72 hours.

For the postulated **loss of the service water supply**, information needed for the assessment of the robustness of the cooling of the fuel assemblies in the fuel pool is not available throughout. According to the Catalogue of Requirements of the Reactor Safety Commission, these require specific examination, which, however, could not be carried out for this statement out due to the extent of the documents and the time frame.

Also, a partial aspect in connection with the failure assumptions, namely the complete failure of the cooling water return system in areas with CCF potential (e.g. entry of the cooling water return pipes into a building), was generally not covered by the answers provided by the licensees. The RSK recommends that in the case of existing CCF potential, corresponding emergency measures are provided for all operating phases in the plants concerned. In the assessment of the fulfilment of the requirements of Level 1, this aspect was not considered due to the lacking data base.

The plant-specific assessment showed that the loss of the service water supply can be controlled in all plants by corresponding emergency measures (Level 1). The GKN 2, KKE and KKP 2 plants have diverse heat sinks (Level 2). In the KKB and KKP1 plants, autonomous diverse and redundant service water supply trains are available for maintaining vital functions (Level 3).

Robustness of precautionary measures

Precautionary measures are understood as measures that for accident analyses are assessed as not failing. If in the robustness assessment their failure cannot be practically excluded, then their failure bears in itself a potential for "cliff edge" effects.

Due to the very specific character of precautionary measures (PM), a specific assessment that is specially suited for to each PM has to be made. In many cases, an assessment of individual PMs by means of the RSK assessment criteria (Levels) on the basis of the information available and in the light of the short time available was not possible. The following statements can therefore only be seen as a first and provisional step of an overall assessment. In the scope of this statement, mainly PMs to prevent flooding were dealt with. In this context, PWR and BWR were assessed separately.

Regarding PWR plants, it was found that flooding in the containment will not lead to a loss of vital functions due to sufficient dimensioning of the volume of the reactor building sump. This means that Level 3 is achieved by all plants.

Flooding in the reactor building annulus of a PWR may lead to the loss of vital functions if the cliff edge level is exceeded. With the exception of the Biblis site, control of this situation by accident management or

higher-order measures was not demonstrated. It was not examined to what extent interventions in the flooded areas are necessary for the accident management measures as provided at Biblis.

Owing to the importance of the generic aspects of "flooding of the annulus in PWR plants", the RSK will include an in-depth consideration of this matter in its working programme and deal with the resulting issues.

The questions regarding the other precautionary measures included in the scope of the assessment were answered by the licensees at very different levels of detail. On this basis, a reliable classification of these precautionary measures could either be made only to a limited extent or not at all within the time frame given. Based on a first overview, it can be said that in the event of a failure of the above-mentioned precautionary measures postulated in terms of a robustness assessment, no obviously existing cliff edge effects could be identified.

However, in the opinion of the RSK, the precautionary measures to prevent load crashes in the area of the primary system and the fuel pool, which are also footed on administrative measures, require further in-depth examination with regard to their consequences. It will included this in its working programme and deal with the resulting issues.

Regarding the BWR plants, there are two cases that have to be considered with respect to the PMs to prevent flooding with the potential of a loss of vital functions. The most extensive inflows of water into the reactor building ensue from leaks in the connecting lines of the pressure suppression pool or from leaks in service water system lines (potentially unlimited with operating pumps). In the case of leaks in the connecting lines of the pressure suppression pool, not only the possible consequences of the flooding but also the loss of the pressure suppression pool as heat sink and water reservoir for RPV feeding have to be considered.

Regarding postulated leaks in the service water system, the potentially most extensive inflows of water will be into the reactor building. In the KKB, KRB II and KKP 1 plants, autonomous emergency systems for residual-heat removal are available to maintain vital functions in the event of flooding (Level 2). In the KKI 1 plant, two pumps of the safety system for residual-heat removal are designed against flooding (Level 2). For the KKK plant, further proof is required to show that in a postulated failure of the PMs a leak in the service water system can be controlled by accident management measures (Level 1).

As regards postulated leaks in connecting lines of the pressure suppression pool, the loss of the pressure suppression pool as heat sink and water reservoir for RPV feeding is the most relevant safety-related consequence. In the KKB, KKI-1 and KKP-1 plants, the timely initiation of cooldown operation by manual action is necessary; if this is unsuccessful, vital functions are at risk. In the shortness of time, it was not possible to derive reliable assessments regarding accident management measures that may possibly be available and effective in this case. On the basis of the information available, an allocation to a particular Level is not possible. In the KKK plant, a containment return system (Level 2) is available should the timely initiation of cooldown operation by manual actions be unsuccessful. Only if the former fails as well are vital functions at risk. In the KRB II plant, a pressure suppression pool water level that is sufficient for residual-heat removal operation is ensured by structural (passive) measures (Level 3).

For a range of events (LOCA inside or outside the containment, transients involving a considerable drop in the water level, inadvertent opening of main-steam valves), the accident control concept of a BWR is based on the successful isolation of the main-steam lines.

With the exception of KKI-1, the individual plants have given no details in the documents presented for the robustness assessment regarding the control of leaks or breaks in main-steam lines in the event of a failure of steam line isolation. As far as the RSK is aware, events involving the failure of steam line isolation are not treated in the operating documents (operating manual or accident management manual) of all plants.

Against this background it is currently not possible to confirm the fulfilment of individual levels.

Aggravating boundary conditions for the implementation of accident management measures (AMM)

Additional to the existing design of the plants regarding the first three levels of defence of the defence-in-depth concept in German nuclear power plants, possibilities were created with the introduction of accident management measures to prevent any serious consequences for the environment even in the case of beyond-design-basis assumptions and scenarios, so that with these measures, the robustness of the defence-in-depth concept was further enhanced.

The objective of this safety review has been to clarify to what extent the existing accident management measures are effective even under further-reaching assumptions regarding aggravated boundary conditions caused by external hazards or with respect to failure postulates and to what extent additional accident management measures for a further minimisation of the residual risk might be useful.

The Reactor Safety Commission ascertains that the answers supplied to the list of questions are presently not sufficient to allow a consistent allocation of the plant-specific AMM to the different levels according t the define criteria. With respect to the events at Fukushima, following the evaluation of the answers and other information provided, the RSK has therefore derived generic key aspects for further considerations.

The accident management concept should be further developed so as to ensure the effectiveness of the AMM even in the event of external hazards. Here, the following aspects following/during external hazards have to be considered:

- limitations of the accessibility of the power plant area and power plant buildings,
- operability of the AMM,
- availability of the remote shutdown and control station.

The availability of three-phase alternating current is a necessary prerequisite for the majority of the AMM by which vital functions can be ensured or re-established. Against this background, the accident management concept should be developed further so that in a postulated SBO the supply of three-phase alternating current can be re-established within a plant-specifically determined grace period. From the point of view of the RSK, this includes:

- external-hazard-protected layout of standardised feed points on the outside of the buildings for the supply of the emergency power busbars and, where necessary, of emergency power busbars supplying the emergency feedwater system (interconnectable in the building).
- external-hazard-protected provision of mobile emergency power generators with sufficient capacity for supplying one redundant residual-heat removal train or for recharging batteries.

Review of the accident management concept with regard to injection possibilities for the cooling of fuel assemblies and for ensuring subcriticality. Here, the following aspects have to be taken into account:

- External-hazard-protected provision of mobile pumps and other injection equipment (hoses, connectors, couplings, etc.) as well as of boric acid, with required grace periods for provision and delivery at the scene.
- Assurance of a water intake that is independent of the receiving water and available even after an external impact (physical separation if necessary).
- Possibilities of injecting water into the steam generators, reactor pressure vessel and the containment (in the latter case also with consideration of higher back-pressures) without the need to enter areas with high risk potential (dose rate, debris load) and to be able to compensate local destruction (e.g. by permanent and physically separated injection paths).
- Optimisation of the BWR accident management measure of steam-driven high-pressure injection in a SBO to prevent the high-pressure path during core meltdown (maintenance of a sufficient pressure suppression capability at increased pressure suppression pool temperature).

The safety margins still available in the beyond-design-basis range have to be identified on the basis of corresponding analyses and can also be used by application of procedures developed on this basis. This should be taken into account in connection with the planned and currently effected introduction of the so-called Severe Accident Management Guidelines (SAMG).

Increased consideration of the wet storage of fuel assemblies in the accident management concept, taking the following aspects into account:

- Possibilities of injecting water into the wet storage facility for fuel assemblies without the need to enter areas with high risk potential (dose rate, debris load) and to be able to compensate local destruction (e.g. by permanent and physically separated injection paths).
- To ensure evaporation cooling: updating of the safety demonstrations for the fuel pool, reactor cavity, setdown pool, reactor cavity seal liner which are at boiling temperature
- Measures for the limitation of releases from the fuel pool in BWRs in the postulated event of severe fuel assembly damage, considering possible H_2 formation.

Man-made hazards

The assessment criteria for a postulated aircraft crash differ in three degrees of protection. Here, a difference is made between the mechanical impact (impact of the aircraft) and the thermal (kerosene fire) degree of protection according to the consideration of the crash of an aircraft comparable to a Starfighter (Degree of Protection 1), the load-time diagram of the RSK Guidelines (Phantom), or the crash of a medium-size commercial aircraft (Degree of Protection 2) and additionally of a large commercial aircraft (Degree of Protection 3).

Consequential mechanical effects due to an aircraft crash that lead to a limited loss of coolant, e.g. leaks in small pipes, have so far not been postulated and could not be assessed within the framework of this review. The RSK will included this in its working programme and deal with the resulting issues.

For all pre-Konvoi and Konvoi PWR plants as well as for the BWR plants KKK and KRB B/C, proof has been furnished that the requirements resulting from the load assumptions according to the RSK Guidelines (Phantom) are fulfilled (Degree of Protection 2). As regards the crash of civil aircraft, further proof of its possible control has to be furnished for a confirmation of Degree of Protection 2 and 3.

For the KKU, KKI 1 and GKN 1 plants, the criteria of Degree of Protection 1 are demonstrably fulfilled. To fulfil Degree of Protection 2, further proof is necessary; Degree of Protection 3 cannot be reached on the basis of the documents presented.

Regarding the KWB-A and B, KKB and KKP 1 plants, fulfilment of the mechanical Degree of Protection 1 – for KKB and KKP1 also fulfilment of the thermal Degree of Protection 1 – depends on the presentation of further proof.

Regarding the capacity of withstanding loads from **blast waves,** the assessment by the Reactor Safety Commission shows that the Degree of Protection 1 can be confirmed for all German NPPs, with the exception of the plants mentioned in the following, with regard to the assumed load (pressure distribution according to the BMI Guideline with a maximum excess pressure of 0.45 bar). As for the adherence to safety margins, there is also confirmatory information in some cases. In other cases, however, no clear statement can be derived from the information provided with respect to the adherence to safety margins. A corresponding review within the framework of this RSK safety review was not possible. The RSK therefore recommends that such reviews should be carried out additionally within the framework of the supervisory procedure.

In the case of the KWB-A, KKP 1, KKI 1 and GKN 1 plants, lower load were assumed, justified by site-specific conditions. Whether the Degree of Protection 1 is fulfilled depends on the presentation of additional proof and its confirmation.

According to the BMI Safety Criteria, the entry of **explosive materials** into the plant has to be prevented. Here, the site-specific boundary conditions have to be taken into account. Having implemented measures to fulfil this requirement, all plants reach Degree of Protection 1. Against the background of the site-specific conditions, however, the plant-specific implementations of these protection measures differ from each other.

As regards an isolation of the ventilation system upon a gas alarm, automatic ventilation isolation is implemented in the KBR, KKB, KKE, KWG, KKK and KKU plants (Degree of Protection 2).

The site-specific consideration of **toxic gases** is part of the design concept of German nuclear power plants. Having implemented measures to fulfil this requirement, all plants reach Degree of Protection 1. An automatic detection of such gases in terms of Degree of Protection 2 has not generally been installed; only in the Unterweser nuclear power plant is it planned to install an automatic detection system with resulting automatic ventilation isolation. The RSK considers a discussion of this topic necessary. It shall add this point to its working programme and deal with the resulting issues.

Regarding the **effects of an accident in one power plant unit on the neighbouring unit**, no specific questions were posed by the RSK. Hence there is no information that might be evaluated available on this topic area. Against the background of the experience gained from Fukushima, the RSK recommends that an analysis of this issue should be carried out as part of the supervisory procedure for the twin-unit plants concerned. Based on the postulated damage states of the neighbouring unit (i.a. fires, activity releases, core damage states, core meltdown), this analysis has to examine the consequences for the maintenance of the vital functions of the unaffected unit.

Terrorist attacks
Breach of vital functions in dependence of the effort required for destruction

Taking the security measures that are currently in place into account, the protection measures of the plants against external hazards (blast wave, aircraft crash) also represent at the same time a far-reaching status of protection against terrorist attacks by external intruders. In addition, a wide spectrum of possible destructions of essential system functions through terrorist attacks is covered by the consideration of the effects of postulates concerning the loss of the electricity and coolant supplies.

Within the time-frame set for this safety review, the RSK was not able to perform a robustness assessment of the plants regarding the necessary overcoming of staggered protection measures.

External attacks on computer-based controls and systems

At present, no software-based systems are in use in the reactor protection systems of German nuclear power plants.

Software-based systems are partly used in limitation systems and operational systems. Despite the defence-in-depth concept it is therefore necessary to examine the effects of such attacks with regard to the robustness of these systems.

This is currently being done within the supervisory procedures of the Länder as a result of the Information Notice issued by GRS.

Recommendations

The Reactor Safety Commission has formulated different recommendations within the framework of this "Plant-specific safety review (RSK-SÜ)" The issues addressed in this context are of differing safety relevance. The formulated recommendations make no claims of being complete.

Conclusion

It follows from the insights gained from Fukushima with respect to the design of these plants that regarding the electricity supply and the consideration of external flooding events, a higher level of precaution can be ascertained for German plants.

The RSK has furthermore reviewed the robustness of German plants with respect to other important assessment topics.

The assessment of the nuclear power plants regarding the selected impacts shows that for the topic areas considered, there is no general result for all plants in dependence of type, age of the plant, and generation.

The existing plant-specific design differences according to the current state of licencing were only partially considered by the RSK. Plants that originally had a less robust design were backfitted with partly autonomous emergency systems to ensure vital functions. In the robustness assessment performed here, this selectively leads to evidentially high degrees of robustness.

The RSK has derived first recommendations for further analyses and measures from the results of the plant-specific review.

(…)