



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

August 9, 2011

MEMORANDUM TO: Said Abdel-Khalik, Chairman
Advisory Committee on Reactor Safeguards
Fukushima Subcommittee

FROM: Antonio Dias, Technical Advisor ~~ADJCE~~
Office of the Advisory Committee on Reactor Safeguards

SUBJECT: WORKING COPY OF THE MINUTES OF THE MEETING OF THE
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
FUKUSHIMA SUBCOMMITTEE ON THE EVENTS AT THE
FUKUSHIMA SITE, ON JUNE 23, 2011, IN ROCKVILLE,
MARYLAND

A working copy of the minutes of the subject meeting is attached for your review. Please send me any comments and changes for incorporation. If you are satisfied with the minutes, please sign, date, and return the attached certification letter.

Attachments:

1. Certification Letter
2. Minutes (Working Copy)

cc: E. Hackett
C. Santos

Certified on: August 10, 2011
Certified by: Said Abdel-Khalik

**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MINUTES OF THE (ACRS) FUKUSHIMA SUBCOMMITTEE MEETING
JUNE 23, 2011
Rockville, MD**

The ACRS Fukushima Subcommittee held a meeting on June 23, 2011 in Room T2B1, 11545 Rockville Pike, Rockville, Maryland. The meeting convened at 1:00 p.m. and adjourned at 3:20 p.m. The entire meeting was open to the public. Dr. Edwin Hackett was the Designated Federal Official for the meeting.

ATTENDEES

ACRS Members/Consultants

Said Abdel-Khalik, Chairman
J. Sam Armijo, Member
Dennis Bley, Member
Charles Brown, Member
Michael Corradini, Member
Joy Rempe, Member
Michael Ryan, Member
William Shack, Member
John Sieber, Member
John Stetkar, Member

E. Hackett, ACRS staff - Designated Federal Official

NRC Staff

Hosung Ahn, NRO
Steve Arndt, NRR
Mark Banks, OIG
Stephanie Bush-Goddard, OEDO
Patrick Castleman, OCM/KLS
Ian Cozens, NRO
Bill Ruland, NRR
Dave Skeen, NRR
Elizabeth Stuckle, OPA
Courtney St. Peters, NRO
Marty Virgilio, OEDO

Other Attendees

John Alvis, ANATECH
Paul Gunter, Beyond Nuclear
Lucas Hixson, Bison Resource Development Group
S. Horne, Bison Resource Development Group
Louis Zeller, Blue Ridge Environmental Defense League
Eric Mader, EPRI
Ken Tueh, EPRI
Patricia Campbell, GEH
Kurshad Muftuoglu, GEH
Diane Curran, Harmon, Curran, Spielberg & Eisenberg, L.L.P.

<p>Temporary Instruction 2515/184. Severe Accident Management Guidelines in place since 1990s. Voluntary initiative from the industry. Issues: uneven maintenance of, location of, and training procedures. Not sure about INPO's oversight. NRC doesn't oversee these either. Issue also identified by Japanese Government report for the IAEA. Question from Member Abdel-Khalik: How does NRC decide whether to impose rulemaking or accept voluntary actions? Answer: no clear pattern over last 35 years. Examples: shutdown risk, groundwater protection. No clear trend towards voluntary actions over last decades. Probably decided issue by issue. Question from member Abdel-Khalik: should guidance be established so that consistency is attained? Answer: This could be a recommendation. Question from Member Stetkar: Have other countries implemented SAMGs? Answer: Some have, stress tests in EU reactors possibility addressing this issue as well.</p>	<p>13-19</p> <p>54-58</p>
<p>Bulletin 2011-01. Licensees given 30 days to affirm that: all necessary equipment is available and capable, all guidance, procedures and training are in place. Positive response from all licensees. Licensees given 60 days to confirm execution of maintenance and configuration control. Responses not in yet.</p>	<p>19-20</p>
<p>Recent Japanese Government report for the IAEA. Nothing in the report tells NRC of the need to do anything regarding providing additional protection to nuclear plants. Question from Member Abdel-Khalik: None of the 28 commitments are appropriate to US plants? Are commitments being made on the basis of incomplete understanding? Answer: there seems to be a gap between facts and recommendations. Still studying the report. Will probably need more information. Rationale for conclusions/ commitments not well documented.</p>	<p>23-25</p>
<p>NRC fact finding mission to Japan in late May. Preliminary assessment, just delivered, contains 15 conclusions and 16 lessons learned. Currently under review.</p>	<p>25</p>
<p>Near-Term Task Force. Sources of information: site team in Japan, staff expertise, recent TI inspections, INPO, and international counterparts. Four themes being considered: protection of equipment, mitigation strategies, defense-in-depth, and principles of good regulation. Timelines for the events not fully understood; this will be better addressed by the Long-Term Task Force. Lack of complete information about events should not affect focus of Near-Term effort. Report due on July 12th. Commission briefing on July 19th.</p>	<p>25-32</p>
<p>Over time, understanding of natural phenomena and their impact on plants has evolved. Earlier licensed plants under different criteria. Backfit applied only when significant safety at issue. Question from Member Abdel-Khalik: Do backfit rule and so-called finality rule adequately serve public's interest? Are these the reason for voluntary responses and for NRC's acceptance of voluntary responses? Answer: Yes. Groundwater protection is good example. TMI is another example: people came up with long lists having</p>	<p>32-34</p> <p>38-39</p>

<p>nothing to do with safety or mitigation. Later on, some of these requirements were taken away. Backfit rule definitely serves the public well. Near-Term task force currently looking at backfit rule, completeness of guidelines, and justification for cost-benefit arguments</p>	<p>79</p>
<p>Station blackouts never before considered from concurrent equipment failures. Questions from Member Abdel-Khalik: Has Task Force looked at coping times in other countries? Familiar with NUREG-1206 (it indicated 3 days coping time for station blackout in France)? Answers: Not sure about Task Force approach. Not aware of NUREG-1206. In US, a study on reliability of power supplies formed the basis for rule. Current station blackout rule does not address common cause failure of onsite and offsite power sources and distribution. Besides tsunamis, other external events (e.g., hurricane, flooding) must be considered depending on location of plant site. Question from Member Brown: Should coping strategies be revisited based on recent events? Answer: Yes. Industry looking at staging equipment in different locales around the country. Infrastructure and decision making factors played role in Fukushima. Things would be different in US.</p>	<p>34-36 40-43 89-94</p>
<p>Japanese Government report indicates instrumentation did not function “sufficiently” during the accident. NRC has not started to collect information related to post-accident monitoring. B5B equipment cannot be credited for purposes other than what they were designed for.</p>	<p>51-54</p>
<p>Comment from Member Rempe: NRC studies in the 90’s looking at instrumentation surviving severe accidents. Someone should look into this again.</p>	<p>59</p>
<p>Hardened vents. During late 80’s, installed in Mark I BWRs to address concerns regarding containment overpressure during severe accidents. Not required by regulations. Design differences among plants: number, location, mode of power for opening valves, use of ruptured disks, tied to multiple units, prevention of backflow. Question from member Abdel-Khalik: Since outside NRC’s purview, how much detail known to NRC? Answer: Knew about differences but not to the extent now being observed. Vents were designed for decay heat removal and not for long-term station blackout. Near-Term task force looking into bringing this under regulatory requirement instead of voluntary action. Question from member Sieber: Should NRC look into adequacy of Mark I vent systems? They really did not help the Fukushima accident. Answer: We are examining ours.</p>	<p>59-61 67-68</p>
<p>Emergency Preparedness. Until now assumed single-unit event. In Japan, loss of power affected communications and ability to respond to event. Also at Fukushima, lack of communication with decision makers. Very different framework from the US where decision makers are the states. Also observed misunderstanding about use/value of KI.</p>	<p>68-69</p>
<p>Questions from member Ryan: Why public information focused on dose and not on isotopic composition? Was this kind of data available? A survey measurement after the explosions does not provide sufficient</p>	<p>69-73</p>

information to understand risk profile. Answers: Relied mostly on flyovers. Capabilities at Japanese site very different from what US can provide to our sites. Damaged fuel was indeed thrown out during the explosions.	
Members provided with a copy of letter from Chairman Jaczko to Senator Webb with justification for 50-mile radius evacuation zone. Use of RASCAL for computer modeling. Question from Member Sieber: topography, meteorology considered in RASCAL simulations? What about the source term? Answer: regional details not considered, source term inferred from assumption that 3 reactors and 4 spent fuels had failed (worst scenario). In the early days no available measured benchmark from the site; instead used RASCAL and NARAC to validate calculations.	74-77
Long-Term task force effort. Currently finalizing its charter. Work to be done at different offices and overseen by steering committee. Possibility of creating external stakeholder advisory group. Also including ACRS in these efforts: periodic interaction with steering committee at high level, normal interactions with staff.	80-82
Prioritization of Near-Term recommendations. Natural prioritization (rulemaking vs. study). Impact on safety will also dictate prioritization of efforts. Long-Term task force and EDO will have decision role. Interactions between steering committee and ACRS will also involve prioritization of efforts.	83-85
Comments from member Rempe: need to fully understand what happened exactly. Need for coordination with Japanese to get correct and important data, just like samples taken out of TMI vessel. Robotics may speed up these efforts.	85-88

Documents provided to the Subcommittee

- 1) Letter from USNRC Chairman Gregory B. Jaczko to US Senator Jim Webb, June 17, 2011. (ADAMS ML11143A037 and ML11143A041)

Official Transcript of Proceedings
NUCLEAR REGULATORY COMMISSION

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Fukushima Subcommittee Meeting

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The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, as reported herein, is a record of the discussions recorded at the meeting.

This transcript has not been reviewed, corrected, and edited, and it may contain inaccuracies.

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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

1 COMMITTEE MEMBERS PRESENT (CONTINUED):

2 JOY REMPE, Member

3 MICHAEL T. RYAN, Member

4 WILLIAM J. SHACK, Member

5 JOHN D. SIEBER, Member

6 NRC STAFF PRESENT:

7 EDWIN HACKETT, ACRS Executive Director

8 HOSSEIN NOURBAKHS, ACRS, Senior Technical
9 Advisor

10 MARTIN J. VIRGILIO, Deputy Executive Director
11 for Operations

12

13 ALSO PRESENT:

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

16 PAUL GUNTER, Director of Reactor Oversight,
17 Beyond Nuclear

18 LUCAS HIXSON, Bison Resource Development Group

19 EDWIN LYMAN, Union of Concerned Scientists

20 LOUIS A. ZELLER, Blue Ridge Environmental
21 Defense League*

22

23

24 *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

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

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

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

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

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

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1 Marty?

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

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

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

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

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

9 Slide three, I think it's an over
10 simplification but as you all well know, that at the
11 time of the event, we go back to March 11th, Units 1,
12 2, and 3 at Fukushima Daiichi were in operation, Unit
13 4 was defueled, Units 5 and 6 were in cold shutdown
14 when the earthquake occurred and subsequently the
15 tsunami struck the site.

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

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

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

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

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

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

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1 conditions.

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

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

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

25 So I think that's a critical issue for

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

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

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

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

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

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

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

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

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

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

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

11 MR. VIRGILIO: Yes.

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

16 MR. VIRGILIO: Yes.

17 CHAIRMAN ABDEL-KHALIK: Is that correct?

18 MR. VIRGILIO: Yes. That was our
19 conclusion.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

8 MEMBER CORRADINI: In some sort of
9 scenario?

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

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

13 MR. VIRGILIO: I can't say.

14 MEMBER CORRADINI: -- on SAMGs?

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

17 MEMBER CORRADINI: Okay.

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

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

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

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

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

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

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

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

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

14 MR. VIRGILIO: Sure.

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

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

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

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

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

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

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

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

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

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

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

22 MR. VIRGILIO: I've not done that.

23 CHAIRMAN ABDEL-KHALIK: Or is it random?

24 MR. VIRGILIO: I've not done that study.

25 I would say it's probably more issue by issue. I

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

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

5 MR. VIRGILIO: Okay.

6 CHAIRMAN ABDEL-KHALIK: Thank you.

7 MR. VIRGILIO: Good.

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

16 So we issued that bulletin on May 11th.
17 And we broke it into two parts. The first part, the
18 30-day response for licensees to affirm that the
19 equipment necessary to execute the strategies was, in
20 fact, available and capable of performing its intended
21 function and the second part was that the guidance,
22 all the procedures, the training and everything else
23 was in place.

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

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1 confirmed that they have the capacity and the
2 procedures. The second piece of that, which is the
3 60-day response, is due on July 10th. And in that
4 response, they have to confirm to us that they're
5 doing the maintenance testing, configuration control,
6 and everything else that you would want surrounding
7 that equipment to ensure its continued operability.

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

11 MR. VIRGILIO: The training and
12 exercising?

13 MEMBER BROWN: -- and exercising, yes.

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

16 MEMBER BROWN: Okay.

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

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

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

24 MEMBER BROWN: You did.

25 MR. VIRGILIO: There are the severe

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1 accident management guidelines and then there is the
2 B5B part.

3 MEMBER BROWN: Okay.

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

8 MEMBER BROWN: Okay. Thank you.

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

20 MR. VIRGILIO: Yes.

21 MEMBER CORRADINI: Okay.

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

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1 its assessment independently.

2 MEMBER CORRADINI: Separately.

3 MR. VIRGILIO: And so --

4 MEMBER CORRADINI: Okay. Thank you.

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

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

9 MR. VIRGILIO: Oh, yes.

10 MEMBER CORRADINI: Okay.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

19 MR. VIRGILIO: Right.

20 MEMBER STETKAR: But do you have a
21 framework --

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

24 MEMBER STETKAR: Okay.

25 MR. VIRGILIO: Yes, we have. But even

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1 this week we're still learning new things.

2 MEMBER STETKAR: Sure.

3 MR. VIRGILIO: I mean last week, I think
4 we first became aware of what really happened within
5 Unit 1 and why the behavior and the core melt in Unit
6 1 occurred probably much sooner than it did in Units
7 2 and 3. So it's -- our state of knowledge with
8 respect to the detailed timeline is continuing to
9 mature.

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

16 MR. VIRGILIO: Right. And on that point
17 --

18 MEMBER STETKAR: And that's --

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

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

23 MR. VIRGILIO: Yes.

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

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

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

10 MEMBER STETKAR: Sure.

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

17 MEMBER STETKAR: Understand that. But --

18 MR. VIRGILIO: Yes.

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

21 MR. VIRGILIO: Yes.

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

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1 MR. VIRGILIO: Yes.

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

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

8 MEMBER STETKAR: Okay.

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

14 MEMBER STETKAR: No, that's --

15 MR. VIRGILIO: -- with respect to this
16 event and the mitigation of this event.

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

25 And you can look at, for example, seismic

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1 design and Reg Guides that were developed in the early
2 '70s and how our thinking about natural phenomenon,
3 about seismic, about response spectra, about
4 qualification of mechanical and electrical equipment
5 in response to seismic events, all of this has matured
6 and continues to mature. And depending on where you
7 were in the licensing process, the plants that were
8 licensed earlier in the point in time do not
9 necessarily have the same criteria applied later in
10 time.

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

17 Slide 13 I think lays it out even more
18 clearly, that I can see major points in time -- in the
19 1970s when we were doing the Systematic Evaluation
20 Program and we looked at those plants that were
21 designed and built prior to the General Design
22 Criteria, well that's one set of requirements that
23 were put in place.

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

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

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

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

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

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

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

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

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

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

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

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

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1 to service.

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

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

11 MR. VIRGILIO: Yes.

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

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

19 MR. VIRGILIO: Okay.

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

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

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1 CHAIRMAN ABDEL-KHALIK: Go ahead please.

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

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

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

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

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

3 MR. VIRGILIO: Thank you.

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

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

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

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

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

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

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

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

24 CHAIRMAN ABDEL-KHALIK: That's the
25 question.

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

2 Yes.

3 CHAIRMAN ABDEL-KHALIK: Okay. Please
4 continue.

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

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

21 If you go to slide 16 --

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

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

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

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

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

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

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

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1 requirements to ours.

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

9 MR. VIRGILIO: Right.

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

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

17 MR. VIRGILIO: Right.

18 MEMBER SIEBER: And --

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

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

24 MEMBER SIEBER: Right.

25 MR. VIRGILIO: -- which is a different set

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1 of plants.

2 MEMBER SIEBER: Right.

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

5 MEMBER SIEBER: Or flooding.

6 MEMBER SHACK: Or flooding.

7 MR. VIRGILIO: Flooding, yes.

8 MEMBER SIEBER: And you intend to do that.

9 MR. VIRGILIO: Yes.

10 MEMBER SIEBER: That's correct. Okay.

11 Thank you.

12 MEMBER STETKAR: Marty, a simple question.

13 And I should know the answer to this but I haven't
14 looked it up. Is the switchgear at Fukushima in the
15 basement?

16 MR. VIRGILIO: Our understanding of Unit
17 1 was yes.

18 MEMBER STETKAR: Okay.

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

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

25 MR. VIRGILIO: Possibly but I don't know

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1 the answer to that.

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

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

6 MEMBER STETKAR: It wasn't effected, okay.

7 MR. VIRGILIO: -- in the same way.

8 MEMBER STETKAR: Okay. Thanks.

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

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

18 CHAIRMAN ABDEL-KHALIK: Seventeen you
19 mean?

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

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

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

5 MR. VIRGILIO: Yes.

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

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

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

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

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

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

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

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

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

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

17 MR. VIRGILIO: Right.

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

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

25 CHAIRMAN ABDEL-KHALIK: I'm talking about

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1 the 2008 comprehensive inspection that you performed.

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

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

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

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

25 CHAIRMAN ABDEL-KHALIK: They're samples.

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1 MR. VIRGILIO: We do a sampling.

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

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

9 CHAIRMAN ABDEL-KHALIK: I'm trying to get
10 --

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

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

14 MR. VIRGILIO: Okay.

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

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

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

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

25 CHAIRMAN ABDEL-KHALIK: Now it's been

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1 nearly -- over two months, I guess, since the near-
2 term Task Force started. And you sort of passed the
3 70 percent point. Are there any conclusions that the
4 near-term Task Force has arrived at with regard to the
5 efficacy of NRC as a regulator?

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

15 So the team -- we're not waiting for the
16 90-day mark to take any actions. But the expectations
17 that are on that team right now is that if they
18 identify something that requires an immediate action
19 on our part of any action on our part, they spit it
20 out and we do it now.

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

1 CHAIRMAN ABDEL-KHALIK: Okay. Please
2 continue.

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

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

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

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

23 MEMBER CORRADINI: Okay.

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

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1 see where they were relative to compliance.

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

4 MR. VIRGILIO: Yes.

5 MEMBER CORRADINI: Okay. Fine.

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

11 MEMBER CORRADINI: Okay. Thank you.

12  CHAIRMAN ABDEL-KHALIK: Now Bulletin 2011-
13 01 was issued to collect information also from
14 licensees to determine whether or not further
15 regulatory action would be warranted. And if you were
16 to look at page 35 of the Japanese government report,
17 it essentially states that the instrumentation of the
18 reactors and containments at Fukushima did not
19 function quote. "sufficiently" during the accident.
20 As a result, it was difficult to identify how the
21 accident was developing.

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

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

5 MR. VIRGILIO: The issues and the
6 questions you raise are outside the scope of that
7 bulletin but not outside the scope of our reviews.
8 The bulletin was strictly focused on the 50.54(hh)(2)
9 --

10 CHAIRMAN ABDEL-KHALIK: Right.

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

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

18 MR. VIRGILIO: But I understand.

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

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

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1 core.

2 CHAIRMAN ABDEL-KHALIK: The same problem
3 Fukushima.

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

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

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

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

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1 MR. VIRGILIO: That's a fact. They were
2 designed for what they were designed for.

3 CHAIRMAN ABDEL-KHALIK: I know.

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

9 CHAIRMAN ABDEL-KHALIK: Okay.

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

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

25 CHAIRMAN ABDEL-KHALIK: So let me go back

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

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

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

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

25 CHAIRMAN ABDEL-KHALIK: On each case.

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

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

7 MR. VIRGILIO: That might be a
8 recommendation.

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

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

15 CHAIRMAN ABDEL-KHALIK: Okay.

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

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

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

11 MEMBER ARMIJO: Okay.

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

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

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1 emergency procedures, or things like that?

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

5 MEMBER STETKAR: Thanks.

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

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

12 MEMBER BLEY: I think it does.

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

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

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

23 MR. VIRGILIO: Okay. All right. Good.

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

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

3 (Laughter.)

4 MEMBER BLEY: Nice try.

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

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

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

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

25  Slide 19 takes you to hardened vents. And

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

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

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

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

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

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

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

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

19 CHAIRMAN ABDEL-KHALIK: Okay.

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

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

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

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

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

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

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1 MEMBER ARMIJO: Okay.

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

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

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

3 MEMBER ARMIJO: The details of the design.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

25 MEMBER BLEY: Okay. If there's anything

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

3 MR. VIRGILIO: Okay.

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

12 MR. VIRGILIO: Yes.

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

19 MR. VIRGILIO: Yes.

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

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

25 MEMBER SIEBER: Right. And if you found,

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

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

8 MEMBER SIEBER: All right.

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

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

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

15 MEMBER SIEBER: That's right.

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

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

25 Slide 21, EP, and when you think about the

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

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

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



MEMBER RYAN: Before you leave that, it

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

7 MEMBER SIEBER: That's right.

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

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

21 MEMBER RYAN: Exposure rate only.

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

25 MEMBER RYAN: Again, no radionuclide-

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1 specific data.

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

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

6 MR. VIRGILIO: Yes.

7 MEMBER RYAN: From sampling, yes.

8 MR. VIRGILIO: Yes.

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

14 MEMBER SIEBER: Homestead.

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

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

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

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

8 MR. VIRGILIO: It was.

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

12 MR. VIRGILIO: Right.

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

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

23 MEMBER RYAN: Okay.

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

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1 MEMBER RYAN: Oh, sure.

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

7 MEMBER RYAN: Okay.

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

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

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

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1 MEMBER CORRADINI: Right.

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

7 MEMBER CORRADINI: Okay.

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

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

18 MEMBER SIEBER: Right.

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

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

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

25 MEMBER SIEBER: One of the things I

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

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

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

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

10 MEMBER SIEBER: Yes, I understand that.

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

14 MEMBER SIEBER: Right.

15 MR. VIRGILIO: -- fully involved.

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

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

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

25 MEMBER RYAN: One kind of detail question

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

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

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

11 MR. VIRGILIO: Right.

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

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

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

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

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

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

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

7 MR. VIRGILIO: Yes.

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

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

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

25 MR. VIRGILIO: It would help us to be able

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

4 CHAIRMAN ABDEL-KHALIK: Okay.

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

7 CHAIRMAN ABDEL-KHALIK: Thank you.

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

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

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

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1 MR. VIRGILIO: Yes.

2 CHAIRMAN ABDEL-KHALIK: Okay.

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

9 CHAIRMAN ABDEL-KHALIK: Okay.

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

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

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

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

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

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

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1 recommendations of the Near-Term Task Force.

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

11 MEMBER CORRADINI: Can I ask about that?

12 MR. VIRGILIO: Sure.

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

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

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1 protocols for interaction and communication.

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

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

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

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

3 MEMBER SIEBER: Yes.

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

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

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

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

24 MR. VIRGILIO: Impacts on safety.

25 CHAIRMAN ABDEL-KHALIK: And who will do

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1 that prioritization?

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

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

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

17 CHAIRMAN ABDEL-KHALIK: Okay.

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

21 CHAIRMAN ABDEL-KHALIK: Okay.

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

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

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

14 MEMBER SIEBER: Right.

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

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

22 MR. VIRGILIO: Okay. Thank you.

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

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

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

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

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

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

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

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

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

12 (Laughter.)

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

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

24 MEMBER REMPE: Right.

25 MR. VIRGILIO: I hope that with robotics

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

5 MEMBER SIEBER: Right.

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

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

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

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1 over and over again.

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

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

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

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

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

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

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

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

22 MEMBER BROWN: As long as necessary is the
23 question.

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

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

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

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

15 MEMBER SIEBER: Right.

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

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

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

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

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

25 MEMBER STETKAR: Even at Fukushima though,

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

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

9 (Simultaneous speech.)

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

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

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

16 MR. VIRGILIO: Right.

17 MEMBER STETKAR: They couldn't connect
18 them.

19 MR. VIRGILIO: Right.

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

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

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

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

6 MR. VIRGILIO: Thank you.

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

11 MS. CURRAN: Good afternoon.

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

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

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

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

9 CHAIRMAN ABDEL-KHALIK: That would be
10 fine.

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

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

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

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

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

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1 design certifications.

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

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

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

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

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

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

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

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

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

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

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1 measures.

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

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

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

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

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

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

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

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

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1 believe you had yielded some of your time to --

2 MS. CURRAN: Yes, to Dr. Lyman.

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

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

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

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

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

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

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

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

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

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

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

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

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1 DR. LYMAN: No, we're not.

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

3 --

4 DR. LYMAN: Yes.

5 MEMBER ARMIJO: Other issues you wanted to
6 raise.

7 DR. LYMAN: That's correct.

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

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

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

24 MS. CURRAN: That's right.

25 MEMBER ARMIJO: Okay. That's very clear.

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1 So, the answer is yes?

2 MS. CURRAN: Yes.

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

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

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

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

11 CHAIRMAN ABDEL-KHALIK: Yes, please.

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

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

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

3 And the response to Dr. Hanauer from
4 Joseph Henry is quite controversial. I'm sure it's all
5 a part of your awareness that a political decision was
6 made, an economical decision was made. And, in fact,
7 16 Mark Is were issued operating licenses after Dr.
8 Hanauer's warning, and three additional construction
9 permits were issued by the Atomic Energy Commission
10 following the advisement to discourage all further use
11 of the Mark I.

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

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

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

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

16 So, when we talk about maturity of
17 thinking, we have to consider that the warning was
18 issued early on, and that containment was what was
19 advised. And that as you've recognized, the venting
20 system that was installed was put in under 10 CFR
21 50.59, this voluntary initiative, which said that the
22 issue of installing this vent would not raise a safety
23 issue above a minimum level.

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

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

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

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

17 MR. GUNTER: He's on the phone.

18 CHAIRMAN ABDEL-KHALIK: Okay.

19 MR. ZELLER: I'm here.

20 CHAIRMAN ABDEL-KHALIK: Mr. Zeller?

21 MR. ZELLER: Yes, I'm here.

22 CHAIRMAN ABDEL-KHALIK: Please go ahead.

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

25 On behalf of the Blue Ridge Environmental

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

24 MEMBER BLEY: Not at this time.

25 CHAIRMAN ABDEL-KHALIK: Okay. Are there

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

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

6 CHAIRMAN ABDEL-KHALIK: Yes, please.

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

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

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

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

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

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

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

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

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1 That concludes my comments. Thank you.

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

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

9 (Laughter.)

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

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

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**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

- **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

- **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

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

Japanese Report to the IAEA

- **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

- **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

- **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

- **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

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

Themes

- **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)

- **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

- **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)

- **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

- **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

- **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)

- **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

- **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)

- **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

- **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

- **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)

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

NRC Programs

- **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

- **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

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

Conclusions

- **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

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 acknowledged 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

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,

Dr. Said Abdel-Khalik, Chair
Advisory Committee on Reactor Safeguards, Fukushima Subcommittee
June 22, 2011
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Attachments: Emergency Petition and Makhijani Declaration

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

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 Group³

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 Intervenor 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. Intervenor 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 intervenor 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, Intervenor 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 Intervenor") 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 Intervenor 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 intervenors 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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FROM THE
DIRECTOR OF
THE JOY LUCK CLUB

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 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/Communiqués-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 Radioprotection et de Sécurité 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 2×10^{-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: 1.5×10^{-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 $1.5 \times 10^{-7} \times 1.0 = 1.5 \times 10^{-7}$; for a BWR it is $1.5 \times 10^{-7} \times 0.25 = 4 \times 10^{-8}$ 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 5×10^{-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 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

Curriculum Vita of Arjun Makhijani

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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

Languages: English, French, Hindi, Sindhi, and Marathi.

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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,

A handwritten signature in black ink that reads "Louis A. Zeller". The signature is written in a cursive style and is followed by a horizontal line.

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 Fukushima-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 to 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 measures 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 assessment 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 based 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 questions 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.

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 to the defined 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:

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- 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 H₂ 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 include 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 KKV, 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 K KU 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.

(...)
