Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Excerpt RE: Fukushima Daiichi
Nuclear Power Plant

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Thursday, April 7, 2011

Work Order No.: NRC-821 Pages 1-101

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

DISCLAIMER

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

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.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

582nd MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

OPEN SESSION

+ + + + +

EXCERPTED PORTION

+ + + + +

THURSDAY

APRIL 7, 2011

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Said Abdel-Khalik, Chairman, presiding.

COMMITTEE MEMBERS:

SAID ABDEL-KHALIK, Chairman

J. SAM ARMIJO, Vice Chairman

JOHN W. STETKAR, Member-at-Large

SANJOY BANERJEE, Member

DENNIS C. BLEY, Member

COMMITTEE MEMBERS: (cont'd)

CHARLES H. BROWN, Member

MICHAEL L. CORRADINI, Member

DANA A. POWERS, Member

HAROLD B. RAY, Member

JOY REMPE, Member

MICHAEL T. RYAN, Member

WILLIAM J. SHACK, Member

JOHN D. SIEBER, Member

NRC STAFF PRESENT:

SYED ALI, RES/SL

STEVEN ARNDT, NRR/DE

SURINDER ARORA, NRO/DNRL/NARP

ERIC BOWMAN

CRAIG ERLANGER, NSIR/DSP

PETER KANG, NRO/Electrical Engineering Branch

TIM KOBETZ, Reactor Inspection Branch

MICHAEL LAYTON, NSIR

ERIC LEE, NSIR

BRIAN McDERMOTT, NSIR/Division of Preparedness and Response

TIMOTHY MOSSMAN, NRR/DE/EICB

WILLIAM RULAND, NRR/DSS

DANIEL J. SANTOS, NRO/DE

NRC STAFF PRESENT: (cont'd)

RANDY SULLIVAN, NSIR

JOHN THORP

BARRY WESTREICH

GEORGE WILSON, NRR/Digital I&C Branch

DEREK WIDMAYER, Designated Federal Official

ALSO PRESENT:

JEAN-LUC BEGON, UniStar

MARK FINLEY, UniStar

GREG GIBSON, UniStar

GENE HUGHES, UniStar

TED MESSIER, AREVA NP

JOSH REINERT, AREVA NP

RICHARD SZOCH, UniStar

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

(10:49 a.m.)

CHAIRMAN ABDEL-KHALIK: We're back in session.

We will now move to the next item on the agenda, a briefing from the NRC staff on the status of the response to the events at the Fukushima Daiichi Nuclear Power Plant following the tragic earthquake and tsunami in Japan.

This briefing will serve as the initiation of significant ACRS engagement on the followup activities and lessons learned from the Fukushima event in order to maintain public health and safety in the United States. The ACRS will have a new Subcommittee of the whole devoted to these activities, and plans to have regular engagement with the NRC task force evaluating the agency's response, as well as other stakeholders, as appropriate, to gain additional perspectives.

In accordance with the recently issued Commission Tasking Memorandum, the ACRS has been formally tasked by the Commission to review the report developed by the staff as part of the staff's longer term review. We will provide our evaluation of that effort in a separate ACRS letter report later this

year.

The Commission tasking for ACRS on the subject of Fukushima is thus far specific to the evaluation of the staff's longer term review. However, the ACRS, consistent with its charter, will self-initiate activities to be appropriately informed and properly prepared to provide the best possible advice to the Commission on an ongoing basis.

Before we begin the briefing, I would like to call for a moment of silence to honor victims of the Japanese tragedy and to serve as a reminder to all of us that nuclear technology is unique, requiring our total, absolute, and unwavering commitment to nuclear safety, public transparency, and professional integrity.

(Whereupon, a moment of silence was observed.)

CHAIRMAN ABDEL-KHALIK: Thank you. At this time, I would like to call on Mr. Ruland to begin the NRC presentation.

MR. RULAND: Thank you, and good morning, Mr. Chairman, and members of the Advisory Committee on Reactor Safeguards.

The staff has prepared a briefing on the Fukushima events and some of the early implications of those events. The earthquake and subsequent tsunami,

which led to the core and -- which led to core and spent fuel damage, is a significant tragedy for the people of Japan. Our sympathy goes out to all of those affected by this event.

While somewhat removed from the suffering of the Japanese themselves, nevertheless, the NRC staff, as nuclear safety professionals, feel the loss personally. What we can do, however, is to focus on learning the right lessons from this event. To that end, we will briefly outline the event only to the extent that it points to areas we will need to examine for possible enhancements or improvements in our regulations. We will follow that discussion with highlights of some of the regulatory areas to be reviewed.

We will try to answer any questions you may have. However, since the event is still ongoing, and much of the detailed information is not available, or not easily confirmed, the implications for U.S. plants will unfold in the weeks and months ahead. Still, based on the information already available, and as directed by the Commission, the staff has launched the task force that you have already mentioned that we will touch on briefly.

At a high level, we will be sure to pass

along to the task force issues that may be raised at this meeting, or we will get back to you with an answer if we can. So let us begin.

Let me just briefly go over the agenda. As you can see, there is a number of staff that are going to be presenting their topics. We are going to try to keep it -- make it quick, kind of march through this promptly, because we know we have only two hours.

Again, the notion here is for us to just touch on the areas that the staff is going to consider or that has implications for our regulations. This is by no means a comprehensive list, particularly given, you know, the timing of this briefing.

So with that, I would ask John Thorp to start us off with the sequence of events.

MR. THORP: Thank you, Bill. Good morning. On March 11, 2011, at 2:46 p.m. Japan Standard Time, a magnitude 9.0 earthquake struck off the coast -- the eastern coast of Japan. According to the U.S. Geological Survey, this earthquake was the fourth largest in the world since 1900 and was the largest ever recorded in Japan.

The earthquake resulted in a tsunami that reportedly exceeded 32 feet in height in some locations, as reported by the Japanese Nuclear

Industrial and Safety Agency, our counterpart regulatory agency in Japan. And note, this is one report on the height of the tsunami. There have been a range of wave heights reported in this event.

Next slide.

MEMBER POWERS: Do we know anything about the seismicity of this particular area of Japan, so that we -- I mean, it says it's the fourth largest since 1900. But do we have a seismic hazard curve for this part of the plant comparable to what we use for the eastern United States?

MR. THORP: I don't have an answer for you on that, but I believe that some of our staff will be addressing seismic issues a little bit later in the presentation, and they should be able to touch on that.

MR. RULAND: Dana, I couldn't hear the question. I'm sorry.

MR. THORP: History of seismicity in that area.

MEMBER POWERS: Do we have an equivalent of a seismic hazard curve of the types that we have generated for central and eastern United States?

MR. RULAND: I think we will be able to at least touch on the answer to that question.

MEMBER CORRADINI: But just to follow up Dana's question, though, but if you can't touch on it today, I assume within the task force report that would be something that we expect to see there.

MEMBER POWERS: Well, one of the things that I found remarkable in the 2006 earthquake was the understanding of the details of seismicity in a more northerly part of Japan was not as detailed as I would have expected. I wonder if it's a similar situation here.

MR. RULAND: If we could -- we will have a presentation on seismicity, so if we could kind of move on. And if you don't mind, hold those questions, so we can kind of go through this. Thank you.

MR. THORP: Okay. Four nuclear power stations were actually affected by this earthquake. At Onagawa, the northernmost affected site, all three units scrammed and are currently in cold shutdown. The single unit at Tokai, the southernmost affected site, also scrammed, and it is in cold shutdown.

The operating Fukushima Daiichi and Fukushima Daini plants successfully scrammed after the earthquake. However, the subsequent tsunami resulted in a loss of heat sink at the Fukushima Daini, ichi being one, ni being two, so this is the number two

station that I'm referring to now.

This was categorized as an INES Level 3 or serious incident. The Fukushima Daini operator was eventually able to restore operation of seawater pumps, but not before suppression pool temperatures reached saturation conditions, necessitating the declaration of an emergency action level and Japanese officials ordering an evacuation of residents within 10 kilometers of the site. The Fukushima Daini reactors are currently in cold shutdown and stable.

Now, the information that I will present in the following slides is taken from various publicly available press releases, primarily from our Japanese counterpart, the nuclear regulator, NISA, and the utility, the Tokyo Electric Power Company or TEPCO.

While assessment is a natural and ongoing part of the agency's response to this event, conclusions based on our assessments will not be presented as part of my slides, because events are still unfolding and the information that is available to us, as Bill pointed out, is incomplete or, in some instances, unconfirmed.

The agency task force assignment that will be discussed later during this presentation includes establishing a framework for the agency's review and

assessment of this event.

Next slide, please.

Extended station blackout at Fukushima Daiichi. Immediately following the earthquake, the reactors at Fukushima Daiichi, Units 1, 2, and 3, scrammed. The earthquake also caused a loss of offsite power, resulting in the plants having to use their emergency diesel generators.

About an hour after the earthquake, the tsunami hit and inundated the underground emergency diesel generator rooms, rendering the diesel generators non-functional and initiating the extended station blackout condition. It is not clear to what extent the station's batteries contributed to mitigating the station blackout with DC power.

Next slide.

Accident sequence. After the tsunami and station blackout, core cooling was provided by an isolation condenser system for Unit 1, and reactor core isolation cooling, or RCIC, systems for Units 2 and 3. Continued operation of an isolation condenser is dependent on the ability to refill the condenser shell side with makeup water to serve as a heat sink.

During a station blackout, RCIC operation is dependent on batteries to provide DC power to

energize valve motors and control circuits. The Japanese utility reported that they lost all cooling, presumably after the isolation condenser boiled dry for Unit 1, and the batteries providing power to RCIC were exhausted for Units 2 and 3.

CHAIRMAN ABDEL-KHALIK: Now, operators can take manual control of RCIC. Has that happened? Did that happen at Fukushima?

MR. THORP: We don't have specific facts that indicate exactly what the operator actions were in response to manually operate RCIC. That is something we will certainly look into as part of our evaluations.

CHAIRMAN ABDEL-KHALIK: The operator station manual control of RCIC, would that have prolonged the time available to them to provide cooling to the plants?

MR. RULAND: At this stage, we -- I mean, clearly, if a RCIC system continued to operate, of course it would provide cooling. But we have no information about what happened.

MR. THORP: The regulator reported -- excuse me. We don't have definitive information on exactly when or how long core cooling was lost for each unit. The regulator reported that at some point

in this sequence of events, Units 1, 2, and 3 commenced seawater injection.

MEMBER CORRADINI: Just to -- you said it, but I want to make sure. So in terms of the timing of what you just said, it's fuzzy.

MR. THORP: Yes, it is.

MEMBER CORRADINI: What's the range of fuzzy? Not earlier than, and not later than. Do you know that at least?

MR. THORP: I don't have specific details for you this morning --

MEMBER CORRADINI: Okay.

MR. THORP: -- on that.

MEMBER ARMIJO: Were the batteries used for spent fuel cooling in Unit 4? Since they didn't have a core inside the reactor, did they try and keep the pools cool using battery power on Unit 4?

MR. THORP: We don't have information on --

MEMBER ARMIJO: We don't know that?

MR. THORP: -- the answer to your question.

MEMBER ARMIJO: Just one other top-level question. Is there any information provided by the Japanese on why Units 5 and 6 survived in a better

state with --

MR. THORP: I have a couple of comments on Units 5 and 6 as we move through that hopefully will answer your question there.

Moving along, the loss of flow, and presumably the inventory, some inventory in Units 1, 2, and 3, resulted in at least partial core uncovery. Primary containment pressure increased, potentially threatening the integrity of these structures, as evidenced by the utility taking measures to reduce pressure through venting.

The regulator reported that on 12 March, as water level in Unit 1 reactor pressure vessel lowered, fuel cladding interacted with the water and generated hydrogen. This hydrogen accumulated outside of the primary containment vessel and caused an explosion in the reactor building. A similar --

MEMBER BANERJEE: How long was this period from the initiation of the accident?

MR. THORP: Well, the accident started on 11 March, and this report from the regulator was that on 12 March the gas buildup occurred, and then the explosion occurred. I don't know exactly the timeframe of the explosion.

MEMBER BANERJEE: So the timeframe -- you

know when the explosion occurred, though, right?

MR. THORP: Yes.

MEMBER BANERJEE: You don't know when the core started to produce hydrogen. That's what you're saying.

MR. THORP: That's correct.

MEMBER SIEBER: How certain are we that the hydrogen came from zirc water as opposed to a couple of other --

MR. THORP: What we have is the report from the regulator and their assessment that it was generation based on zirc water reaction.

MEMBER SIEBER: Okay.

MR. THORP: A similar explosion was reported by the regulator as having occurred in Unit 3 on 14 March. Two more explosions were reported in Unit 2 and Unit 4 on 15 March. However, the exact cause of these explosions is as of yet unconfirmed. Open source imaging shows significant damage to the Units 1, 3, and 4 reactor buildings. News videos recorded the explosion in one or more of the units.

The utility reports that the Unit 2 explosion may have occurred within the suppression chamber or torus, potentially damaging that unit's primary containment.

MEMBER CORRADINI: I'm sorry. So the last statement you just made is confirmed or speculation?

MR. THORP: It's a report from the utility.

MEMBER CORRADINI: And, again, the report was -- where did it occur? Excuse me.

MR. THORP: That the Unit 2 explosion may have occurred within the suppression chamber.

MEMBER CORRADINI: Within.

MR. THORP: Yes.

MEMBER CORRADINI: Okay.

MEMBER SHACK: Do we know how they tried to do the venting?

MR. THORP: We don't have specific details on the venting process they took.

MEMBER SHACK: So we don't know whether they have hardened vents, sort of akin to what we would expect.

MEMBER SIEBER: They apparently do not.

MR. THORP: It's not clear. We have been told they don't. We have been told maybe they do, so we have to find out.

MEMBER CORRADINI: So I'm going to ask you something that is probably unfair, but -- so yesterday in the House Energy and Commerce Committee,

Congressman Markey claims he has an NRC report that they had hardened vents. And I am trying to understand where he got that and if it's true. So what I'm hearing today is unclear.

MR. THORP: That's a totally unfair question, right.

(Laughter.)

I really don't know.

MEMBER CORRADINI: Because Marty Virgilio looked awful surprised when it was asked of him, and I --

MR. THORP: Yes.

MEMBER CORRADINI: -- I want to get clear what the facts are. And if we don't know the answer, then we don't know the answer.

MR. THORP: We don't know the answer, but that's certainly one of the questions that we will be pursuing as part of our followup.

MEMBER SIEBER: Yes. The photos I saw --

MR. RULAND: Yes. We take, obviously, what we say very seriously, and we want it to be absolutely credible. So --

MEMBER CORRADINI: The reason I -- no, the reason I ask that is because Marty's response was, "We don't know." And he was told he was wrong, and I

thought -- and the source of that was NRC, and I thought that didn't make sense to me, and I wanted to make sure at least I think -- at least somebody ought to followup as to why these incorrect facts are getting out.

MR. RULAND: You might have read some press information about a document, a New York Times article yesterday, you know, quoting a document from the NRC. And I would submit that the people that are quoting that document don't understand the context that that document --

MEMBER CORRADINI: Fine, okay.

MR. RULAND: -- was produced.

MEMBER CORRADINI: Thank you. Fine.

MEMBER SIEBER: I have a quick question. You had a torus explosion, presumably in Unit 2. That was from the inside of the torus?

MR. THORP: It's not clear whether it was just outside the torus or whether it was inside the torus.

MEMBER SIEBER: Okay. But the inside of the torus ordinarily would be under a nitrogen blanket in that type of reactor, right?

MEMBER ARMIJO: Until it's vented, yes.

MEMBER SIEBER: And so --

MEMBER CORRADINI: I was going to followup my question. You're thinking the same thing I am. I can understand it near, but not in.

MEMBER SIEBER: Yes, I guess we don't know the answer to that right now.

MR. THORP: No, we don't.

MR. RULAND: Correct.

MR. THORP: Okay. Next slide. The status on Units 1, 2, and 3 -- note, your particular handouts, the hard copies that you have, may look a little bit different than what is displayed on the screen. I deleted the date 5 April, because I tried to obtain the latest status as of this morning, so I have got a couple of pieces of information that are later than April 5th.

The regulator had reported that the Units 1, 2, and 3 reactor cores are likely damaged, as evidenced by the presence of iodine and cesium in the environmental monitoring samples they have taken. Additionally, TEPCO, Tokyo Electric Power Company, has announced publicly that they estimate the core damage in Unit 1 as 70 percent; Unit 2, 30 percent; and Unit 3, 25 percent. These figures were based in their statement on radiation levels that they measured in the units on March 14th and 15th.

MEMBER BLEY: We don't know what that means, right?

(Laughter.)

I certainly don't know what that means.

MEMBER CORRADINI: So just to give you a historical connection, if I remember correctly, the few days following TMI, a number of laboratories were asked to do analyses, and all came in with a damage based on zirc water reaction of something on the order of 50 to 70 percent. Is that -- I'm trying to understand what that means. Is it a zirc water reaction analysis? Is it a radioisotope analysis? What is it?

MR. THORP: We don't really know. They indicated it was based on radiation levels that they had --

MEMBER SIEBER: So you can't prove that.

MR. THORP: That's right. Now, the use of seawater for core cooling was taken for several days, and resulted in some degree, we believe, of salt buildup within the reactor pressure vessels for these units. They have switched to fresh water cooling.

We learned from a Japanese television news report on Tuesday, 5 April, that a safety relief valve on Unit 1 was believed to be stuck open. But we have

not obtained other or subsequent reports on the status of this valve on Unit 1. We do --

MEMBER REMPE: Excuse me. What date would they claim it had started to be stuck open?

MR. THORP: April 5th.

MEMBER REMPE: Okay.

MR. THORP: Nitrogen inerting of Unit 1 primary containment, those operations were conducted on Wednesday, 6 April, yesterday, commencing at 10:30 p.m. Japan Standard Time.

MEMBER CORRADINI: I'm getting ahead of you -- I apologize -- but -- so do they have instrumentation that they can actually see a pressure change with this injection?

MR. THORP: It's not clear what instrumentation they have and how reliable the instrumentation they have is.

MEMBER CORRADINI: And so the reason -- public reason given for this injection is?

MR. THORP: Well, their containments are supposed to be inerted anyway. So their concern is to inert the containment, so that if they have to vent they will minimize the possibility of hydrogen explosion.

MR. RULAND: And the inerting is happening

in Unit 1, correct?

MR. THORP: Unit 1. That's correct.

MEMBER BANERJEE: Can you explain that to me? I was also puzzled by that. How does injecting nitrogen --

MR. THORP: It's not clear to me. I don't want to dwell on it. It was --

MR. RULAND: What was the question?

MR. THORP: It was a discussion of partial pressures. He doesn't understand why injection of nitrogen would necessarily be a mitigating factor for the potential for explosion.

MEMBER POWERS: It's a well-known phenomenon that injection with nitrogen, getting it up over 70 percent, interferes in the propagation of a deflagration front, because -- simply because of heat capacity.

MEMBER BANERJEE: So is that -- the containment is supposed to be inerted, at least the primary containment. So the point you are making, Dana, is if it issues as a mixed stream of nitrogen and hydrogen, that changes the deflagration of --

MEMBER POWERS: I believe the concern is that the hydrogen within the drywell may be accompanied by oxygen that exolved from the seawater

that has been pumped in, subsequently leaked through the -- into the drywell, and so they want any hydrogen/oxygen mixture to be inerted.

MEMBER BANERJEE: Okay.

MEMBER POWERS: Right now it is probably steam-inerted. But if you start putting cold water in, you are going to eliminate the steam-inerting, so they replace it with nitrogen-inerting and get it back to the condition that it was designed to be in -- that is, inerted.

MEMBER BANERJEE: Okay. Thanks.

MEMBER SIEBER: In order to re-inert Unit 1 containment, did they actually have to vent the containment?

MR. THORP: I don't know the specific sequence of steps taken.

MEMBER SIEBER: To replace whatever is in there with fresh nitrogen. Otherwise, pressures will drop and --

MR. THORP: Right.

MEMBER SIEBER: -- I would have seen that on the charts I read, and I didn't.

MR. THORP: Right. I don't know the specific sequence of steps they took.

MEMBER CORRADINI: If I might just --

again, I think you're going to say you're not sure, but they are -- the procedures of venting are not -- I know that they occurred over the first few days. Is there still venting going on, or is that unclear also?

MR. THORP: That's also unclear, and certainly the report that the safety relief valve was stuck open is one indicator that perhaps they are having to deal with that, but --

MEMBER CORRADINI: On Unit 1.

MR. THORP: -- it's unclear. On Unit 1.

MEMBER CORRADINI: The only reason I ask the question is, from the same public sources I think we are all looking at, Unit 1 is the only one that is showing pressurized.

MR. RULAND: That's correct.

MEMBER CORRADINI: Okay, fine.

MR. RULAND: It's about seven pounds I think, the last time I saw the number.

MEMBER ARMIJO: John, just a real basic question. Do we have reasonably up-to-date drawings of the Japanese plants and -- so that we can compare them with the U.S. plants? You know, BWR4, Mark 1's, BWR3's.

MR. THORP: I think we have been working to obtain materials that -- from our staff that are

stationed in Japan. We call them the site team or the Japan detachment.

Bill, I don't know if you have other comments on that.

MR. RULAND: Everybody knows this plant was built by General Electric, so I would imagine General Electric has the drawings and --

MEMBER ARMIJO: I've been there, you know, and I --

MR. RULAND: Right.

MEMBER ARMIJO: -- from a hazy recollection, they were very similar, if not identical, to the U.S. plants. But I have heard all sorts of stories that they were different, and I had wondered -- I would like to know if the NRC has drawings of the plants as they currently exist.

The other thing I know about the Japanese, they were very careful to follow the safety upgrades that the NRC required in the U.S. plants, but I have heard otherwise. So I'm probably in the same state as you may be, and I'm not sure what I can rely on.

MR. RULAND: Yes. One of the things the staff is sensitive for -- is sensitive about is when we -- we don't want to divert the Japanese attention on their primary responsibilities to get the plant

under control. Basically, you know, stop working on what you're doing and, you know, come brief us. That's not where we're at.

MEMBER ARMIJO: Send us your drawings, while you're busy --

MR. RULAND: And so that has been, you know, some of the reason, you know, the data stream we have is slow. But I'm sure in the weeks and months ahead, you know, we will be, you know, trying to get that information.

MEMBER ARMIJO: Okay.

MEMBER SIEBER: When I looked at aerial photographs, the vents did not appear to be hardened. You can actually see them. And that leads to the conclusion that the explosion probably occurred in the outer shell of the containment building out in the primary containment, but the concrete structure -- concrete and sheet metal structure above that, and vent pipes -- it's hard to tell which unit you were looking at that the vent pipes appeared to be broken, and the building -- most of the building outside covering is missing.

And with a hardened vent -- the vent, prior to the venting operation, still filled with oxygen, so the chance of a deflagration inside the

vent is real, if you vent hydrogen through that.

MR. THORP: Let's see, to continue, I don't -- I took that as a statement, not a question.

MEMBER SIEBER: It's a statement.

MR. THORP: Okay. Thank you. All the units are using cooling pumps that are powered by offsite power sources as of April 3rd. I apologize if I am repeating myself.

Freshwater is being injected through various means, including the feedwater and low pressure coolant injection systems. There are reports of high radiation levels, in the thousands of r, inside the primary containments, as I had noted above.

While the radiation levels are high, they have trended downward. As a result of the significant dose rates onsite, several workers have received higher than normal doses. However, there have been no reports of workers exceeding regulatory dose limits for response to emergencies.

MEMBER SIEBER: That's 10 for equipment, 25 for rem.

MR. THORP: I have seen a 25 rem limit for a response to emergencies, and there are lower limits, their normal regulatory limits, for exposure, occupational exposure.

MEMBER SIEBER: Well, there's two -- 10 and 25 -- is the three.

MEMBER REMPE: They increased it periodically. It's my understanding that they went to higher levels as this accident progressed.

MEMBER SIEBER: I'd rather two instances over ten.

MEMBER RYAN: There's probably a little bit of detail there in terms of the folks who get -- their feet have been exposed, and that's a local skin dose as opposed to a whole body --

MR. THORP: Extremities dose, yes.

MEMBER RYAN: So I think it's -- you've got to lay out all of the details to really understand what the number means and in what context.

CHAIRMAN ABDEL-KHALIK: John, please continue.

MR. THORP: Okay. Thank you. I'll try and move along.

The Unit 4 reactor core was offloaded into the spent fuel pool about three months prior to the earthquake. The Unit 4 explosion that occurred on 15 March caused significant damage to the reactor building. Since the spent fuel pool cooling system is not functional, cooling and makeup water is being

provided by injection of fresh water from a concrete pumper truck.

Units 5 and 6 did not experience an extended station blackout condition following the earthquake and tsunami, although Unit 5 may have experienced loss of all AC power for a period of time. These two units are in cold shutdown, and shutdown cooling systems are operating normally for Units 5 and 6.

MEMBER CORRADINI: Can we go back to Sam's question about -- I'm sorry, but Sam asked something, and you were going to defer him. So this is --

MEMBER ARMIJO: Yes. Do you have any kind of a -- call it speculation for now -- from the Japanese or from internally of why Units 5 and 6 fared better? Are they --

MR. THORP: I have a photo --

MEMBER ARMIJO: -- at the same elevation?

MR. THORP: -- that will come after this that will I hope show you -- well, you won't see Units 5 and 6 on this photo. But Units 5 and 6, oddly enough, are located to the north of Units 1, 2, 3, and 4, okay? And they appear to be on somewhat higher ground than those four units.

MEMBER SIEBER: Do we know how much higher

that is?

MR. THORP: We don't know how much higher that is.

MEMBER ARMIJO: Well, John, many of us -- as you must realize, we have been working on this thing from various sources of information. And if you go on Google Maps, they have an elevation feature. And I did, in fact, look to see if there was any elevation differences in parking lots next to Units 1 through 4, and 5 and 6. And my unverified numbers was about another 10 feet higher up on the Units 5 and 6.

I don't know if that's actually fact or -- but I'm looking for some reason that tells us why 5 and 6 made it past this, didn't get into the same state.

MEMBER SIEBER: Yes. I reviewed your numbers. I don't fully agree.

MEMBER ARMIJO: I wouldn't be surprised.

MEMBER SIEBER: I think it's a figurative distance.

MEMBER ARMIJO: Well, that's good.

MEMBER SIEBER: But that's probably the reason why that occurred right there.

MEMBER ARMIJO: Well, that's sort of the things that are on a list of questions that the ACRS

is probably going to be putting together, a list of kind of key questions that --

MEMBER SIEBER: We could all --

MR. THORP: One of my colleagues that will speak to the station blackout topic, and will be able to address a slight difference between Units 5 and 6, emergency diesel generators and how they respond to a blackout --

MR. RULAND: John?

MR. THORP: -- or loss of power versus --

MR. RULAND: John?

MR. THORP: -- the other units, so I would like to defer to --

MR. RULAND: George, why don't you mention that briefly.

MR. WILSON: Yes. The --

MR. RULAND: This is George Wilson.

MR. WILSON: One of the units has a HPCS, and Unit 5 has HPCS diesel -- or it might be Unit 6 -- has HPCS diesel, has a HPCS system. So if it has a HPCS diesel, that is the power supply. So the fact that it has a HPCS diesel, that -- and at that elevation, nothing happened to that HPCS diesel.

Therefore, power was there, and they were able to -- what we think is that they were able to

cross-connect the Unit 5 and Unit 6 spent fuel pools, because they didn't have the power from the HPCS diesel on the other unit. So there was nothing happening to that.

MEMBER ARMIJO: And you mentioned a somewhat higher elevation? Do you have a --

MR. WILSON: Well, it --

MEMBER ARMIJO: -- for that, or is that a fact, that you know that there is an elevation difference?

MR. WILSON: As John said, I don't know if there is an elevation difference. But as you do know, HPCS is a safety-related system. And it's used -- I mean, it should be in an environment that it would be protected from that, because that would be the safety-related diesel. So, and that's all we know.

MEMBER ARMIJO: Okay.

CHAIRMAN ABDEL-KHALIK: Now, with regard to the spent fuel pools, it is my understanding that the emergency operating procedures used by the Japanese are similar to those used at U.S. plants. And for both BWRs and PWRs, the emergency operating procedures focus on maintaining the critical safety functions of the reactor.

Nowhere in the EOPs are the operators

asked to check the status of the spent fuel pools. Given what happened at Fukushima with regard to the spent fuel pools, should the licensees be asked to evaluate the adequacies of their EOP?

MR. RULAND: EOPs and the SAMGs are going to be one of the things that the task force is going to look at.

CHAIRMAN ABDEL-KHALIK: Okay.

MEMBER CORRADINI: Can I get back just to -- so we asked about the schematics, and you said they're busy and you don't have them. What about the capacities and the loadings on the spent fuel pools, including the common ones? Do you know what that is, or --

MR. THORP: I don't have specific details with me on that. We have worked to get some information from GE-Hitachi on the fuel assembly loadout in the various spent fuel pools, and the normal core loading number of assemblies, etcetera, in each of the reactor pressure vessels. But I couldn't answer the question for you right now.

MEMBER CORRADINI: That's fine. That's fine. I figure a lot of the things we're asking you're going to defer, and that's fine. We'll make a list.

But the reason I'm asking the question is, particularly for Unit 4, since it was offloaded, I was curious about what was in Unit 4 besides the core. And given the fact there is like three or four NUREGs that NRC has done on spent fuel pools relative to accident situations and essentially boildowns, what would be -- has the NRC done a calculation on if -- if unattended, how many days would this pool have been able to -- do you know what I'm asking?

MR. THORP: Yes. Yes.

MEMBER CORRADINI: And has that been done?

MR. THORP: We have been working to obtain information in that regard and to conduct some calculations, but I don't know whether they are finalized or not.

MEMBER CORRADINI: That's fine, that's fine. But you have already thought in that regard.

MR. THORP: We did.

MEMBER CORRADINI: Thank you.

MR. RULAND: When we talk about emergency planning, we have -- that's one of the topics.

MEMBER CORRADINI: Okay. Thank you.

MR. RULAND: We'll bring that up then.

MEMBER CORRADINI: Thank you very much.

MEMBER SIEBER: One thing I would point

out is the fuel pool content is going to be typical of plants that are regularly in service. On the other hand, I think it makes, from a thermal hydraulic standpoint, a difference to know how they -- where they place fuel assemblies in the pool.

You can build a chimney effect by having a whole core discharge in one place in the pool, which, you know, mixing is natural circulation, and fuel damage will occur earlier if it's that way as opposed to spread around to cool it. So that would be something that we need to learn what the pattern was.

MR. RULAND: Randy? If you don't -- Randy, could you talk about this a little bit, please?

MR. SULLIVAN: Yes, Randy Sullivan. I'm not the spent fuel pool expert, but much of what you are asking was known in the Operations Center. And these spent fuel pools very much do not look like your typical American spent fuel pool. They are not re-racked densely.

In Unit -- let's see, let me get this straight -- 1, 2, 3, there is like one core offload. There was some calculations -- this was a surprise to us early on. We were unaware of this until later in the event, but we do have some calculations in the Ops Center on time to boil off.

You know, we would assume in a typical U.S. spent fuel pool you've got, I don't know, six days, eight days, something. These are more like 30 days. I have even heard 100 days.

Now, Unit 4 was the exception. There was a 105-day-old full core offload, and of course Unit 4 is where the problem was.

I don't have the actual numbers at my fingertips, and I would encourage you to wait.

MEMBER CORRADINI: That's fine.

MEMBER REMPE: Would you elaborate a little more about the geometry being different? And, in particular, in Unit 4?

MR. SULLIVAN: Yes.

MEMBER REMPE: Tell me what, you know --

MR. SULLIVAN: In a typical U.S. spent fuel pool, you will find several cores, right? And we're -- I'm sorry?

MR. RULAND: Just to kind of put this in perspective, the spent fuel pools -- we don't know what the condition of the spent fuel pools were after the seismic event.

MEMBER REMPE: I'm talking about just the --

MR. RULAND: We don't know --

MEMBER REMPE: -- structure, John.

MR. RULAND: We don't know structurally what their condition was. We don't know how much water was in the spent fuel pools after the seismic event. And we don't know how much water was in after the explosion. So there is lots of uncertainty to -- you know, trying to -- you know, truly it is a rough estimate. Anything that we could have done was a rough estimate about time to boil.

CHAIRMAN ABDEL-KHALIK: But in terms of geometry, there were indications that there is a shallow part of the pool. And if that is the case, was the full core offload for Unit 4 placed in the shallow part of the pool?

MR. RULAND: I have no idea. No idea.

MR. SULLIVAN: The only thing I wanted to relate that we were sure of is that there was fewer elements in the pool than perhaps you were expecting, given your U.S. experiments.

MEMBER CORRADINI: That's fine. Thank you.

MR. SULLIVAN: That's what I am sure of.

MEMBER CORRADINI: Thank you.

MEMBER REMPE: But building geometry, anything different that you know about?

MR. SULLIVAN: No, sorry. Can't help you with building geometry.

MEMBER REMPE: Okay.

MEMBER BLEY: Bill, quickly, you mentioned the SAMGs. I've heard different things over the years. Up to this point in time, does staff review the SAMGs in any way, or audit them? Or because it's outside the design basis, are they really outside of the normal scope?

MR. RULAND: The SAMGs are something that we worked with industry to establish, right, at a high generic level. So that's what we did.

MEMBER BLEY: Okay.

MR. RULAND: You know, I'll be sure that we're -- the whole issue of SAMGs and what -- what is appropriate there is going to come out. I know the Chairman here has opined that the -- you know, they have similar procedures that we do. We have heard that.

CHAIRMAN ABDEL-KHALIK: Not with regard to SAMGs, though.

MR. RULAND: With SAMGs or EOPs. You know, we -- that has not been verified. That might be -- you know, that could be a presumption, but we don't know for certain. You know, this will come out in the

weeks and the months ahead.

MEMBER SIEBER: One of the things I think would help in an analysis of all of this is to know what happened in that first hour of operation between the earthquake and whatever seismic damage occurred in the tsunami, because it appears to me is the tsunami caused the bulk of the problems, as opposed to the seismic event.

And from a regulatory standpoint, that makes a big difference as to how you treat various phenomena, natural phenomena at various sites. So perhaps you can reach into that area and see what you can pull out.

MR. RULAND: How much more time, John?

MR. THORP: We're just about done.

MR. RULAND: Okay.

MR. THORP: But I think that's going to be another one of the focuses of the task force's Committee.

There are a number of photographs -- you can see one of them here -- of the Fukushima Daiichi site that have been released through the media. This is one such photograph with the units labeled as shown. The degree of destruction of the secondary containment buildings is evident from the photographs

as you look at them.

Units 5 and 6 are not --

MEMBER RAY: You are now calling these "secondary containments" consistently.

MR. THORP: That's what I am calling them. You know, I'm a PWR guy, so here I am trying to relate BWR stuff.

MEMBER SIEBER: Call them reactor buildings.

MR. THORP: Reactor building, yes.

MEMBER RAY: Reactor building is what I have been calling them.

MR. THORP: Yes. I'm good with reactor building.

MEMBER RAY: All right.

MR. THORP: Units 5 and 6 are not show in this picture, but they are located, as you're looking at this picture, to the left or to the north end of the site.

And that concludes the slides that I intended to present.

MEMBER ARMIJO: Where is the common fuel pool for the discharge?

MR. THORP: The common fuel pool -- I can't point it out exactly, but it's kind of south of

Unit 4.

MEMBER ARMIJO: Okay.

MR. THORP: In one of the structures there, but I don't know specifically.

MEMBER ARMIJO: All right.

MEMBER SIEBER: Those tower-like structures are the vent towers, right?

MR. THORP: That would have been my guess, but I don't know for sure.

MEMBER SIEBER: That's what I assume from the photographs that I saw.

MR. RULAND: Eric?

MR. BOWMAN: Good morning. On March 18th, we issued the first generic communication on the subject. It is the only generic communication we have issued so far, Information Notice 2011-05.

The purpose of that Information Notice was to provide a summary, a high-level summary of the events as they happened, as we knew them at the time, to the industry and to allow the recipients to review the information and consider what actions would be appropriate on their parts to avoid having similar problems at their sites.

In addition to the description of the circumstances as we knew it to have occurred, we

provided a discussion of the regulatory background that we felt was pertinent to the events that took place.

In particular, we discussed General Design Criteria 2, or whatever the similar design criteria requirements were for appropriate licensees, the B.5.b requirements for mitigating strategies for beyond design basis events that came out after the terrorist events of September 11, 2001, and the station blackout rule.

We also provided a look ahead to what was -- what we knew of the industry initiatives following on to the event to verify their capabilities. Tim Kobetz will be covering that. And we provided a discussion of the upcoming Temporary Instruction to conduct inspections, and Barry Westreich will be discussing the task force action that came out after the follow-on Commission meeting.

CHAIRMAN ABDEL-KHALIK: It's my understanding that the equipment staged by the licensees in response to Section B.5.b are based on an event at a specific unit, at a single unit. So for licensees of multiple-unit sites, are they being asked to also evaluate the adequacy of the staged equipment, if more than one unit is involved?

MR. THORP: This was an information --

MR. RULAND: Barry, could you -- hold on a second. Barry was associated with -- you know, he is on rotation from NSIR. Can you answer that question, Barry?

MR. WESTREICH: Yes, the B.5.b equipment was there for an event. It wasn't for a single unit. So the licensees evaluated an event -- large explosion -- to see the location of the various units. They may be designed for multiple units. We don't really know. I mean, I can't give you an answer specifically for the fleet. So some sites have capabilities for multiple units; some may not.

MEMBER ARMIJO: This was a mind-boggling event, you know, which may be much different than what we have traditionally thought of as an event.

MR. THORP: Barry, if I could address the question, this was an Information Notice. We did not ask them to evaluate anything. We provided the information so they could do their own evaluations. The Temporary Instruction inspection will follow-on to take a look at those things.

And also, the details of the mitigating strategies requirements are typically Official Use Only security-related information that we have not

released to the public, and we aren't really prepared at this point to --

CHAIRMAN ABDEL-KHALIK: But the industry, on its own, is asking licensees to do these evaluations, and the question is whether the staged equipment would be adequate if you have an event that involves more than one unit on a multi-unit site.

MR. RULAND: I'm certain that that is one of the questions the task force will address.

CHAIRMAN ABDEL-KHALIK: That what --

MR. RULAND: The task force will address that question.

CHAIRMAN ABDEL-KHALIK: The task force, right? Is that a question that has already been asked?

MR. RULAND: The task force has not only long term, which is -- has the short-term actions, which is within 90 days, and those are the issues that are adequate protection issues. So that's what the task force has on their plate near term. And then, after the three months, it turns out the three-month to nine-month timeframe is the longer term actions.

So the task force is asking the adequate protection issue virtually as we speak. Is there anything that needs to be done, as an adequate

protection issue, that needs to be addressed now? And that's the question that is on the task force's plate.

CHAIRMAN ABDEL-KHALIK: Thank you.

MEMBER CORRADINI: Just a clarification. So I don't understand the sequence. So the Information Notice went out within the first week?

MR. BOWMAN: Yes.

MEMBER CORRADINI: Okay. And then, this in some sense -- I don't want to say call it an inventory, but this is a -- shall I say, an inventory of what from various rules historically are onsite for the various units. And then, you said something after that that I wanted to connect to it. You said that there will now be a temporary order or a temporary -- I don't remember what you called it, but an inspection, an onsite inspection, by the NRC staff.

MR. BOWMAN: Tim will be addressing that.

MEMBER CORRADINI: Oh, I'm sorry. Okay, okay. Thank you.

MR. BOWMAN: Any other questions for me?

(No response.)

MR. KOBETZ: All right. I'm Tim Kobetz. I'm the Chief of the Reactor Inspection Branch, and, as we have just discussed, I am going to be talking about -- at a high level about some industry

initiatives, because we only know about them at a high level.

But I am going to be talking about our Temporary Instruction and what that is, and how that is going to be looking at some of what they're doing, and then also performing somewhat of an independent assessment. But it's a quick high-level look, and I'll talk about that.

So within a few days of the event, the industry -- an industry-wide initiative was launched to assess the plant's readiness to manage some of these extreme events. The assessments are scheduled to be completed within 30 days, so that would be mid -- probably late April.

There is really four areas that they were looking at, and, again, I'm going to talk about them at a high level, because we don't know specifics as to, you know, the question that you just brought up about, are they looking at the 50.54(hh)(2) for multiple sites. We don't know that yet, but that's part of what our Temporary Instruction would be doing.

So the first area that they would be looking at is verifying each plant's capability to manage major challenges, such as aircraft impacts, as we just talked, and other losses of large areas of the

plant due to natural events and fires. You know, this is somewhat from the 50.54(hh)(2).

Specific actions would include testing and inspecting equipment required to mitigate these events, and verifying that qualifications of the operators and support staff are in place, and, you know, up to date to deal with what they have put in place.

The second one would be verifying the plant's capability to manage a total loss of offsite power. You know, you're at station blackout, which, as we said, George Wilson will go into a little bit more on our requirements for a station blackout. But this is going to require verification that all of the required materials are adequately -- are adequate and properly staged, and that the procedures are in place, and that operator training is, again, up to date.

The third one is verifying capability to mitigate flooding and impact of floods on systems inside and outside the plant. Specific actions include verifying required materials and equipment are properly located again.

One of the things I would like to point out is these are things that we do look at during, you know, the inspections. But they are going to be

looking at them here from a slightly different angle now as to what could go beyond.

And then, the last one, they are performing walkdowns and inspections of important equipment needed to respond successfully to extreme events like fires and floods. This will include an analysis identifying any potential equipment functions that could be lost during a seismic event, and then developing strategies to mitigate any potential vulnerabilities.

Walkdowns and inspections will include important equipment, permanent and temporary, such as storage tanks, plant water to intake structures, and fire and flood response equipment.

So the NRC obviously wants to -- may have a good understanding of what the licensees are looking at, and then perform somewhat of an independent look as to what else we think should be addressed going into the future.

So that takes us --

MEMBER CORRADINI: I'm sorry. I just wanted to make sure -- this is everything onsite, and particularly in your fourth bullet relative to natural disasters. So spent fuel, other things that are not necessarily independent, is that what I understood

that to mean?

So, for example, what I was looking for is some sort of discussion about natural events that may affect spent fuel cooling.

MR. KOBETZ: Would they be looking at this?

MEMBER CORRADINI: Yes.

MR. KOBETZ: That's our understanding.

MEMBER CORRADINI: Okay.

MR. KOBETZ: Again, we're going to have to follow up during the TI, but --

MEMBER CORRADINI: Thank you.

MR. KOBETZ: So we decided to perform a Temporary -- issue a Temporary Instruction to perform an inspection. Just to give you an understanding of what a Temporary Instruction is, you know, we have our normal baseline inspection program and other special inspections. But when things come up, a Temporary Instruction is used for a one-time inspection to focus on a current safety issue.

Now, where we usually use Temporary Instructions are going to be maybe to follow up on licensee actions in response to a Generic Letter or something like that, something that we are going to do one time, or when an event like this happens and we

want to gather some information and see what else maybe we should be doing, or the industry should be doing. And then, this -- the information that we would gather from this would feed into the teamwork that Barry is going to be talking about.

So on March 23rd, the NRC issued a Temporary Instruction, which was very quick for doing one of these, to focus on these things. The objective of the TI is to independently assess the adequacy of the actions taken by the licensee in response to the Fukushima event. The inspection results from this TI will be used to evaluate the industry's readiness for a similar event, and aid in determining whether additional regulatory actions by the NRC are warranted.

The intent of this TI is to be a high-level look at the industry's preparedness for events that in some aspects could exceed a design basis for the plant -- in some instances. If necessary, more specific followup inspection will be performed.

The inspection assessment area is similar to the industry initiative. However, to maintain our independence, as I was noting, from the industry inspection, we are going to use a combination of looking at what the industry is doing, what they are

finding, and then doing some independent looks at those areas.

Our inspections are scheduled to be completed by April 29th, and then the report documented by May 13th.

MEMBER POWERS: I'm a little unclear. What is it that you are looking for? Their ability to respond to beyond design basis events?

MR. KOBETZ: Well, it's to look to make sure that the things that they've put into place for some of these other things, such as 50.54(hh)(2), station blackout, they are still -- they are maintaining them and that.

But the fourth one is to look at, okay, let's say we do have the fire and the flood and the earthquake at the same time. What are the vulnerabilities? Are there things that they need to put in place? Are they putting things in place into their corrective action program?

But, again, it's a high-level look to see, are there some vulnerabilities that we haven't noted before? And what is the industry doing about it? And what should we maybe do about it down the road?

MEMBER CORRADINI: I'm kind of with Dana. I want to understand the logic. So the first logic

was the -- what's called the Information Notice, to kind of list the stuff. I'll call it an inventory. That's the wrong word.

Now, you are going out with staff to look at the list and say, "Okay. What is the current status of these items relative to their originally intended function?" And then, you are going to ask -- or you are going to look at the same things and their maintenance and upkeep for what exactly?

I understand Step 1, which is you were supposed to do this, what's the list, now I am going to go out and make sure that the list is there and it's being maintained per the original objective. Now, the second part of that I'm still --

MR. KOBETZ: Well, actually, it's the fourth part --

MEMBER CORRADINI: Okay.

MR. KOBETZ: -- is the licensee would be going out and performing walkdowns of other equipment -- tanks, things that could be lost that maybe weren't considered in the original design basis of the plant but need to be looked -- or they think could cause a vulnerability, maybe not. But it's to look, you know, at those types of things.

MEMBER CORRADINI: All right. I mean, I'm

sorry I can't get a hold on this one. So do they know what they are looking for? That's what I'm -- I'm struggling here. I understand their original objectives and what they have installed it for, and I understand that you want to make sure that what is installed is there and being properly maintained.

But the fourth thing I'm -- it seems a bit fuzzy, so I'm trying to understand what -- what is an applicant going to do there, and what is the staff going to do versus the applicant's stuff onsite?

MR. RULAND: Right now, what the staff -- the regional staff and the inspectors have been assigned to do is not only to kind of look at what licensees are doing, but to independently examine the site, think about potential flooding, dam failures, whatever external events that site could affect, write that down and provide it to us.

And what that is going to do is inform the task force, oh, here is what so-and-so inspector at such-and-such a plant identified as a potential vulnerability, and that will -- that information -- because we're not going to do anything about it at this stage, that information then would go to the task force, be examined by not only the task force but NRR management, and, okay, what do we need to do about

this? It's basically going to feed into our overall picture of, what do we need to do to respond to this event?

MEMBER CORRADINI: But let me just push back a little bit. So I understand the objective, but the staff -- your staff, I mean, inspection staff that's going out, to put it crudely, do they have a menu or a thinking process they are going to use as they go doing this looking? If the answer is no, you could get soup to nuts.

MR. RULAND: And that's --

MEMBER CORRADINI: That's what I'm worried about.

MR. RULAND: That's -- well, I would argue that that's not a worry; that's an advantage. We've got 104 sites out there. Inspectors know the plants. They know what their FSAR says, and they have a decent idea of what are those potential events. This is something that the staff got out very quickly. It is just our initial look at what is going on out there. It is not the -- in any shape or form the final statement about what licensees need to do or do not need to do.

MEMBER CORRADINI: That part I get. I understand.

MR. KOBETZ: And to help focus, one of the things that we are doing -- because, you know, obviously we do have 104 sites, 65 reports. We have weekly calls. We start having weekly calls with the different regions to talk about things that they are finding, so they can exchange information. Maybe there is something at a plant that one inspector identified that another inspector didn't think to look at, and so we are trying to do that. But, as Bill said, this is the first of -- just to feed in.

MEMBER CORRADINI: Okay.

MEMBER SIEBER: You're actually inspecting for the current requirements of the plant as opposed to tasking inspectors to figure out what happened at Fukushima, and how should you change the plant. To me, that's two different things. I think that you are treating it as two different things, which is the appropriate way to do it.

Until your task force is done analyzing what happened in Japan, that's the only way you can decide what new requirements you need to put on plants here to protect against that same thing.

So you are determining existing conditions, deciding what needs to be changed, changing the rules to make that happen, and sometime

in the future there will be an inspection to make sure everybody did it. And that's what -- how I understand, in simplistic terms, what it is you're doing now. Is that correct?

MR. RULAND: Yes.

MR. KOBETZ: That was all of the -- my presentation, if there's no other questions.

CHAIRMAN ABDEL-KHALIK: Thank you.

MR. WESTREICH: My name is Barry Westreich. I'm going to talk about the task force. We have talked about it quite a bit already, so that there is a lot of the details we have already gone over. And just to clarify, I am not on the task force, so -- I have spoken to them. I know they have started their efforts, and we are providing input to them as they begin to understand what their efforts are going to be.

But on March 23rd, the Commission directed the staff to establish this task force. It is a methodical review and will recommend near-term actions to improve our regulatory system. It is independent from the industry efforts, so it is our own independent review. And they will be discussing with staff and others a variety of our current status and the areas where we need to go in the future.

As on the slide, they have a number of milestones. The first milestone is a 30-day Commission meeting, which the date is May 12th. And then, the 60-day meeting on April 16th, and the 90-day meeting corresponds with the issuance of their final near-term report, which is on July 19th.

And then, they are also looking at a longer term. And as Bill indicated, that effort is to start no later than the issuance of the 90-day report, and it will extend for six months.

They are looking at specific information on sequence of events. A lot of this stuff we have talked about today they will be looking at in greater detail -- potential interagency issues and policy issues, as well as lessons learned for non-operating reactors, non-power reactors.

They intend to have extensive interaction with the key stakeholders, and they will issue a report at the end of that six-month period for the longer term effort. And then, as you indicated, the ACRS has been asked to review that and report back to the Commission on their findings.

MEMBER CORRADINI: Is there -- I'm sure there is. Is there a -- for want of a better word -- a to-do list and a schedule that goes along with three

months, and then the further meeting, that is out there?

MR. WESTREICH: Well, my understanding, they do have a charter that has been developed, but I think they are still reviewing kind of the world, the universe of issues they might want to consider in --

MEMBER CORRADINI: But they are still developing this.

MR. WESTREICH: They are.

MEMBER CORRADINI: Okay.

MR. WESTREICH: As far as I know.

CHAIRMAN ABDEL-KHALIK: Now, most of our plants are located on multi-unit sites. And yet many of our safety-significant decisions are made on an individual unit basis. There are many examples of that. The estimated risks are done on an individual unit basis rather than site-wide basis.

Our operator training programs, simulator training scenarios, design of full-scale simulators, the role in training of shift technical advisors, given what happened, should we change our paradigm and address issues based on site-specific evaluations, general site evaluations rather than unit-specific evaluations?

MR. WESTREICH: Well, I think those are

all good issues that the task force I'm sure will be wrestling with.

CHAIRMAN ABDEL-KHALIK: Okay.

MR. RULAND: That's it, right, Barry?

MR. WESTREICH: Yes, that's it. So now we tag-team to the next group.

MR. RULAND: Yes, right. Next group?

(Pause.)

MR. RULAND: I've just advised the NRC staff that we have like 51 minutes left, so kind of march -- you know, let's try to -- because I know the ACRS members want to address each one of these issues.

MR. ALI: Yes. I'm Syed Ali from the Office of Research SL, Structural Issues, and I'm going to give you a brief overview of the seismic environment or seismic background.

So this earthquake was magnitude 9 on the Richter scale. The epicenter was about 109 miles from the Fukushima site. The peak ground acceleration at about 80 miles from the epicenter was in the range of 1 to 2.75 g.

A couple of slides down I will give you a little bit more on the Fukushima site itself. The question that came up in the beginning about the hazard, we don't have probabilistic data, but we do

have some comparisons of the design versus the observed.

MEMBER SHACK: How about their procedure for developing a design earthquake? Does it sort of go through a seismic hazard analysis somewhat akin to what we do, or do they go strictly on historical record?

MR. ALI: Well, I think they are in the same kind of a phase that we are. You know, previously, they were more deterministic, and now they are trying to do more of hazard assessments. But for this particular plant, from what we know it was, you know, deterministic basis.

MR. RULAND: But we have been working very closely with the Japanese in this particular seismic area. As a matter of fact, the event, if you recall, happened on Friday, the 11th of March. Their seismic experts were here in country for the RIC, and our seismic experts were meeting with them during that time.

MR. ALI: That's right. I was actually in that meeting all day long with them and their Director of the Seismic Division. That was JNES was going back and forth to the Ops Center to, you know, find out the status of what is happening and kind of updating us.

So, yes, we do have a cooperative research program with JNES.

The tsunami data -- we say peak amplitude reports vary, because looking at different reports we get different numbers. Now, that could be because they were observed at different locations or interpreted differently, but we have numbers anywhere varying from 14 meters to 23 meters from the wave height.

The design basis number -- again, we don't have the exact numbers right now, but that also varies anywhere from five to 10 meters. And we have seen some reports stating that the reactors and the backup power sources were located 10 to 13 meters above the sea level. But, you know, this is something that we will be getting more details on and firm up the numbers as we move along.

MEMBER STETKAR: Syed?

MR. ALI: Yes.

MEMBER STETKAR: That's the diesels. Where are -- the switchgear was located relatively low in the plant, though, wasn't it?

MR. ALI: That I don't know.

MEMBER STETKAR: Okay. But, I mean, you can have survivable diesels but no -- they seem to be

having problems connecting electric power to things.

MR. RULAND: Right.

MEMBER STETKAR: Because of flooded switchgear.

MR. RULAND: Right. It's the whole suite of what, you know, you need the diesel for -- the tanks, the diesels, and the switchgear, all of them, right, is what could have been affected.

MR. ALI: Actually, I was in Japan. I went there as a part of the second team and just came back a couple of days ago. And, you know, their emphasis right now is to deal with the current crisis and not -- not deal so much with the -- you know, how it happened, but, you know, deal with the crisis as it unfolds.

The next -- this slide gives a little bit of a flavor of the design basis peak ground acceleration versus the observed. And what you see here for -- you know, this is kind of a representative number for Unit 2. The design was less than the observed. The observed was more.

We do have numbers for the other units also, so from the records that we have seen, or from the reports we have seen, for Daiichi, three of the six units had observed accelerations greater than the

design. And the other three were either close to the design or a little bit less than the design.

MEMBER ARMIJO: What was Unit 4? Was it --

MR. ALI: Unit 4 was -- actually, the maximum was less than the design.

MEMBER ARMIJO: So it was --

MR. ALI: Yes, 2, 3, and 5 -- 2, 3, and 5 observed as more than the design, Units 2, 3, and 5.

MEMBER ARMIJO: Okay.

MR. ALI: And the other three units were less than the design.

MEMBER SIEBER: Now, your observed numbers come from seismic instrumentation?

MR. ALI: Right.

MEMBER SIEBER: Okay. It's unusual to see such a variation over a short distance, unless there is soil --

MR. ALI: Right. It could be part --

MEMBER SIEBER: -- or something like --

MR. ALI: -- partly because of the soil, partly, you know, as was discussed here, that the level of the different buildings is different also.

MEMBER SIEBER: I can picture how it would happen, but it's sort of unusual anyway.

MR. ALI: Yes. So from the numbers that I have here, the observed varies from 319 gal to 550 gal, like 300 -- .3 g to about .55 or .56 g.

MEMBER STETKAR: One centimeter per second squared.

MEMBER REMPE: Dennis has the answer.

MR. ALI: You have to divide by 90 D1 to get gs. So g would be a little bit more. So if it's .55 -- or 500 gal, that might be .56 or .57 g's.

MEMBER STETKAR: Okay. Thank you. Thank you.

MR. ALI: But that's all I have, you know, as far as the overall background.

MEMBER SIEBER: Thank you.

MR. WILSON: My name is George Wilson. I'm the Electrical I&C Branch Chief right now in NRR. I'm going to be basically going over how we implemented a station blackout rule here for the plants in the United States.

In 1988, we -- NRC issued a station blackout rule that required every plant in the United States to be able to take a station blackout and recover from it for that -- for a specified duration. We issued Regulatory Guide 1.155, which endorsed the NUMARC 87-00 standard, that is the standard the

industry used to implement the station blackout rule.

We also performed evaluations and issued safety evaluations for all 104 plants, and performed eight pilot inspections, two in each region, to get a feel for what we -- make sure they had implemented the rule correctly, and no major issues were identified during those inspections.

First, I want to go over what we classify to be the --

MEMBER BROWN: What was the specified duration that you listed in the second -- I just don't remember --

MR. WILSON: Four hours.

MEMBER BROWN: Four hours?

MR. WILSON: Right.

MEMBER BROWN: Thank you.

MR. WILSON: It will be for batteries, and I'll explain that in a little bit.

MEMBER BROWN: Okay.

MR. WILSON: First, I want to explain what coping is. The coping duration is actually the time that you get a station blackout event until you either restore offsite power or you restore a diesel generator, so you get the power back. And the coping durations were evaluated on the design of the plant

for both onsite and offsite power systems.

The offsite power systems would be the redundancy of the different lines coming into the switchyard, and also the chances that they would have a loss of offsite power. That could be where they were located by the severe weather. the factors onsite would be the redundancy of the diesel generators and the reliability of the diesel generators.

We allowed two different types of coping mechanisms. One was AC-independent, and that means a battery only. We only allowed each nuclear powerplant -- they could only cope with a station blackout for four hours on the batteries. If it was longer than four hours, they had to make modifications to the plant or they had to have an alternate AC source.

So, and the alternate -- and on the alternate AC source, they analyzed how long it would take them to get back the power, and they use that for two to 16 hours. There is one three-unit site that has a 16-hour coping, and that means they have to have all of the fuel oil and everything to run that plant for -- those diesel, that other supply, for 16 hours. Forty-plants are battery coping plants; 60 plants are alternate AC plants.

The big key on the station blackout is that it required every plant to have procedures to be able to recover from the station blackout, and those procedures specifically recovered the restoration of AC power. That means that they enhanced the diesel generator troubleshooting plans that were made. They also addressed to be able to hook up temporary power.

And they also have -- during Generic Letter 2006-02 that we issued with the grid interface, we ensured that every nuclear powerplant have an interface agreement with their local grid operator to ensure that they would be the primary source to restore power first, if offsite power was lost.

They also evaluated non-essential DC loads for stripping to increase the capacity of the batteries. And some examples of that would be lighting in the control room, they could break that down, or if the diesel generator start circuits actually come from the battery, they could open that up, so that at least it wouldn't continue to try to start. So they would strip some of the loads down.

They also took actions for a loss of ventilation to ensure that the rooms were being cooled, or looked at potentially bypassing some of the isolation circuits that would cause an isolation for

HPSI and RCIC. And, like I said, you know, they had grid interfaces.

MEMBER STETKAR: George, I suspect I know the answer to this -- or at least your answer -- do we know whether the Japanese had similar station blackout coping procedures?

MR. WILSON: I do not know.

MEMBER SIEBER: I think the more important question is -- Fukushima had the event. At the time of the flooding, that was the start of the station blackout. How long did they last until they got core damage? Was it four hours? Eight hours? Two hours? Ten minutes? If you could answer that, that will tell you the validity of the four-hour, eight-hour, what have you, stipulation in our rules. Does anybody know the answer to that timing question?

MR. RULAND: We don't know specifically what the answer is. But, you know, of course you know that the NRC has done some analysis as part of the SOARCA program to estimate -- if you remember, the Peach Bottom sequence in there is very similar to what was done, right? It's basically loss of offsite power, no recovery, right? And that was the analysis we did.

So that could help inform us about

approximately, you know, when core damage could have started.

MEMBER SIEBER: But I think it would be important to look at this event to see -- as another way to validate what we believe station blackout or duration time really is.

MR. RULAND: Yes, correct.

MEMBER SIEBER: And I would like to know the answer, if I could find out somehow.

MR. RULAND: Yes, sir.

MEMBER SIEBER: Okay. Thank you.

MR. RULAND: That will be on our plate.

MR. McDERMOTT: Good morning. My name is Brian McDermott. I'm the Director for the Division of Preparedness and Response in NSIR, and I'm going to be speaking about NRC's incident response relative to this incident.

Shortly after 4:40 a.m. on Friday, March 11, the NRC headquarters operations officers made the first calls to inform NRC management of the earthquake in Japan. Although there was no significant threat to NRC licensed facilities, it quickly became evident that the Fukushima Daiichi site had multiple units in a station blackout condition, and that we would need to engage our stakeholders.

In order to coordinate interactions with federal partners, NRC elected to staff the NRC Operations Center with a liaison team. However, as requests for technical and radiological assessment began coming in, staffing was expanded to include a reactor safety team and a protective measures team.

Later that day, in response to a request from the U.S. Ambassador in Japan, the NRC discharged two senior staff to provide technical assistance at the U.S. Embassy in Tokyo under the umbrella of the USAID disaster assistance response team. Within a few days, seven additional staff were dispatched to assist the Embassy and serve as technical liaisons with Japanese counterparts.

Since March 11, we have continued around-the-clock staffing in the Operations Center, and maintained the multi-discipline team in Japan.

Actions to stabilize the situation at Fukushima are ongoing, and so is NRC's response. NRC's role in the events at Fukushima has really been primarily to provide technical assessment and coordination assistance. We are supporting the U.S. Embassy in Japan in its efforts to assess the situation and make recommendations relative to the protection of U.S. citizens.

In addition, we are supporting the Japanese government by responding to their technical questions and coordinating efforts in the U.S. to address other requests for assistance. The NRC has also been working domestically with federal partners on the issue of trace radionuclides detected here in the United States.

Under the national response framework, the Environmental Protection Agency has the lead role for such events. However, in a support role, the NRC has provided peer reviews for technical papers and worked with licensees on the sharing of radiological monitoring data.

In terms of our coordination, support, and outreach, we utilized our knowledge regarding the basic boiling water reactor designs at Fukushima. NRC has been able to provide significant support to other agencies as they assess the event and evaluate potential impacts on their missions and personnel.

In order to develop the best possible technical responses to questions received from Japan, the NRC's reactor safety team has been working closely with nuclear experts from other civilian agencies, the Department of Defense, General Electric, and the Institute for Nuclear Power Operations.

Relative to our dose assessments and plume modeling, the protective measures team has worked closely with the Department of Energy counterparts, and the National Atmospheric Release Advisory Center, also known as NARAC. Throughout the event, the NRC's liaison team has been working to ensure a timely exchange of information with the White House, congressional stakeholders, federal and state partners, and international organizations such as IAEA.

Regarding our continued support for the response, as I noted earlier, the Operations Center remains staffed, and we continue to have the team in Japan. And while there are many of us very interested in learning lessons from the events at Fukushima, this remains an ongoing event. The information available today is often incomplete and difficult to corroborate.

As the situation on the ground improves, and our Japanese counterparts are able to share additional details, I fully expect and support a thorough examination of the facts by the NRC's newly formed task force, as the lessons learned will help strengthen our domestic preparedness.

I am prepared to answer any questions you

might have.

MEMBER POWERS: Question on the dispersal. You said you were working on the dispersal of radiation.

MR. McDERMOTT: Yes, sir.

MEMBER POWERS: What computational tool are you using to estimate the amount of dispersal that you get?

MR. McDERMOTT: We are going to have a presentation by Randy Sullivan next, and we are going to talk about our dose assessment in particular.

MEMBER POWERS: Well, I was more interested in the -- it's a substantial distance from Japan to our --

MR. McDERMOTT: Yes. The short answer is that NRC has the RASCAL code, which we use to generate source terms. However, dose projections in terms of plume for RASCAL only go out 50 miles. That is our quick-look tool in the Operations Center. For the official U.S. Government position on plume modeling, we coordinate with NARAC, and we do that -- practice that during our exercises. And they have the capability to model over a greater distance.

MEMBER CORRADINI: So was -- is this the appropriate to ask a question on that? So I saw a

release on the 16th of March and an appendix, which looked like it was from the RASCAL code.

MR. McDERMOTT: We're going to speak to that.

MEMBER CORRADINI: You're going to speak to that.

MR. McDERMOTT: I guess, yes.

MEMBER CORRADINI: So can I ask the -- I will save that part of the question. My second part of the question is: are NARAC calculations being done simultaneously so there is more refined analysis that is available to you?

MR. SULLIVAN: Simultaneously? I --

MEMBER CORRADINI: Well, I mean, you are doing the RASCAL calculations very quick. But the NARAC calculations I thought were also being -- I thought were available.

MR. SULLIVAN: They are not simultaneous. They take many hours to do, and it's not simultaneous, as you're saying. We are working on some comparisons, but that's more for follow-on than happened on the 16th.

MEMBER CORRADINI: There were NARAC calculations by the 16th?

MR. SULLIVAN: On the 15th, that's right.

MEMBER POWERS: Let me ask you one other question. We have this team that has been set up to learn sorts of things about licensees and accidents and what not. Will you be looking at the tools that you have within the Operations Center to see if there are tools that could be refined, improved, created, gotten rid of, whatever it is that should be done with that, to -- I mean, this is a wonderful exercise for you in the sense that you can have a certain detachment from it, but it gives you some hint, if you weren't so detached. And will you be coming forth with a set of -- maybe it's in the longer term, but --

MR. McDERMOTT: It will be. We are going to do the lessons learned relative to the functions within the Operations Center. This was a very valuable learning experience for us on how we work as a team in response to emergencies. You know, you learn a lot of things just from the fact that we were running around-the-clock operations now for the last several weeks.

So there is a lot of logistical and integration type things we can learn, but the tools are certainly on the list of things we need to take a hard look at.

MEMBER POWERS: I think the -- I mean, I

think the chore of managing around the clock operations, I don't want to underestimate the difficulty there. The Committee here has very little expertise in that, but the tools we might be very interested in. Sometimes our Committee may seem to go around the clock, but it doesn't involve managing lots of people.

MR. SULLIVAN: I had the privilege of staffing several shifts around the clock, and I don't know that detached would be the right word. We are heartsick over the events in Japan, and we did everything we could to support them with our technical expertise.

MEMBER BANERJEE: Are you going to talk in -- about these RASCAL --

MR. SULLIVAN: I'll talk about them, yes. Let's go to the next slide.

MR. RULAND: Before we move on, just -- I want to emphasize for the support for the Ambassador and the U.S. Government as a whole, there was -- you know, the NRC is just one part of the overall federal family, right? There's the Department of State, Defense, Energy, right? And I think we have integrated well with all of those organizations.

Go ahead, Randy.

MR. SULLIVAN: Well, I was going to start by talking about EPZs, but I think you all already know this.

MEMBER SIEBER: Yes, we know that.

MR. SULLIVAN: So go to the next slide.

If you want to talk about the recommendation, I'm prepared to do that.

MEMBER BANERJEE: This is of great interest.

MR. SULLIVAN: So I thought. I wasn't sure we would have time for it, but apparently we do, so --

MEMBER SIEBER: It's a yellow announcement. I think we all read it.

MR. SULLIVAN: Okay. Do you want a presentation, or do you want to ask questions?

MEMBER CORRADINI: Yes. Well, I guess my first question -- I just wanted to know that the release -- I don't know if it was on the 16th or 17th -- there a click point on the PDF that had an output.

MR. SULLIVAN: Yes.

MEMBER CORRADINI: But there was no input. So I'm asking a simple engineering question --

MR. SULLIVAN: Sure.

MEMBER CORRADINI: -- where is the

complete calculation?

MR. SULLIVAN: I'm sorry. Ask that again?

MEMBER CORRADINI: Where is the complete calculation, so I can see the source, the assumed source, and the assumptions?

MR. SULLIVAN: Well, that's available. We have a book of RASCAL stuff.

MEMBER CORRADINI: Okay. But it wasn't released?

MR. SULLIVAN: No, it was not.

MEMBER CORRADINI: Okay.

MR. SULLIVAN: But I can rattle it off for you, if that's what you want. I mean, I can rattle off our assumptions.

MEMBER CORRADINI: That's what I guess I was --

MEMBER BANERJEE: Do we have this written down somewhere?

MR. SULLIVAN: I think so, yes.

MEMBER SIEBER: That would be a better way to give it to us.

MR. SULLIVAN: Okay.

MEMBER BANERJEE: But weather conditions, wind velocity, everything.

MR. SULLIVAN: Sure.

MEMBER SIEBER: Well, and the other factor that I think is important is, do you have more than one reactor?

MR. SULLIVAN: Yes.

MEMBER SIEBER: So you had a bunch of different source terms.

MR. SULLIVAN: Unfortunately, RASCAL doesn't handle a bunch of different source terms.

MEMBER SIEBER: I understand how RASCAL works. That's -- so there has to be a compromise in there someplace.

MR. SULLIVAN: Exactly.

MEMBER SIEBER: Source term -- you can't really tell what it is because it's multiple sources that came at different times?

MR. SULLIVAN: That's right.

MEMBER SIEBER: And as far as I could tell, neither the licensee nor the officials in Japan knew exactly what the source term strength was and what its composition was. So it becomes very difficult to make an evacuation recommendation under those circumstances.

CHAIRMAN ABDEL-KHALIK: I understand that a request has been made to provide that information in written form.

MEMBER SIEBER: Yes.

CHAIRMAN ABDEL-KHALIK: But I think it would be very informative to us if you just go ahead and talk about the assumptions on which this calculation was based.

MR. SULLIVAN: I'm assuming that the task force will be looking at this in some depth. I'll provide what I know from a response person's point of view. I wasn't there for the calculation.

But I have to set the stage for you a little bit. I'm not sure about these times, but -- and of course this record is known. There was an explosion at Unit 1 on the 12th. There was an explosion at Unit 2 -- I'm sorry, Unit 3 on the 14th, and an explosion at Unit 2 on the 15th.

Before that time, the NRC's position was that we were advising the Ambassador to advise citizens to obey the Japanese Protective Action Recommendation. We performed a calculation that -- well, the morning of the 16th, we were very much worried about the status of the spent fuel pools, in addition to the reactors.

Our vision was what you might have expected in a spent fuel pool in America, and that would be a lot more fuel in them than turns out to be

the case, which we learned several days later. So we were very worried about the spent fuel pools.

We were not getting succinct information, as you might imagine. We did talk to a NISA representative on the morning of the 16th, and we didn't get much information that would tell us things were going in the right direction. The gentleman did his best to inform us of what he knew, but that wasn't at all what we would have expected in a nuclear event in the U.S.

That being the case, my staff -- I'm the protective measure team's director, developed a source term that they thought would represent the potential situation using the tools we had -- that's RASCAL. NARAC takes a couple of days to perform -- well, several hours, and perhaps longer, to perform a calculation. So we needed to use the tool that we had -- that was RASCAL.

We did a calculation that would give you -- the details do exist, and whether the task force looks into that deeper or they can be provided, we will have to get back to you on that. But the first source term was 100 percent fuel damage in Unit 2, and literally no -- it was assumed to be ex-vessel and an unfiltered, totally failed containment. By "totally

failed," that is typically 100 percent a day.

MEMBER CORRADINI: So it was 100 percent release bypass. As you use RASCAL, it asks you whether or not you have containment bypass. You assume containment bypass.

MR. SULLIVAN: I think we did not. I think we assumed failed containment. But I could be wrong on that, so we'll have to get back to you on that. The difference is some plate-out factors that are embedded in RASCAL, and I just don't know which --

MEMBER CORRADINI: That's fine. Okay. But approximately what you're saying is --

MR. SULLIVAN: Yes, it's a big release is what I'm approximately saying.

MEMBER SIEBER: You have scrubbing and plate-out, but otherwise it looks like a Chernobyl source term.

MR. RULAND: Randy?

MR. SULLIVAN: I wouldn't say that. Yes?

MR. RULAND: I understand you are trying to be responsive to the Committee here, but I'm getting the sense that we need to have some more refined numbers and answers to the Committee. So I would ask some forbearance on the Committee, and let's get something in writing and provide that to the

Committee.

MEMBER ARMIJO: Well, Bill, I want to make sure that we get the analysis and the numbers that were actually used in coming up with this decision, because, clearly, there were -- a number of conservatisms were made, and as time goes on we will find out how conservative they were, and we can look back and -- on this decision. But I would like to see the actual analysis as it was done at the time.

MR. RULAND: We understand, and we will -- you know, we will be responsive to the Committee. But as you can imagine, as Randy has already alluded to, right, this -- typically in an emergency event, right, we are going with the best available information that we have at the time, which was based on essentially press reports and our inferences that we were drawing based on what we knew.

While the individual that Randy had talked to about, you know, the individual we had talked to, it's not clear to us that that was the right person. We suspect that the Japanese in fact had that information internally for them. They clearly had their hands full, and, you know, so they were not, you know, providing us detailed source term information they were using.

MEMBER CORRADINI: Can I just follow up with what you just said? I'm sorry, I don't completely understand. So you're saying that there was a lack of data, or you're saying that there was data and you weren't getting it?

MR. RULAND: We -- what we -- the data -- the only thing that we were doing is trying to make a recommendation -- trying to help the United States Government provide whatever information the Ambassador needed relative to a recommendation for U.S. citizens.

MEMBER CORRADINI: How many U.S. citizens are we talking about?

MR. RULAND: We're talking probably in -- where, in the --

MEMBER CORRADINI: In that zone.

MR. RULAND: I don't know the answer to that question. You know, approximately 320,000 Americans in Japan total, but I don't know in that particular area. Don't know. Don't know the answer to that question.

MEMBER ARMIJO: There's a military base in --

MEMBER CORRADINI: I guess I'm -- this is out of the realm of technical, but in some sense it's in the realm of --

MEMBER ARMIJO: Public confidence, really.

MEMBER CORRADINI: Public confidence would be one way of putting it, but in the realm of reasonableness. I guess I'm trying to understand whether it was a lack of data or there was data there and you were concerned that it was not being shared. And if it was a lack of data, then I can understand that, because you'd have to go in in a station blackout condition and go poking around in areas that would be a bit hazardous. So that's what I'm trying to understand.

The other part of this technically is is that if you look at the two calculations, the four-unit calculation in our smaller doses -- are smaller doses than the one unit calculation, which confused me.

MR. SULLIVAN: Okay.

MEMBER CORRADINI: As a function of distance, they are different, which means you're assuming something on some refinement on four units that you're not assuming on the one unit calculation. So that also confuses me.

MR. SULLIVAN: Okay.

MEMBER CORRADINI: So I was left confused on the 17th.

MR. SULLIVAN: Okay.

MEMBER CORRADINI: Not informed.

MEMBER BANERJEE: Mike, maybe -- you were just starting to tell us what your assumptions were. Let's get through this, and then we will get back to you.

MEMBER SIEBER: I would like to write them down first.

MR. SULLIVAN: I thought we agreed that some sort of written summary --

MR. RULAND: Yes.

MEMBER BANERJEE: Yes, that's great, but if you would just do it qualitatively right now.

MR. SULLIVAN: Sure.

MEMBER SIEBER: Unit 2, 100 percent.

MR. SULLIVAN: First off, I think we are leaving you with the wrong impression about data and RASCAL. We did not have any effluent monitoring data. We did not have any spectral analysis from a plume. All this is is an assumption given what we knew was potentially the status of the reactors in the spent fuel pool. There is no data from the site that's involved in this, "data" as in measurements.

MEMBER CORRADINI: Well, I guess what -- I'm sorry that I'm picking on you, but you just happen

to be there. It's just if you have a calculation that is very quick to do, I would think I would have the monitoring data that -- the airborne monitors that a lot of us were looking at every day --

MEMBER SIEBER: Right.

MEMBER CORRADINI: -- every hour of every day and asking, "How can I get a calculation that maps up with what I see there to at least benchmark what I'm calculating?"

MEMBER SIEBER: You can't do it.

MEMBER BANERJEE: You can do that in RASCAL.

MR. SULLIVAN: The wind was not blowing in the direction of those monitors for the most part. I mean, if we're going to do an assessment of a potential future dose rate, we are not looking at the way the wind blew yesterday or the deposition on the ground. We're using what we know to frame a potential accident at the site, and then going forward with what that hypothetically could result in.

MEMBER CORRADINI: So to better understand what you're saying is is that you were doing a what-if calculation.

MR. SULLIVAN: That's right.

MEMBER CORRADINI: Not a benchmarking of

what you saw.

MR. SULLIVAN: That's right. I think we got through the first calculation. It's 100 percent fuel damage. I'm sorry, I don't know whether it's containment bypass or failed containment. That's a piece of information that we can know from the calculation record. And relatively low wind speed, stable air, light precipitation, and a 16-hour release duration.

The second calculation assumed --

MR. RULAND: Randy?

MR. SULLIVAN: Yes.

MR. RULAND: I think I had previously stated that we were going to provide them -- the Committee something --

MR. SULLIVAN: I'm happy to do that.

MR. RULAND: -- in writing. And my -- I'm reluctant for you to provide this, so I'd ask the Committee's forbearance, that we are going to -- we will provide something to the Committee on this matter.

CHAIRMAN ABDEL-KHALIK: That's fine.

MEMBER ARMIJO: Well, can you tell us something at least qualitatively on statements that we read in the media that we knew that the spent fuel

pool in Unit 4 was dry? That was the Chairman's testimony on this.

And so, you know, was that in your assumption, that the spent fuel pools were empty? I'd like to know as much as -- whatever you can tell us about that.

MR. SULLIVAN: Well, Unit 4 had -- reactor building had experienced an explosion event.

MEMBER ARMIJO: I know that. I know that. I'm not disputing that, but --

MR. SULLIVAN: -- or not, I don't know, but certainly in bad shape you could know.

MEMBER ARMIJO: So your assessment was that the Unit 4 fuel was the source of that explosion?

MR. SULLIVAN: There was limited and uncertain data, and although our assumptions here don't necessarily track, we, the staff, were worried about all the spent fuel pools. You know, we were unaware of the low heat loading in Units 1, 2, and 3, and we were aware that mitigative actions were not being taken.

Well, we thought -- we didn't know that mitigative actions were being taken. So that gave us great pause. Although we didn't model four spent fuel pools in trouble, it was part of the limited and

uncertain data that forced this conservative and prudent recommendation.

MEMBER ARMIJO: The reason I'm pressing on this is this was a very, very important decision. And I would have expected there would have been high-level conversations between our regulatory bodies and our government with equivalent people in the Japanese government on the worst-case analysis that we were doing. Was there anything like that going on?

MR. SULLIVAN: You know, I'm not aware of what took place at a high level. I'm more of a staff guy.

MEMBER BANERJEE: So these calculations were done, and they went where after that?

MR. SULLIVAN: To the Chairman, right?

MR. McDERMOTT: They were assessed by the executive team and discussed with the Chairman.

MEMBER BANERJEE: So it went to who in the executive team?

MR. RULAND: Typically, the executive team is deputy office directors and office directors. I d not recall who specifically was the executive -- the ET director at the time that this recommendation was made.

MEMBER CORRADINI: But I guess Sanjoy

asked the question I think you wanted to get an answer to.

MEMBER BANERJEE: Yes, I want an answer on this.

MEMBER CORRADINI: Who reviewed it?

MEMBER BANERJEE: Who reviewed it?

MEMBER CORRADINI: Because at least from my standpoint, I think Sam kind of expressed it for a number of us. We're a bit concerned about the fact clearly you did a what-if calculation, but I'm assuming the Japanese did a what-if calculation. Before you started publicizing our what-if, I'd like to have done some sort of comparison, because it creates a -- it potentially can create a misimpression.

MR. RULAND: As everybody here I know is well aware, under normal circumstances in the United States -- in the United States, there is no such thing as conservative or non-conservative in EP, in emergency planning. It's you try to get it right, what the recommendation is, right? I mean, that's kind of our operating -- that's kind of the operating presumption.

MEMBER CORRADINI: But let me reverse this. Thirty-two years ago, if Japan would have done

a what-if calculation about Three Mile Island, and said all the Japanese within 50 miles of Harrisburg should get out, what would be our response to that, from a policy standpoint?

MR. RULAND: I can't answer that question.

MEMBER CORRADINI: Well, that's the sort of thing that I think Sam --

MEMBER ARMIJO: Well, it's just as we talk to many people, they come up to us and ask us, friends, associates, they say, you know, what was your assumption, and how did you coordinate with the Japanese regulators?

And this is a very high-level decision, I would think, and it would have -- you know, the Chairman of the NRC called up his counterpart or the Embassy and they say, "Hey, look, we're getting some very, very different numbers, and what do you think? And we're thinking of getting our people out, and what do you guys think?"

MR. RULAND: As Brian McDermott said, one of the things that we have to do for the incident response program is do a hotwash. Basically, examine our incident response to this event. And this will be included, as well as all of the actions we have taken.

So we are going to examine how this

recommendation was made and/or whatever. You know, this will be part of our overall review of our agency response to this matter.

CHAIRMAN ABDEL-KHALIK: I think the point has been made, and you promised to give us the detailed --

MR. RULAND: Yes, sir.

CHAIRMAN ABDEL-KHALIK: -- information to support that calculation.

MEMBER SIEBER: I don't want to prolong the questioning in this area, and I would like to leave aside whatever diplomatic issues are there.

But had the accident occurred in the United States, would your calculation and your recommendation, which would differ from state, local, and utility recommendations be similar, or would you have -- would you say, "This is the -- I think the whole reactor went, and I got all of these spent fuel pools, and this reactor went, and that reactor went, so we'll take 100 percent of all of it."

And I didn't have -- I didn't model the topography, and I think the wind is going to blow it over the mountain.

MR. SULLIVAN: Could we back up one slide? Because that goes to --

MEMBER SIEBER: That to me is the most important thing right now.

MR. SULLIVAN: I mean, our expectation is that if it were our licensee --

MEMBER SIEBER: Right.

MR. SULLIVAN: -- and our response in the U.S. we would have better data, a very different response, and we would have much better plume measurements. And maybe the Japanese had some of that, but we didn't.

MEMBER SIEBER: Yes.

MR. SULLIVAN: All right? I want to point out that the 10-mile EPZ is designed, tested, and inspected to be able to perform response actions, protective actions, within hours. Our longest ETEs -- evacuation time estimates -- in the U.S. are 10 to 14 hours. So that is the initial phase.

We have always said that should it be necessary, the EPZ -- the 10-mile EPZ provides a substantial basis for expansion should that ever be necessary. We have studied evacuations in the U.S. We have studied some 250, some 50 or 60 in detail. They are ad hoc evacuations for the most part. They are all successful. They all saved lives. so local authorities know how to evacuate people should there

be a threat.

So getting back to your question, we would have expected different data, more data, plume measurements, better effluent monitoring, on and on.

MEMBER SIEBER: Provided the licensee provided that, because you don't have access --

MR. SULLIVAN: We have people onsite.

MEMBER SIEBER: You don't have NRC people or any federal people out there with monitoring.

MR. SULLIVAN: We have state people out there with monitoring.

MR. RULAND: In addition, if I could add, the NRC does not make protective action recommendations. Our role in a U.S. event is to understand, to do our own independent calculations, so when the state or when the licensee makes protective action recommendations to the local, county, or state officials, who actually make the decision, we can verify whether those recommendations -- you know, we can do an independent check. That is our role during a U.S. event.

And so it is -- in this case, it was a different role that the NRC was playing, it was fulfilling.

MEMBER SIEBER: It's exactly how that role

is portrayed in the United States that I would be concerned about, you know. And I think this area needs more examination. I'll leave it at that, and thank you.

MR. SULLIVAN: Thank you.

CHAIRMAN ABDEL-KHALIK: Please proceed.

MR. SULLIVAN: Well, I'm pretty much done. I'm the last speaker.

CHAIRMAN ABDEL-KHALIK: Let me just ask a question about a topic that didn't come up in the discussions, and that pertains to dry cask storage. My understanding is that Fukushima had many dry casks, and assisted with a lot of dry storage casks, is that correct?

MR. SULLIVAN: Sorry. Don't know. Does somebody? I heard not so many dry cask storage, but I'm not --

MEMBER ARMIJO: Nine.

CHAIRMAN ABDEL-KHALIK: Nine. Okay. And that none of them was damaged, is that correct?

MR. McDERMOTT: According to the TEPCO reports, they performed walkdowns and did not identify anything on their initial inspections. They indicated they would be doing subsequent detailed examinations, and they never reported out on that.

CHAIRMAN ABDEL-KHALIK: Was that due to their inherent robustness, or was it because the pad was located at a much higher elevator?

MR. McDERMOTT: I don't think we have that information at this time.

CHAIRMAN ABDEL-KHALIK: Okay. Are there any additional questions to the staff? Mike?

MEMBER CORRADINI: Just I wanted to compliment the staff. This is kind of a tough area. So I appreciate them coming on such short notice to inform us. I guess I don't want to -- them to take away our aggressive questioning to imply anything different. I really do appreciate the staff coming to talk to us.

MEMBER ARMIJO: I would like to provide some feedback, if it's okay. The thing that I think I'm missing -- it's probably there -- is in the 30-day review, and then the 90-day review, I think it's very important to get down to the root cause of the things that failed, because before we start saying, "This is what we've got to do to improve our plants here in the United States," and not limit ourselves to a tsunami, because most of our plants aren't subject to a tsunami, but we may be subject to other things that are worse than what we thought we had to deal with.

But I think it's very important to get to the root cause of why some units survived well, and why others didn't. And until we know that fairly well, even at a working level, working hypothesis, I think it's kind of premature to be making recommendations on what to do about something that we haven't really sorted out. So --

MR. McDERMOTT: I would agree with you 100 percent. I think understanding this event will be very important for NRC, but, as I mentioned earlier, this is an ongoing event. You know, they have taken some actions at this point in time that appear to have brought some stability to the situation. However, we don't have enough information to verify that at this time. So --

CHAIRMAN ABDEL-KHALIK: As I indicated earlier, this briefing serves as the initiation of significant ACRS engagement on the followup activities and lessons learned from the Fukushima event in order to maintain public health and safety in the United States.

While the Commission tasking for ACRS on the subject of Fukushima is thus far specific to the evaluation of the staff's longer term review, however, the ACRS, consistent with its charter, will self-

initiate activities to be appropriately informed and properly prepared to provide the best possible advice to the Commission on an ongoing basis.

At this point, again, let me express my thanks and appreciation to the staff.

MR. RULAND: Thank you.

CHAIRMAN ABDEL-KHALIK: Mr. Ruland?

MR. RULAND: Mr. Chairman, I have some closing remarks that I --

CHAIRMAN ABDEL-KHALIK: Yes, please.

MR. RULAND: Thank you. I just wanted to say thank you to the Committee for their forbearance in our frequent saying, "The task force is going to handle that." But, you know, it is -- as you know, you know, we probably started working on this presentation early this week. So, you know, normally we get to do lots of dry runs, because we take Committee meetings extremely seriously.

But two areas I would like to address is, first, the actions of our Japanese colleagues. You know, what we are -- what you heard here, you might have assumed that the Japanese, you know, were not -- may or may not have been doing what was appropriate. We don't know that, right? As far as we can tell, right, the Japanese took the actions that they needed

to to protect their citizens, and attempting to try to recover the plant.

We have -- you know, we were trying to, in the United States, to protect our citizens or to make recommendations, as appropriate, based on the limited information we had. And sometimes during emergencies you have to basically make a decision on the spot that -- you know, based on limited data. And sometimes you have to make a decision, and sometimes that's better than no decision. So I just kind of wanted to say that.

And the other thing has to do with the timing of root cause evaluations and the timing of our recommendations. This is a balance that we are trying to -- you know, how long do you wait before you start acting on making recommendations to change our regulatory framework? It's -- you know, do we continue to wait for root cause evaluations, or do we start the process now of examining what we should do?

And so similar to what I have just said about, you know, making decisions with limited data, you know, the staff -- we need to make some decisions and make some recommendations to the Commission with the data we have today, and the data we might have in the next 60 to 90 days.

So I would just ask, basically, a collective understanding from everybody of, you know, the situation we're in, and we're trying to do our best. So --

CHAIRMAN ABDEL-KHALIK: Thank you very much.

MR. RULAND: And thank you for allowing me to say that.

CHAIRMAN ABDEL-KHALIK: Thanks.

At this time, we are scheduled for a one-hour lunch break, and we will reconvene at quarter to two.

(Whereupon, at 12:44 p.m., the proceedings in the foregoing matter went off the record.)

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Advisory Committee on Reactor Safeguards

Fukushima Event and Issues

April 7, 2011

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

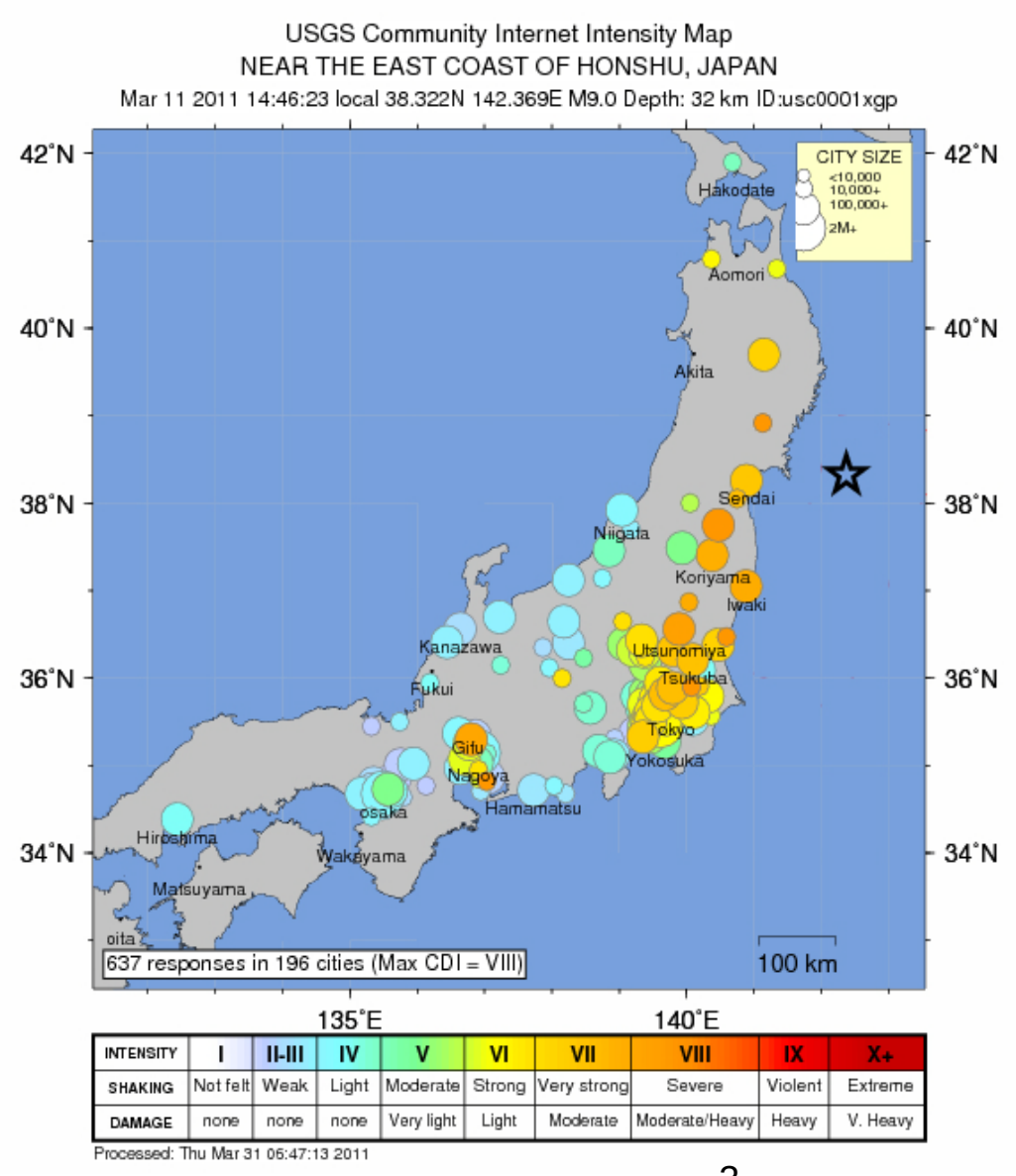
Agenda

- Introduction – Bill Ruland (5 min)
- Sequence of Events – John Thorp (10 min)
- Information Notice – Eric Bowman (5 min)
- Industry Actions and Temporary Instruction – Tim Kobetz (5 min)
- Near Term Task Force – Barry Westreich (10 min)
- Seismic Attributes – Syed Ali (5 min)
- Station Blackout – George Wilson (10 min)
- NRC Incident Response – Brian McDermott (10 min)
- Emergency Preparedness – Randy Sullivan (10 min)

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

Tohoku Pacific Earthquake

- 14:46 (Local) March 11, 2011
- Magnitude 9.0 Earthquake
  - 4th largest in the world since 1900 (USGS)
  - Largest in Japan since modern instrument recordings began 130 years ago (USGS)
- Resulted in a Tsunami that is estimated to have exceeded 32 feet in height (NISA)

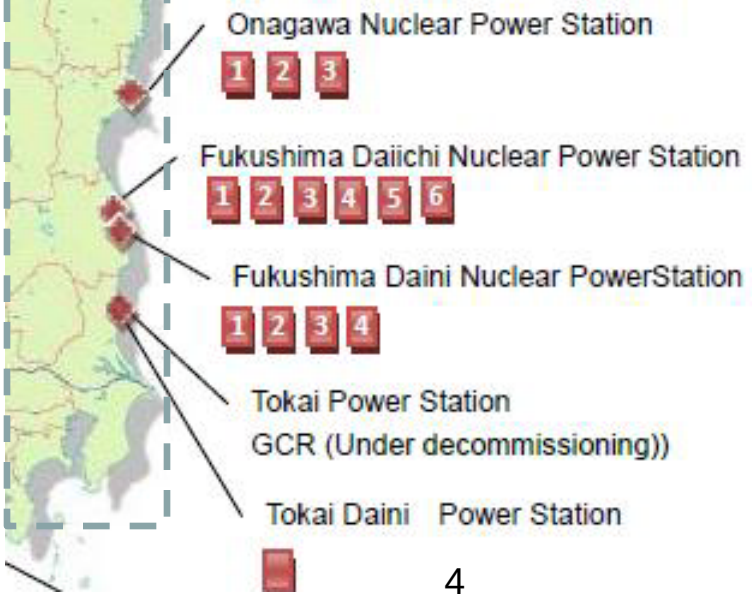


U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Affected Nuclear Power Stations

- **Onagawa** NPS
  - All 3 units scrammed
- **Fukushima Dai-ichi** (I) NPS
  - Units 1, 2, 3 scrammed
  - Units 4, 5, 6 already shutdown
- **Fukushima Dai-ni** (II) NPS
  - All 4 units scrammed
- **Tokai**
  - Scrammed (single unit site)

Source: NISA



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

Extended SBO at Fukushima Dai-ichi

- Earthquake
  - Reactor Units 1, 2, and 3 scram
  - Loss of offsite power to all 6 units
- Tsunami
  - Loss of emergency AC power
- Extended Station Blackout

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

Accident Sequence

- Reactor coolant flow after SBO
  - Reactor isolation makeup water system
- Loss of coolant flow
  - Utility established seawater injection
- Elevated primary containment pressure
- Explosions
  - Damaged reactor buildings for Units 1, 3 and 4
  - Unit 2 explosion in primary Containment- reactor building not damaged, possible torus damage

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

5 April Status: Units 1,2 and 3

- Cores reported to be damaged
  - Extent unknown
  - Salt buildup from seawater injection
- All units have offsite AC power available
  - Equipment verification in progress
- Freshwater injection via:
  - Feedwater line
  - Low pressure coolant injection
- High radiation levels in containment and site

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

Status: Units 4, 5, and 6

- Unit 4
  - Core offloaded to spent fuel pool (SFP)
  - An explosion caused significant damage to Unit 4 reactor building
  - SFP cooling system not functional
  - SFP being cooled periodically by injection of fresh water from a concrete truck pump
- Units 5 and 6
  - On external AC power with core cooling functional
  - SFP cooling is functional on both units

Fukushima Dai’ichi Nuclear Power Station

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

Information Notice 2011-05

- Purpose: to provide high level discussion of earthquake effects at Fukushima Daiichi and allow licensee review and consideration of actions to avoid similar problems.

- Background discussion of pertinent regulatory requirements
  - General Design Criteria 2 (or similar)
  - "B.5.b Requirements" for beyond design basis events
    - Interim Compensatory Measures Order EA-02-026, Section B.5.b
    - License Conditions
    - 10 CFR 50.54(hh)(2)
  - Station Blackout Rule, 10 CFR 50.63

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

Industry Initiatives

- An industry-wide assessment to verify and validate each plant site's readiness to manage extreme events
- Initiatives include licensee verification of:
  - Each plant's capability to manage major challenges, and losses of large areas of the plant due to natural events, fires or explosions
  - Each plant's capability to manage a total loss of off-site power
  - Verifying the capability to mitigate flooding and the impact of floods
  - Performing walk-downs and inspection of important equipment needed to respond successfully to extreme events like fires and flood including identification of any potential that equipment functions could be lost during seismic events appropriate for the site, and development of strategies to mitigate any potential vulnerabilities.

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

NRC Inspection Activities

- Temporary Instruction 2515/183, “Followup to the Fukushima Daiichi Nuclear Station Fuel Damage Event
- Inspection uses a combination of assessment of licensee actions and independent inspections
- The inspection is for fact/data gathering to help evaluate whether future regulatory actions may be necessary.

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

Near-Term Task Force

- Commission Direction for Near-Term Review
  - Conduct a methodical and systematic review of relevant NRC regulatory requirements, programs, and processes, and their implementation, to recommend whether the agency should make near-term improvements to our regulatory system
  - Recommendations for the content, structure, and estimated resource impact for the longer-term review
  - Independent from industry efforts
  - Milestones
    - 30-day Commission meeting (5/12/11)
    - 60-day Commission meeting (6/16/11)
    - 90-day final report, SECY, and Commission meeting (7/19/11)

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

Longer-Term Review

- Commission Direction for Longer-Term Review
  - Specific information on sequence of events and equipment status
  - Evaluate policy issues
  - Potential interagency issues
  - Lessons learned for facilities other than operating reactors
  - Receive input and interact with all key stakeholders
  - Report within six months after beginning of long-term effort
  - ACRS to review final long-term report (as issued in its final form), and provide letter report to the Commission

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

Tōhoku Earthquake and Tsunami

- Earthquake Data*
  - Magnitude 9.0
  - Epicenter: ~109 miles from Fukushima site
  - Peak Ground Acceleration
    - 1.0g up to 2.75g at 80 miles from epicenter
    - ~0.30g to 0.58g in Fukushima Prefecture

*California Coastal Commission. “The Tōhoku Earthquake of March 11, 2011: A preliminary Report on Implications for Coastal California “

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

Tōhoku Earthquake and Tsunami

- Tsunami Data*
  - Peak amplitude reports vary
  - Reached shore within ~ one hour after the earthquake
  - Up to six miles of run-up in flat regions

*California Coastal Commission. “The Tōhoku Earthquake of March 11, 2011: A preliminary Report on Implications for Coastal California “

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

Tōhoku Earthquake and Tsunami

- NPP Foundation Accelerations*

Location	Design Japanese Regulatory Guide g	Observed g
Daiichi Unit 2	.45	.56
Daiichi Unit 6	.46	.45
Daini Unit 1	.44	.23
Daini Unit 2	.44	.20

*TEPCO Press Release April 01, 2011: The record of the earthquake intensity observed at Fukushima Daiichi Nuclear Power Station and the Fukushima Daini Nuclear Power Station (Interim Report).

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

Station Blackout– Background

- **NRC issued SBO Rule (10 CFR 50.63) in 1988**
- **Each plant must be able to withstand for a specified duration and recover from a SBO**
- **Regulatory Guide (RG) 1.155, "Station Blackout," - endorsed NUMARC 87-00 industry guidance for SBO rule**
- **All 104 plants met the SBO rule requirements at the time of the staff's review**
  - Safety Evaluations
  - Pilot Inspections

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

Station Blackout - Implementation

- **Coping Duration**
  - Factors affecting Offsite power design
  - Factors affecting Onsite power system
- **Coping Methods**
  - AC independent
  - Alternate AC
- **Procedures**
  - Restoration of AC power
  - Non essential DC loads for stripping
  - Actions for loss of ventilation
  - Grid Interface

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

NRC Incident Response

- Response Decisions
- NRC Roles
- Areas of Focus
- Coordination, Support and Outreach
- Current Status of Response

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

Emergency Planning Zones

- Two emergency planning zones (EPZ) around each nuclear power plant
  - 10 mile EPZ – plume exposure planning zone
    - Response within hours
  - 50 mile EPZ – ingestion exposure planning zone
    - Response within days
- EPZ size established:
  - Encompasses most accident sequences
    - WASH 1400 Reactor Safety Study
    - Conservative Assumptions
  - Provides a substantial basis for expansion of response beyond the EPZ should it be needed

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

PAR for U.S. Citizens in Japan

- Recommendation for 50 mile evacuation
  - Limited and uncertain data available
  - Significant challenges to 3 units and 4 spent fuel pools
  - Potential for large offsite release existed
  - Rapidly modeled aggregate cores to simulate potential release
  - Decision to expand evacuation was prudent given the uncertain conditions

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

Questions?