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NUCLEAR REGULATORY COMMISSION

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BRIEFING ON IIT REPORT ON VOGTLE EVENT

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Friday, June 8, 1990

The Commission met in open session, pursuant to notice, at 10:00 a.m., Kenneth M. Carr, Chairman, presiding.

COMMISSIONERS PRESENT:

KENNETH M. CARR, Chairman of the Commission
KENNETH C. ROGERS, Commissioner
JAMES R. CURTISS, Commissioner
FORREST J. REMICK, Commissioner

STAFF SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary

JOE SCINTO, Office of the General Counsel

JAMES TAYLOR, Executive Director for Operations

DR. THOMAS MURLEY, Director, NRR

ALFRED CHAFFEE, Team Leader, Vogtle Incident Investigation Team

EDWARD JORDAN, Director, AEOD

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

10:00 a.m.

CHAIRMAN CARR: Good morning, ladies and gentlemen.

Commissioner Roberts will not be with us today.

Today the Commission will be briefed on the findings of an incident investigation team, or IIT, sent to the Vogtle Plant in March of this year. Under the Commission's incident investigation program, an IIT is activated to investigate operational events which have potentially significant safety implications. The team is composed of technical experts selected on the basis of their expertise, potential contributions to the investigation and their freedom from significant prior involvement in the licensing or inspection of the facility or in the issues implicated in the investigation.

The objective of the team is to undertake a thorough investigation of the event and its probable causes, including a determination whether the regulatory process contributed to the causes or course of the event.

In this particular case, on March 20th, 1990, the station experienced the loss of all AC power

to its safety electrical buses while Vogtle Unit 1 was in a refueling outage with the core loaded and the reactor coolant system drained to mid-loop. As a consequence, shutdown cooling was also lost for a period of time. This event offers a number of valuable lessons in terms of plant design, work management and licensing requirements. As is frequently the case, this event had no single cause. We look forward to hearing the team's evaluation of the causes.

I understand that copies of the briefing slides and the incident investigation team report on this event are available at the entrance to the meeting room.

Do any of my fellow Commissioners have opening comments?

If not, Mr. Taylor, please proceed.

MR. TAYLOR: Good morning. With me at the table, to my left, Al Chaffee, the team leader of the IIT; to my right, Ed Jordan, Director of AEOD, responsible for this program, and Tom Murley, Director of NRR. The team -- many of the team is behind me.

This is the fifth IIT that we've conducted since the program was initiated following the Davis-Besse event in 1985. At first, we initiated an

augmented inspection team, which is not unusual for this event, to try to understand what had gone on. Then, several days later -- and we thought that would be adequate just due to our general perception of reduced risk during shutdown. But as the event began to be understood and the complications that were involved were known here, it became clear to me that it was appropriate to upgrade it to an IIT and I did that about -- I think it was March 23rd.

I believe that was an appropriate decision because the results that are in the report and the results that you will hear today show that the risks can be significant and potentially need further attention from the NRC and the utility industry.

As you noted, Mr. Chairman, the report was first distributed within staff and is being released today. Our presentation today will -- it's a rather large report. We'll try to stick to findings and conclusions and give you an overview. The depth, of course, is contained in the report.

I'd like to note that we do plan, as usual in this type of effort from an IIT, that there will be follow-on actions for potentially the NRC, industry and Vogtle, that we will track the major actions and we will formally close them out. So, the job is not

done. The first part of the job is done.

Of course, prior to restarting Vogtle, those things that needed to be immediately taken care of were taken care before Vogtle restart occurred.

I'd now like to turn the meeting over to Ed Jordan, who will introduce Al and the team.

MR. JORDAN: Certainly. The Office of Analysis and Evaluation of Operational Data provided administrative and morale support for the team and I must commend the team for being dedicated individually and for working collectively in a very organized fashion.

Al Chaffee has been introduced. All of the team members are present except for Harvey Wyckoff, and I should go through their names. Bill Lazarus, from Region I, was Assistant Team Leader. Bill Jones from the Office of Analysis and Operational Data participated; Rick Kendall from the Office of Nuclear Reactor Regulation; Warren Lyon from that same office; Gene Trager from AEOD; Garmon West from NRR. Paul Dietz was our industry representative, and this is under the Memorandum of Agreement that we have with the Institute of Nuclear Power Operations to provide for industry participation. With him, as consultants, Harvey Wyckoff from the EPRI organization participated

as a consultant, and also Michael Jones, who is present, from CP&L.

So, the team was, I think, well rounded, a very strong team. Cherie Siegel from my office accompanied them as an administrative assistant. The team worked with the help of Patricia Wilson, Team Secretary here in Bethesda, and Walt Oliu and Juanita Beeson as the editors who made strong contributions to the product that you have in front of you.

The team worked under a charter that the Executive Director for Operations signed which directed them to develop an event chronology, the systems response, the human factors aspects of the event, equipment performance, consider precursors to this particular event, look at the emergency response aspects of the utility's response and its generic implications, ascertain the safety significance, look at any radiological considerations and, of course, look at the regulatory process and its potential contribution.

The incident investigations do not include assessing violations of rules and requirements, so that's not in the review process.

Without any further discussion, I think I'd like to turn it to Al Chaffee and have him go

through the technical presentation.

MR. CHAFFEE: Thank you.

COMMISSIONER REMICK: Excuse me just a minute. I had a question. Is this the first we have used what I think NTSB calls parties in an IIT? In other words, people from outside on our IIT teams.

MR. JORDAN: This is the first industry support in this fashion. The Amersham source review did include other agencies and state members along the way, so as not to make that difference.

COMMISSIONER REMICK: Thank you.

MR. CHAFFEE: (Slide) Can I have the first slide?

Well, what the first slide is going to show you is the agenda that I intend to talk to. There we go.

As far as introduction, most of the introductory remarks have already been made. As Commissioner Carr has stated, in this event they did lose RHR for a period of time and the RCS did heat up from about 90 degrees to 136 degrees. There was no release of activity and there was no -- to the environment. In fact, it didn't even come close to that. They prevented the heat-up, stopped it far before they got to the point of boiling. In this

event, the licensee did declare a site area emergency and they did initiate and take action to notify local, state and county authorities. They did not, however, complete those within the 15 minutes that are required by the regulations, but did complete those eventually.

What I will be talking about is the factors leading up to the incident, and there are three. Then I will talk about how the licensee handled the incident and I will talk about what we have learned from how they handled the incident relative to potential generic implications for licensees' abilities to handle loss of RHR events generically. And at the end, I'll summarize.

(Slide) Next slide.

The factors leading to the incident were of three types. One was the licensee's control of activities in the switchyard, which they did not do in a comprehensive fashion. As a result of that, the event was initiated by a truck which collided with a support for a power line to a reserve x-ray transformer which was providing power to the safety buses.

The second factor that contributed to the event occurring was that the licensee did not have-- or had only two power sources available at the time of

the event.

The third factor that contributed to the event was the fact that the diesel generator did not operate reliably during the event.

So, we will focus on three different factors that contributed to the event occurring.

(Slide) The next slide focuses in on switchyard administrative control. This event occurred because a fuel and lubrication truck was moving about the plant inside a protected area during outage activities and the licensee had stored various pieces of equipment in what they call their low voltage switchyard, which is a 230 kv switchyard. The truck had free access in and out of that area and in the process of doing its activities, the truck backed into this support stanchion and caused loss of the reserve x-ray transformer.

In looking into this, what we found was that the truck itself had a 200 foot blind space in the back. The licensee did have a requirement to have a flagman available to monitor truck movements, but that hadn't been implemented in any procedures and so that type of a guide did not exist when the truck was moving around.

Also, we found that the licensee didn't

have any prohibitions on having materials stored in that area. It's interesting, however, that this did exist, although there have been several events that have occurred in the industry in the past 20 years of events of this type where work activities in the switchyards have caused the loss of transformers and resulted in some loss of power on-site. There is some guidance that had gone out discussing that and giving some guidance to the industry. For that reason, we concluded that the licensee did have opportunity and could have prevented the initiation of the event from occurring.

Also, we took a look at, in regard to the truck colliding, what were the potential ramifications of that. In this case when the truck collided, it simply removed power from the reserve x-ray transformer and that was the extent of the effect. It was possible though that the -- when the power line fell, it could have come in contact with the truck and could have led to a fire or possibly an explosion which could have further caused damage out in the switchyard which, based on the licensee's analysis, could have resulted in the additional loss of non-safety power.

In this particular incident, the licensee

only lost safety power. If the explosion had occurred, they would have also lost non-safety power. That would have further complicated their ability to mitigate the event.

In particular, it would have made it more difficult for them to shut the equipment hatch. Their equipment hatch is one that has electrical hoists that are used to lower or raise the hatch. If they had had this explosion, they probably would have lost that ability and it would have taken them several hours to shut the hatch instead of the 79 minutes that it took in event.

So, in conclusion, in looking at how the licensee's -- looking at the licensee's controls in the switchyard, the team concluded that the licensee had had opportunity and could have prevented the initiation of the event by more stringent controls on the activities in the switchyard.

(Slide) Next slide.

The next opportunity that we focused on that the licensee had an opportunity to prevent the event from occurring was their controls on the number of power supplies that were available when the event initiated. Of course the event did occur when the plant was in mid-loop and they had two sources of

power available. They had one diesel generator and they had one off-site transformer, a reserve auxiliary transformer. The other power supplies, that being a diesel and another reserve auxiliary transformer, were out for maintenance. The licensee did a preliminary analysis looking into the possibility of them having rescheduled their activities so that this did not occur when they were in mid-loop and found that they could have done that without any significant impact on their outage.

As we will talk about later when I talk about risk management in a little more detail, apparently there is no really good reason for why they didn't schedule their activities differently. If they had, they would have had an additional source of power available when the event occurred, therefore further minimizing the potential for loss of power and loss of RHR.

In addition, we noticed when we looked into electrical -- the number of electrical power supplies that were available, that they did meet the tech specs requirements. The tech specs required two power supplies to be available and they did meet that and later on we'll talk about the implications of tech specs, particularly as it relates to risk management.

(Slide) Next slide.

The third opportunity that the licensee had to prevent this event was in the area of their diesel generator. The diesel generator, from the licensee's analysis, appeared to have not operated in a reliable fashion because of problems with some Calcon sensors. In fact, in looking into this, we found that the licensee had a fairly extensive history of problems with their Calcon sensors.

Since 1985, we found that there were somewhere in the order of 64 failures of the Calcon sensors that had occurred at Vogtle. Most of these failures had occurred during three periods. One was in 1985, when they were doing construction acceptance testing and then again in '88 when they had their first refueling outage; and then again in 1990 when they did their second refueling outage. In both of -- in all three of those -- well, in the first two periods, particularly in '85 and '88, the numbers of failures, the team concluded, were sufficient that the licensee should have had ample indications to dig into the problems with these sensors.

For example, in this event, the licensee has concluded that the most probable cause for the diesel failures was problems with what are called

jacket water temperature sensors, of which this is one of those. This is a temperature sensor from Calcon. This particular sensor -- not this one, but this type of sensor had given the licensee a lot of problems over the past five years. They had had nine failures of these in 1985 and 17 failures of these in 1988, during their first refueling outage, and they had six failures of these during this particular outage.

In digging into in detail what has gone on with these, they found a number of problems in relationship to these sensors. They've also found here recently that they also have had problems with pressure sensors, although the pressure sensors-- it's not clear that they contributed to this event, but this is a pressure sensor. Interestingly enough, there have been problems with these both at Vogtle and throughout the industry. These pressure sensors, there was a Part 21 in April of '88 that addressed problems with the pressure sensors and also somewhat the temperature sensors. But again, with that input that the licensee had, they really were not able to do or did not initiate a really aggressive program for determining what the problem was until this incident occurred.

Coming out of this incident, what the

licensee has found in terms of why they're having problems with these sensors is, one, they found out they've had calibration problems. It turns out from the tests that were done at Wylie Laboratories coming out of this incident, they found that the calibration process is significantly impacted by the length of time that you thermally soak these particular sensors before you finish the calibration process. They also found foreign material. They found that -- they found pipe fitting material and also metal fragments that were located inside the sensor.

Those metal fragments, they have not determined yet where they came from, but it's possible they came from manufacturing or from the calibration process itself. When they put the sensor into the plant, one of the things they do is this fitting is removed and reinstalled. It's possible that the process of putting the fitting in -- but you can even see some of the pipe fitting compound on here. The process of putting that in or taking it out is introducing both the pipe fitting compound as well as it could be causing some burring of the aluminum casing of this.

So, they don't know exactly where it's coming from but there's a number of possibilities.

The significance of it is that even a small amount of pipe fitting compound or very, very small metal fragments. They found some of those were lodged between the seating surface and resulted in the sensor passing air, which is equivalent to generating a trip signal.

So, in conclusion, we found that the licensee had a fairly extensive history of failure of these sensors and that the licensee had not been successful in dealing with that history and getting to the root cause for why these sensors were giving them problems prior to the event. If they had, then when the event occurred, most likely the diesel would have started and they would not have had a loss of AC power and a loss of RHR.

(Slide) Next I'd like to talk about the licensee's handling of the event and also the potential generic implications or what we can learn from how they handled the event and problems that they had.

In doing that, there's several different areas that we'll talk about. We'll talk about some of the command and control and communications problems they had. We'll talk a little bit about some of the equipment hatch closure issues, diesel generator

trips, how they handled the diesel generator trips, a little bit about some emergency preparedness problems. We'll talk a little bit more about this concept of shutdown risk management and shutdown operations and what we've learned from Vogtle, and we'll talk about what we learned in terms of looking at the extensive history that exists in terms of past events in this area and what's being done with that information in terms of feeding back lessons learned to the industry. And we'll talk about what we've learned in terms of the need to do additional analysis or the need to-- or what we found in terms of the current status of analysis that exists in terms of understanding what types of phenomena can occur when you have a loss of RHR for some extended period.

First let's talk about the overall performance of the licensee. Basically, we felt the licensee showed good instincts in how they dealt with this particular event. By that we mean that in the control room, the shift superintendent, when the event occurred, he recognized well before his procedure told him to, the need to get the equipment hatch shut and he initiated those actions. He also recognized or acted on the need to try to put the RCS into a configuration that, as much as possible, could return

RCS boundary integrity. And they also demonstrated a high degree of concern for the need to get electrical power back in order to be able to restore shutdown cooling to cool the core.

So, their instincts were right and they did do a good job recognizing that in some cases their procedures didn't help them very much. They compensated for that.

It's interesting in the area of how they handled the reconfiguring the RCS because up until this time, based on what the team could find, there is no guidance that exists that addresses what sort of actions should be taken to reconfigure the RCS when you have a loss of RHR system event, in part because it -- from what the team could find, it's not clear that people had recognized that potentially there would be time to do that type of activity. So, the operators did take action, they did restore the RCS fairly quickly and they did that even without any guidance.

We also, in looking at how the licensee overall handled the event, saw the positive impact of the NRC's generic letter 88-17 in that we found that this licensee was in a much better condition for handling this event than some of the predecessors had

been. For example, Diablo Canyon. In this particular event, the licensee did have essentially redundant level indications, so they had a good control of what the RCS level was doing in the vessel. They had good indications of core temperature. They had two temperature indications and they were able to monitor the temperature increase as it occurred. And as a result of that, they had good feedback to gauge the timing of their actions so that they would neither over-react or under-react to the event.

They also were very knowledgeable of possible alternate methods of cooling the core in the eventuality that returning the residual heat removal system to service took a long period of time. They were aware, for example, that they could gravity feed from the refueling water storage tank. All of those things are very positive and seem to have been the result of lessons learned from the NRC's generic letter 88-17. That was very positive.

(Slide) They did have some problems, however, and on the next slide what we'll see is that the first problem they had, as we mentioned a little bit earlier, was they had difficulty in making their notifications off-site to some of the state and local authorities than the 15 minutes that they're required

to do that. That occurred because when they lost safety power, they lost power to their normal communications circuits for notifying offsite authorities. That, combined with the fact that the communications people on-site were not familiar totally with the backup communications resulted in delays and their ability to make their notifications in a timely fashion.

The next thing we looked at in terms of communications problems and also control problems was what for this event was not a significant failing in that they shut the pressurizer manway cover. But it's significant in that what it tells us about how controlling RCS configuration can, in fact, interestingly enough, get out of control somewhat.

In this event, the licensee did shut the pressurizer manway cover, although, in fact, the shift superintendent had given directions to not do that. The reason that this occurred was because the shift superintendent's directions to not shut the pressurizer manway were misunderstood and the communications had basically gone down two parallel paths and as a result of that the working level people had gotten the impression that they should shut this pressurizer manway cover and, in fact, that activity

did occur a little over an hour and a half into the event.

In fact, the actual activity occurred after the licensee completed doing a transition from a pre-emergency organization, including their outage organization, into an emergency organization after they declared the site area emergency. In fact, the process of shifting from one to the other to an extent contributed to the people that were in control not being aware that this activity was going to commence and was actually completed. They first realized that the actual activity had been completed some -- when the thing was finally completed, which somewhat surprised them and they had to react to it.

So, again, it's significant because, as I'll talk about a little bit later, the reactor coolant system configuration system is critical in terms of what types of actions you need to take in terms of mitigating a loss of RHR event.

(Slide) The next slide, we focused in a lot on the equipment hatch closure. This is because, again in generic letter 88-17, that was one of the central focal points of the generic letter ensuring that licensees had the capability to shut their equipment hatch in sufficient time if you had a loss

of residual heat removal.

In fact, in Vogtle's case, we found that they shut the hatch in 79 minutes. That was ample time for the event that they had, this specific event they had. But as it turned out, that was not within the time frame of what their own analysis and, in fact, their own procedure had identified as the time needed or available to shut the hatch. They had identified 57 minutes as being the time that was available to shut the hatch for a limiting event. In fact, their own procedure had specified that they were supposed to assure that they had the capability of doing that. At least in looking at how they performed this event, they did not do that.

The team looked hard to see if perhaps they might perform differently under different conditions. We were unable to conclude that they would have been able to meet the 57 minutes under our more limiting case, in part because one of the things that this event pointed out was, and allowed us to focus on was the impact of loss of power. Loss of AC power can have a big impact on your ability to shut the equipment hatch. In fact, in this case, the licensee told us that if they had lost electrical power, it would have taken them some two hours to shut

the equipment hatch. So, their ability to shut the hatch within 57 minutes is in question and it doesn't seem like they can do that.

COMMISSIONER REMICK: Just out of curiosity, is this equipment hatch steel on the inside of the containment or exterior?

MR. CHAFFEE: It's on the inside.

COMMISSIONER REMICK: Inside.

MR. CHAFFEE: And, in fact, it moves down. It has some electrical hoists to do that.

We also looked at their analysis in which they used to determine the 57 minutes. In that, one of the things they assumed in order to make the 57 minutes to be available was that they had containment air coolers available to keep the temperature down so the people could do work in there. Again, they failed to consider the aspects of loss of electrical power because then those coolers would not be available. So, again, the 57 minutes is even in question for a loss of electrical power.

So, one significant lesson learned out of this is to look at the impact of loss of AC power on your ability to deal with the loss of RHR event.

(Slide) Next slide.

Next we looked at the licensee's

activities to try to return electric power through trying to restore the diesel generator. Again, as I said earlier, the reason the diesel failed to operate reliably was because of problems with the Calcon sensors. When the diesel did trip, the first thing that we became aware of is that the licensee had great difficulty determining what caused the diesel to trip. That was because -- in part because all the trip indications are not recorded anywhere. They're not recorded in any hard copies. So, because of that, it's necessary to have people look and see exactly what it caused and remember that.

The next problem we found in relation to that was that at Vogtle at least, during the outage, the operators had gotten into a mind sink or had gotten into the regular habit of resetting the alarm panels to get rid of spurious alarms so that they could then focus on what was the real alarms. Unfortunately, in doing that for the diesel, when you reset the alarm panel, you remove all of the trip alarms because the way the diesel operates, it removed the alarm signal when the diesel trips. So, this practice they had then resulted in no alarm information being available. So, as a result, it was difficult for the operators, for at least the first

trip and to some extent the second trip to have good indications of why the diesel tripped.

In addition, we looked into it further and what we found in Vogtle's case was that even if they had left the alarms in, the alarm indications they had could be misleading. The way the panel was designed and also, in fact, what alarms actually came in first for the particular event in question were misleading. After the event there was some testing that was done in which they attempted to reproduce what they believed to have been the event, meaning by that they initiated jacket water temperature trip signals. In doing that and watching the diesel actually trip, what they found occurred instead was that the first trip alarm that came in was low jacket water pressure. In fact, the actual trip signal, the high jacket water temperature trip, didn't come in for some ten or 11 seconds later.

So, again, the main drift here is that it was very confusing and there was a number of barriers that prevented them from understanding what was actually causing their diesel to trip.

We then looked farther into their handling of the event and we found that they did not have a complete understanding for how the diesel generator

controls and the load sequencer worked. What we found here was after the diesel tripped the first time and it did not restart, even though they still had no power to the safety bus, the operators went out to see if there was something wrong with the sequencer. They went there and they found the sequencer was locked up. They did not realize that the sequencer and the diesel had performed per design. When they went out there, they then attempted two methods to try to fix the situation. The first one didn't work. The second one, which was de-energizing the sequencer panel, did work and then the diesel restarted.

Again, the point is that knowledge of this complicated system was not complete, although through trial and error they were successful in getting the diesel to start.

Later on, after the event, also we became aware that -- or the licensee became aware of another feature of the diesel, that being an emergency reset button which could have helped them in this event. Again, the significance there is that there are several aspects of this diesel and its operation which are complex and the knowledge level, at least at Vogtle, was not complete in that area and it could have helped them in dealing with the event.

It's interesting, however, though, that in spite of all of this, they did get the diesel started in 36 minutes. They did that because they were very aggressive and they tried a number of things. It's interesting to see how people that are trying very hard to get something going can eventually do that. In fact, the diesel itself had some design features inherent within it that eventually, through maybe not understanding why but eventually the normal course of activities can lead to a diesel being started.

(Slide) Okay. Next slide.

We next looked into some emergency preparedness issues. Again, as I've already said a little bit, they had some problems in terms of the timeliness of notifying off-site organizations. But we also looked into the classification process. What we found in looking into that was that the classifications of emergencies on a loss of AC power, at least by looking at procedures at several utilities, are not being done the same.

The way the emergency classification process exists or is done is for like a loss of AC there can be several criterias that you would make your determination from in terms of what -- that ought to be a site area emergency or some other

classification. We looked only at one. We looked at the loss of AC, at that specific one. In there we found that licensees, in terms of what their procedures stated, could classify this event anywhere from a non-event up to a site area emergency.

Of course, classifying an event is very important in that because it conveys a message to the agency and to others in terms of what actions need to be taken. So, it was interesting to us that that classification process was being done differently at different sites.

We also looked at the guidance that exists as it relates to shutdown operations. What we found there was that, again, different licensees are handling that differently. For some criteria, some licensees' procedures would say that it doesn't apply at shutdown. Other licensees, the procedure would say it does apply.

We also looked at how the classification guidance takes into account certain unique things that exist in shutdown. For example, in shutdown at mid-loop, and in fact in Vogtle's case, they did not have containment integrity. They did not have the reactor coolant system area intact and they had low water inventory. The emergency classification process

doesn't -- at least we couldn't find a way that it took that into account. Therefore, what is the appropriate classification when you're in shutdown is somewhat unclear in the guidance.

We also learned from the Vogtle event that accountability of personnel when you have an event in shutdown has some new challenges. Just the number of people that are on-site -- in Vogtle's case, it was close to 1,000 people on-site that needed to be processed for an accountability standpoint. Also for an event that occurs in shutdown, that can result in the need for some of those people to be involved in actually mitigating the event.

In fact, in Vogtle's case, that was the case. They did have a number of people that needed to stay inside containment, that needed to be involved in activities to fix the damage that was done out in the low voltage switchyard and also a number of people that were needed to shut the equipment hatch. Those people did not then report to their accountability area because they needed to stay where they were and that caused some confusion and some difficulty in accounting for the people during that event.

Also, the accountability was made a little more complex because when the licensee classified the

event, they went directly to a site area emergency which required accountability, even though there was no releases even envisioned. So, the system was challenged and they needed to take actions fairly quickly and it created some confusion.

Last, as we talked about earlier, there was some delays in their ability to make the notifications.

(Slide) On the next slide, shutdown risk management, what we found here was that Vogtle-- their shutdown risk management basically consisted of relying upon technical specifications. There were some exceptions to that, but that was pretty much where their benchmark was in terms of what sort of configurations were acceptable during shutdown operation. In particular, when we pressed the licensee trying to get an understanding for how they could do better, what we basically found, as I said earlier, was they could have shifted the diesel generator and reserve x-ray transfer of maintenance activities around such that they had three sources of power available when they were in mid-loop operation and they could have done that with essentially no significant impact on their outage. Only by causing a shift in emphasis to focusing on -- not the tech

specs, but focusing on those things you can do to enhance your plant's reliability, for example, when you're in mid-loop operation. We thought that was very interesting.

The other thing that we thought was important is in order to enable that type of culture to exist, it's important to give it some horsepower. So, perhaps through formal procedures or something that causes people to focus on that is something we didn't see at Vogtle and the lack of having that made us recognize that just talking about it is nice, but there's a need to put some power into it.

The other thing that we thought that was interesting when you looked at shutdown operations in this risk management concept is the fact that there is a lot of risk when a plant is in shutdown. That's when a lot of outage activities are ongoing. That's when you do have a lot of equipment out of service and that's when you have a very high likelihood for problems to occur, initiation of events.

In fact, in looking at the history that exists in the industry, there have been a high number of events that have occurred to plants that were in shutdown operations. In fact, we did a rough cut looking at the number of events on a per month basis

and found it was close to twice the number of events occur in shutdown on a per month basis compared to when you are up at power. So again, it's keenly important that risk management be done when a plant is in shutdown operations.

(Slide) Next slide.

We also looked at all this information that -- all the precursor events that have occurred and there's a large number, and also the guidance that had gone out to the industry. What we found was the following. In the last 25 years, there has been 74 loss of off-site AC power events during cold shutdown. Many of those were partial losses, some were complete. Some of them resulted in complete loss of on-site power at the rate of about three a year. We also found that there was 52 losses of RHR near mid-loop operations since 1973. That's about the last 17 years. Again, they're occurring about the rate of about three a year.

So, for the last 15 years or so, there's been at the rate of about six a year a combination of loss of off-site AC power and loss of RHR events when you're in mid-loop.

Interestingly enough, we found that coming out of all this history there's been a large number of

documents that have gone out to the industry giving guidance and feedback on these events. There's been some 16 documents talking about loss of power during cold shutdown and there's been about 28 documents talking about loss of RHR near mid-loop. In looking more closely at these particular documents, we found some things of interest.

One, as I mentioned before, there was a couple of documents that focused on the type of events that can cause problems in switchyards. Again, as I said earlier, at Vogtle they had not fully encompassed that. They had handled the specifics of those particular documents but not the generic concern. In fact, that's the general theme we found. We found that the way this current system works, it gives very good guidance, focusing on the specific problem. But synthesizing that into a broad-type overall general type guidance thing is not being done as completely.

We also looked at some other guidance that exists, focusing on loss of RHR and the impact of loss of power to RHR and we did find there were some documents that addressed that. There was about five. They basically focused on three events. One event was an event in 1980 at Davis-Besse when they had a loss of RHR due to loss of power. There was lessons

learned out of that. That also got into the area of loss of electrical power. There was another document -- that was a bulletin. There was another event at Palisades in '84 where they lost AC power and there was some focus in there and to the needs of being able to assure that you have adequate power supplies. Then also, and the most recent document is a generic letter, 88-17, which focused mostly on loss of RHR excluding loss of AC, but it also touched on loss of AC. It did address the need to consider support systems and it did allude to electrical power as well.

However, in all of these, we saw that each of them did focus on the specific issues of the particular event that occurred, but the guidance did not seem to grow and develop, at least to the point where it clearly encompassed all this history and focused in on a strong attack on making sure that loss of AC power would not be a problem in mid-loop operation.

And we also saw in looking at the history that there was a number of documents that focused in on problems associated with diesels. As I said earlier, there was Part 21 that talked about Calcon sensor problems.

So, there was a lot of history here and the history that was here was sufficient that a licensee who is very aggressive could capitalize on all of that, but again there's an awful lot of it and we found that the process -- in fact, what we were told by the licensee is it's a fairly significant undertaking to be able to fully take advantage of that information and draw and expand beyond the guidance that's there into a more generic and strong attack on those generic problems. So, we found that there's both good in here and bad. There's some work that's not complete.

We also took a look at the analysis that currently exists that addresses what kind of things can happen when you lose the residual heat removal system. In focusing on that, we found that the analysis is greatly improved coming out of the generic letter 88-17. There have been several analyses done and the understanding in terms of what sort of phenomena can occur has improved but it's not complete. We found that currently the analysis does not consider certain aspects that could result in getting ambiguous core indications, for example reactor vessel level indications can be misleading in that you can get, after you've had a loss of RHR for a period of time,

you could get phenomena where the RCS level indication could be indicating an increase or stable level when, in fact, the level is going down.

Or I should say based on our study of this, and it's all very preliminary, we have come up with some potential phenomena where that could occur. We also looked at reflex cooling and found that there's currently some disagreement in terms of how effective a cooling mode that is and therefore what sort of phenomena would be seen when RHR is lost for a period of time.

We also found that based on some of the modeling that exists and some of the analysis, they did not protect certain cyclic phenomena where the RCS -- where the water in the reactor coolant system can shift from the pressurizer to the core and back and reflex cooling can occur for awhile and go away. And again, what we found is -- in looking at this, what we came up with is preliminary. It's not based on an extensive research, but we found enough variations and things that could be misunderstood that we concluded that the analysis is not complete. In order to provide additional guidance to operators for the types of things that they need to deal with when you have loss of RHR for some period of time, that

that guidance, that some of that analysis, some completion in that area may be warranted.

We also looked at technical specifications. For technical specifications, we found that the technical specifications are based on analysis that are done for at power operation. We found that the tech specs have not been tailored for the type of events or problems that would occur in shutdown operation generally. Refueling operation, there are some analysis that have been done in that area and a few others to alter or tailor the technical specifications.

For example, we found that the equipment hatch closure requirements, in Vogtle's tech specs, they require that they be able to shut the equipment hatch within four hours. There's no differentiation made between that and mid-loop operation where the need to be able to shut it sooner could occur. We also found that two sources of power supply are what's required when you're in shutdown operation independent of the configuration you're in, except when the core is off-loaded. At that point, there's no power required.

We also found that single failure criteria is generally not applied to the technical

specifications when the plant is in shutdown operation. That's what we found in tech specs.

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In summary, the team concluded that the event was preventable. The team concluded that overall generally the licensee did handle the event well.

The team concluded that there are potential generic lessons. First, that shutdown risk management does need to be improved and further developed. We also concluded that there is a need to complete the process of implementing the existing guidance that is out. Generic letter 88-17 did say that the licensee should have in place a process to ensure they can shut the equipment hatch in a sufficient time and Vogtle had not completed that.

Also, the team concluded that, as another generic area, is that additional analysis on it should be what could happen when you lost RHR for an extended period of time is not complete. Also, the feedback process to the industry, although it's very extensive and there's a lot of it and it's very powerful in looking at specific events, is not complete. The synthesis of it is not complete. In fact, its final form, in the form of bulletins and generic letters and

whatever the form is, needs to be a form that ensures that it has the kind of power and forcefulness to ensure that the type of actions necessary are taken.

We found that there was -- the team concluded that there were classification problems, potential classification problems generically. The team concluded that there is a need to look at the tech specs and evaluate if there is a -- if it would be warranted, that they be tailored somewhat to shutdown operations. And the team concluded that the diesel generator system, at least at Vogtle, is very complex and the understanding is not complete and the tools that are available to try to identify what caused a diesel trip were not very effective at Vogtle and there may be some generic implications of that.

MR. TAYLOR: Mr. Chairman and Commissioners, I'd like to thank Al Chaffee and the team for what I regard as a very technically good, thorough and critical job of taking a look at this event. We thank them. They put in a great deal of time since this team was started.

As the Commission is aware, we've spent much time over the past years in looking at operating plants and operational safety. Our previous IITs have basically concentrated on that in the reactor area and

we have -- we believe through many indications have achieved improved safety in normal operations.

I think this event, this IIT, and the messages brought back will cause us now to focus on what we can learn from the conditions that occurred during this event and other events that have previously occurred. That's the task which the staff has. As I mentioned to you, we will proceed to formally track our follow-up to this IIT and we'll keep the Commission closely advised.

With me at the table is Doctor Murley. In terms of follow and what the event means, I'll ask him to say a few words.

DOCTOR MURLEY: Thank you, Jim.

Mr. Chairman, Commissioners, I would like to add my thoughts that Al Chaffee and the team did an excellent job and they've produced a good report. We want to take time to study it carefully and learn all the lessons that are in here.

But in a preliminary way, I can say that we're reviewing this not in isolation, as an isolated event, but as an example of the broader issue of assessing the risks during shutdown operations. I think it's fair to say that we've been perhaps somewhat slow over the years to fully recognize the

full scope of the issues affecting shutdown safety.

Some issues were raised several years ago, as a matter of fact, in the context of reviewing tech specs as to whether there can be risks in shutdown modes. The Diablo Canyon event, which was loss of decay heat removal system during shutdown and I guess was about three years ago, caused us to look more broadly at one aspect of that which was mid-loop operation. We issued generic letter 88-17 that asked PWR licensees to look at their plants and find ways to improve. I think it has had an impact broadly on the industry in improving the safety during shutdown operations. I believe Mr. Chaffee mentioned that at the beginning of his talk as well.

But several months ago, I had asked my staff to pull together a comprehensive program that addresses this broad issue of shutdown risks. We're working with AEOD and the Office of Research on this program. In fact, some months ago, Research has already accelerated some risk studies that they're doing.

In broad outline, I think the program is going to have generally three elements, three ways to approach the issue. First, we have to understand what the real risks are during shutdown operation. Al

Chaffee and his use of the term "risk management during shutdown," as I read in Chapter 7, they're using risk in a qualitative sense and not in the quantitative sense of assessing the frequency of events, times or consequences. I don't think the team really got into an assessment of the consequences of this event. Our preliminary analysis is that the Vogtle event was not a close call to a core melt or a core damage accident, for example. And that element has to be part of our overall assessment of what the real risks are.

Nonetheless, my sense of things is that we're going to find that the risks are not negligible for shutdown operations. In this regard, we've been briefed in recent months on some foreign reactor PRA studies that show that the -- at least the core damage frequency due to shutdown operations is a significant fraction of what it is at power operations. There's no reason to believe that when our studies are completed they won't show the same things.

The second step then is to -- and we'll be doing some of these in parallel. The second major step is to ask whether regulatory actions are needed by NRC to assure that sufficient safety equipment is available at all times during shutdown.

Then the third aspect is to develop what those regulatory actions need to be. For example, do we need to change our tech specs to control what equipment is out of service and at what times? Do we really need additional instrumentation and additional readouts in the control room or do we even need additional power supplies, for example? We're not at that stage yet, of course.

But, in broad outline, that is the approach that we're going to take and we will be reviewing this report very carefully.

Thank you.

MR. TAYLOR: That concludes the staff's presentation, sir.

CHAIRMAN CARR: Thank you, Mr. Taylor.

Commissioner Remick?

COMMISSIONER REMICK: First I'd like to commend the staff also on what I think was an excellent job of review, analysis and report. I do have some questions, but I think they lead more to what actions will be taken in the future. I realize the staff's not prepared to answer those. I just might throw them out in general for what they might be worth and that would be the question of does the risk-based tech spec effort, will that incorporate the risk

in modes 5 and 6 as now envisioned at risk-based tech spec. It seems like it could be incorporated readily into that effort.

Then, looking ahead, the question, can we anticipate that in the evolutionary and advanced reactors, their tech specs, will they include consideration of shutdown modes and the risks associated with that?

Then, the report points out, as Mr. Chaffee pointed out, a number of procedural and training weaknesses that were uncovered and how these would be addressed and are they or could they be incorporated into the accident management effort and accident management training under IPE or will they need to be done separately to address those?

It's curious to know if there's any obvious solution to accountability at a time when you need those people to be doing important tasks. Maybe there is. I was trying to think, how do you handle that situation readily when you know you want people to be performing tasks, important tasks, and perhaps not going back and worrying about accountability, but maybe there's a solution to it. Is there any obvious solution?

MR. CHAFFEE: I don't know.

COMMISSIONER REMICK: Yes, I don't know either.

MR. TAYLOR: People were trying to do the right thing, that's for sure.

COMMISSIONER REMICK: That is correct, that is correct, and we should applaud them for that.

On the equipment hatch issue, if I recall, and the preparation of generic letter 88-17, I think ACRS had some differences with staff on how readily one can button up containment and the reactor coolant system. If the staff hasn't gone back, I suggest you go back to that letter where I think we did have some differences, ACRS did have some differences with the staff on how easily that can be done at a time when you lose the residual heat removal system.

So, with those general comments, Mr. Chairman, that's all I have today.

CHAIRMAN CARR: Commissioner Rogers?

COMMISSIONER ROGERS: Just a question. Do they have system engineers at Vogtle?

MR. CHAFFEE: Yes.

COMMISSIONER ROGERS: Do they use the system engineers?

MR. CHAFFEE: Yes, they do.

COMMISSIONER ROGERS: That's a little

disquieting then with respect to this lack of knowledge of real understanding of the diesel generator sequencing system because one would expect with a system engineer on that system that that should be fully understood. If there isn't a system engineer, then maybe something fell through the cracks. But if somebody is assigned to that diesel generator system as a system engineer, that person is expected to know everything about that system and that then raises the question of whether -- what we expect and what the licensee expects their systems engineers to do and know. They should know everything about the system and that's a kind of shocker to me, that if they have a system engineer, that organizational structure, that that was a difficulty unless the system engineer wasn't around.

Was the system engineer involved then?

MR. TAYLOR: Did you look at that specifically?

MR. CHAFFEE: We did work with the system engineer. He was very knowledgeable, but he didn't understand all these aspects. He did learn several things from the event. But he was, in many regards, very knowledgeable, but not on the emergency reset or on the other item that came up.

COMMISSIONER ROGERS: Well, they're obviously very key parts of the system.

DOCTOR MURLEY: I think, Commissioner Rogers, that's a very good point. I think we will run a follow-up on that. Our expectation is like yours, that system engineers in general ought to know these kinds of things. But I think we need to look and see, maybe they don't have the detailed knowledge of all the subtleties of the equipment out there. If that's the case, I think we ought to know that too broadly across the industry --

COMMISSIONER ROGERS: Yes. Yes.

DOCTOR MURLEY: -- and not just at Vogtle.

COMMISSIONER ROGERS: That's right.

DOCTOR MURLEY: I think that's a very good point.

COMMISSIONER ROGERS: Because we have certain expectations when those things -- when that organizational structure is being employed and I wonder if they're being met.

The NUREG report states in the findings and conclusion section that the existing analysis and understanding of shutdown thermal hydraulic phenomena and behavior at Vogtle are incompletely addressed in Vogtle's analysis training and procedures. Do you

think that we at the Commission have an adequate understanding of these?

DOCTOR MURLEY: I'm sorry, I don't --

COMMISSIONER ROGERS: The Vogtle analysis of thermal hydraulic phenomena behavior in this kind of a situation were incompletely addressed in their analysis. The question is do we feel confident about our own strengths in understanding these phenomena in this particular kind of a situation?

DOCTOR MURLEY: We've done a lot of studies. I think I would like to ask Warren Lyon if he might comment on his -- he did a lot of the work on bulletin 88-17, for example, and how he feels our staff understands the situation.

MR. LYON: We do not --

CHAIRMAN CARR: Would you identify yourself, please, for the reporter?

MR. LYON: Yes, Warren Lyon.

We do not have a complete understanding of all of the behavior that one may see during a loss of RHR event. We do have a good understanding of the kinds of things that occurred during the Vogtle event.

COMMISSIONER ROGERS: Do you feel that this was really just not -- that the knowledge is there, that it's available, but the Vogtle people just

didn't have it themselves?

MR. LYON: No, sir. What I'm saying is that in the broad scope of these kinds of events, there are areas in our knowledge base that do not exist.

COMMISSIONER ROGERS: You're talking about thermal hydraulic phenomenon?

MR. LYON: That is correct.

MR. CHAFFEE: In the Vogtle event, it did not proceed for a long enough period of time that the event cut into the situation where something that was not understood could have occurred. That's the distinction he's making. In other words, for the actual event that Vogtle had, because it was mitigated within only 36 minutes, the phenomena of just heating up to 136 degrees is well understood. It's what can occur if it had not been -- cooling had not been restored --

COMMISSIONER ROGERS: I understand. Okay.

MR. CHAFFEE: -- and boiling had occurred. It's when boiling occurs and time marches on that it's not --

COMMISSIONER ROGERS: Well, what were the inadequacies in the Vogtle analysis then and understanding of the -- that were referred to in the

report?

MR. CHAFFEE: It's from a generic standpoint. The analyses that exist to date, they consider a homogeneous void mixture that exists in the RCS. So, they don't set up a model where you can get certain cyclic types of phenomena where the water can be moving from one location to another and that's-- it's not just Vogtle, but it's -- what we have found, it seems to be that's the state of the art in terms of development in that particular area. Also, the problems that exist to date really haven't taken into account the possibilities of some of the normal level indications to the phenomena where you can have part of the RCS being pressurized and then forcing water into it. For example, a Tygon tube where it gives you a false indication of level.

COMMISSIONER ROGERS: Well, I think we could talk about the details here all day and it would be very interesting to me, but I'm not sure to everybody. But I wonder if this isn't something that we ought to make sure that Research is very comfortable about and whatever information that we feel should be in the hands of licensees and understanding such things, at least they know where to go to get it.

MR. TAYLOR: It's particularly complicated depending on the mid-loop configuration and then with potential openings and same that are associated with where this event started. So, we'll take that as part of our tasks.

COMMISSIONER ROGERS: General -- oh, excuse me. Yes?

DOCTOR MURLEY: Commissioner Rogers, Rick Kendall, one of the team members, wants to add some thoughts on the system engineer because I think it might illuminate.

MR. KENDALL: Just a comment.

CHAIRMAN CARR: Would you identify yourself for the recorder?

MR. KENDALL: Yes, Rick Kendall.

I thought that the diesel generator system engineer at Vogtle had a good understanding of the diesel generators. I think that the problem was more that the operators or the operations personnel, perhaps, did not have a real good understanding of all the controls that were available to them. It appeared to be more along those lines.

CHAIRMAN CARR: Are you saying that the system engineer didn't have time to get into the action?

MR. KENDALL: Well, I'm just saying that the system engineer is not the one that operates the diesel during the event nor, do I believe, he's the one that trains the operators or does those types of things. So --

CHAIRMAN CARR: Was he called on in this particular instance?

MR. KENDALL: Not to my knowledge.

CHAIRMAN CARR: That's what I suspected.

COMMISSIONER ROGERS: Well --

DOCTOR MURLEY: But that in itself raises a question that we might want to look at.

COMMISSIONER ROGERS: Yes.

CHAIRMAN CARR: Well, finding any one particular person in 36 minutes to answer a specific question in an emergency is going to be a tough job.

MR. JORDAN: I think the point is well made that the procedures and the training for the operators needs to be -- needs to incorporate the lessons and knowledge that the system engineer has so that when they're faced with an event, they can cope with it and they were misled or didn't understand the implications.

COMMISSIONER ROGERS: Well, I don't know. I mean you folks will have to decide that, what's the

best way. But you wouldn't expect operators to have the same kind of detailed knowledge of everything that the system engineer would have. Otherwise they'd be system engineers plus operators and everything else. So, there is a limit of expectation there as to what to know. You are the folks who have to decide that, I'm sure. But it would just seem very important that the system engineer's knowledge be available at the time that it's needed to the operator.

It sounds to me like there's some hesitancy about how this thing functioned or would function and a system engineer being called upon if the person was on-site might have been able to help.

One of the aspects of what I've been hearing there seems to suggest that one of the problems is that there's a great deal of information and guidance that we keep putting out to licensees that flows out and that there is difficulty in absorbing that and turning it into useful actions. It's the old question of trying to take a drink from a fire hose. I wonder if we shouldn't think a little bit about whether the form that we supply this kind of information to people in is one which can help with that problem. It just seems that we've said that there's a great deal of guidance out there, but it

isn't necessarily being followed. My guess is that it's just overwhelming in some ways to some extent.

I wonder if you might want to comment on that, Doctor Murley.

MR. JORDAN: I think I'd like to comment on it first, at least. We recognize that as maybe one of the big lessons out of this. From TMI, it was found that we weren't feeding back the lessons, either industry or the NRC sufficiently to utilities. We've certainly corrected that and now we're feeding back the lessons in multiple copies and increment by increment.

Perhaps there is a need, as this report suggests, for some synthesis in given areas. And that may be an industry action or it may be an NRC action or a combination. Codes and Standards should be compiling this kind of information, perhaps, in a fashion utilities can use in an effective way. So, we're very interested in that aspect.

MR. TAYLOR: I expect that now focusing on this and looking at it further just in that process will help tie a lot of the pieces together. I really do because we -- I think this is serving to bring-- as Tom mentioned, as we understand the risk, it leads us to take a look at this whole spectrum and out of

that effort perhaps a more unified approach.

CHAIRMAN CARR: Well, let me jump in on that one. I agree with Al pretty much, what we send out to them are specifics and they all go look at those specifics and say, "I fixed that. That doesn't bother me," without looking at the picture and say, "Hey, what was the real problem here and how many more vulnerabilities have I got to that same problem that they didn't tell me about," and taking a good look at the generic problem. I think you've pointed that out accurately.

It's going to be very impossible for us to tell them all the things that are likely to happen out there. We had all the precursors in our office that they had in their house and we couldn't tell them this event was about to happen. So, it's going to be very hard for us to come out with guidance that's going to tell those guys how to fix the problem. What we can do is point out what has happened and we have to depend on them to be able to take that kind of information and apply it broadly across the board to see what kind of effect it has. That's my opinion.

COMMISSIONER ROGERS: Yes. Well, it may be that both are part of it. I'm sure that it's a complicated situation to some extent. But obviously,

the responsibility has to be with the licensee to look at their whole system and just following NRC's suggestion about something is not necessarily fully discharging the responsibilities to themselves and for the future. So, I'd agree with you on that.

The classification process, what are we doing on that? I hear that's a confusion in this kind of a situation. What do you see evolving here to straighten this out and make it easier to classify more rapidly and systematically this type of event?

MR. JORDAN: In this area there is an industry proposal that the staff is reviewing for guidance that would supplement 0654 for classifying emergencies with criteria that would be adopted by utilities to supplant 0654. The staff is reviewing it, both NRR and AEOD, and that's one possibility for making it more consistent. There's also consideration for revising reporting requirements further along the way to assist in that. But certainly this gives us an impetus to look at it in a more rapid time scale.

COMMISSIONER ROGERS: Are you contemplating any kind of additional feedback from the industry on this, any kind of a workshop or anything of that sort

MR. JORDAN: The NUMARC process was, in

fact, a workshop. So, they have a proposed document that they have submitted to the NRC for consideration. So, that is well along.

COMMISSIONER ROGERS: Okay. Good.

Well, I just wanted to add my compliments to what seems to be a very, very excellent piece of work and a very fine presentation by Mr. Chaffee. Thank you very much.

CHAIRMAN CARR: Commissioner Curtiss?

COMMISSIONER CURTISS: I just have a couple of comments and a couple of questions and will begin with the questions first.

On the issue of diesel generator reliability, did the -- would we expect the Calcon failures to show up in some kind of reporting mechanism in NPRDS or reported to us in sort of an earning warning way? If so, did they translate into any indications on diesel generator reliability?

MR. CHAFFEE: We looked into that and, interestingly enough, very few of these failures were reported in NPRDS. In fact, in looking into it, that's one of the problems and they weren't after the NPRDS system.

COMMISSIONER CURTISS: Is that because of a shortcoming with the NPRDS system or a shortcoming

with licensee reporting here?

MR. CHAFFEE: A little bit of both. What had happened is a lot of these failures don't result in the diesel tripping. They're a component failure. A lot of these failures were situations where the S-found calibration was out of spec. So, what's true is licensees were capturing these failures where they caused the diesel to trip in NPRDS, but in those cases where it didn't actually result in actual diesel trip. In those cases, it would not be captured in the NPRDS system. That's in the process of being changed, is my understanding, and they will be captured.

COMMISSIONER CURTISS: I guess I'd encourage you given the extent to which we rely -- the NPRDS system is relied upon, that if there are shortcomings in the reporting and what's required to be reported, that this event is identified to go back and, in the process of examining the issues that you're taking a look at here, take a look at that one as well.

Let me pick up on the guidance question that Commissioner Rogers and Chairman Carr raised. I too, I guess, am struck by the amount of guidance that was out there involving a number of things that happened here, including the guidance that you talked

about on control of activities in the switchyard and then the guidance on mid-loop operation in the generic letter. I agree with both of what Commissioner Rogers and Chairman Carr have indicated in terms of areas to look at as to how we approach that guidance.

I guess the third thing that I would add to those recommendations is that we've got kind of a schizophrenic approach on guidance in this agency, I think, and particularly when it comes to generic letters. We're careful to say that the letters don't require anything of the licensees in a lot of respects.

I guess I'd encourage you to go back and if we intend to require something of the licensees with the guidance that we put out, we ought to either say that in the generic letter, we ought to handle it in a different way. But when we reach this point we ought to be able to say that where we expect the licensees to do things, whether it's in an information notice.

As I say, I just quickly looked through the appendix here on the number of information notices that have gone out. Perhaps we ought to go back and take a look at what we can do as an agency from the process standpoint to focus -- to sift through and to

try to refine the hose that Commissioner Rogers referred to, to recognize the suggestions of the Chairman about we can't tell them all their problems, but at the same time we get down to the high priority things that we think are important, perhaps reassess the question of whether we've drawn the line properly and where we want to send out communications to licensees that we describe simply as for your information or for whatever you think is appropriate and those things that we really do intend to require of the licensees. It seems to me it would be helpful to look at that process as well.

DOCTOR MURLEY: Can I comment on that, Commissioner?

COMMISSIONER CURTISS: Go ahead.

DOCTOR MURLEY: I think you're exactly right. The staff at least does feel this, as you termed it, schizophrenic approach sometimes. Three hundred and sixty four days a year I'm defending why we're backfitting and so forth. And then on the one day where there's an event, we have to say why haven't we done more and put out more guidance. So we struggle with that continually, I think, where to draw the line on requiring something versus sending the guidance out. And I think we need to keep looking at

it, as you suggest.

COMMISSIONER CURTISS: Okay.

Third comment --

MR. TAYLOR: May I add that I --

COMMISSIONER CURTISS: I'm sorry. Go ahead, Jim.

MR. TAYLOR: The look at risks here may lead us to say we need to take -- and that's part of our problem, clearly. We may take an action beyond what's been done.

CHAIRMAN CARR: Let me emphasize once again, what we owe those utilities and their operators is all the information we can get from all the incidents that happen. They have to learn from those, because they happen all the time and they're going to have to think beyond the immediate event as to what is the real significance. We just can't do it by regulation or by generic letter or whatever. You can't cover all the things that could possibly happen.

COMMISSIONER CURTISS: I do want to emphasize that I agree with that. Whatever we do in this area needs to be leavened by the fact that in this case we're only talking about PWRs and you get down into the details on some of these letters. An incident happened at a particular plant and it may

apply to you. Take note.

I do recognize that the diversity within the individual plants necessitates that approach, but if there are cases, as you look back here, where it would be appropriate to re-examine the question of how we've struck the balance between providing suggestions, comments, recommendations, but just short of requirements to the licensees, I'd appreciate your thoughts on that as you go forward.

More of a narrow question here. As I took a look at this particular incident, it seemed to me that it was very difficult for the licensee to perhaps line up the electrical systems in the time that would be required to respond in a way that might have alleviated the severity of the incident. I know we've emphasized in the past the question of independence. As you look at this particular incident and as we move forward, the down-side of independence is that it's --on the one hand, we do discourage electrical line-ups that minimize electrical propagation of failures and I think that's important.

But at the same time, the other side of that coin is that we make it more difficult in cases like this to line up the electrical systems in a way that might be helpful in a positive way. I'm not sure

I have any thoughts to add on how you strike that balance --

MR. TAYLOR: No, we're aware of this.

COMMISSIONER CURTISS: -- but it seems to me that's a two-sided coin.

MR. TAYLOR: It is. That's brought out in the report and certainly we're --

COMMISSIONER CURTISS: A couple of just general questions about where we go from here.

I know you had a member of INPO on the team participating. Do you have any knowledge of what INPO plans from here on out in terms of their own assessment of this situation and the broader implications?

MR. JORDAN: No. They have not had an opportunity to review the report as yet, and so --

CHAIRMAN CARR: Let me rephrase that question a little bit.

MR. JORDAN: Yes, sir.

CHAIRMAN CARR: Did you find that his presence on the team was valuable and do you plan to include participation like that in the rest of the IITs? And you can put him on report here. We don't care whether he is hearing it or not.

MR. JORDAN: Certainly. From

communicating with the team leader and meeting with the team, his presence was extremely valuable.

CHAIRMAN CARR: I think that was the thrust of your question, wasn't it?

COMMISSIONER CURTISS: Well, two-fold.

MR. JORDAN: Very beneficial.

COMMISSIONER CURTISS: And two, in addition to whatever we have going on within the Agency, I trust that INPO will be doing the same kind of thing, not just with the NPRDS but beyond that to assess the implications in a complementary way.

MR. JORDAN: Indeed. And that's the benefit that we expect to get from this as well, that there is a direct tie, a feedback of the results of this effort, including the background.

COMMISSIONER CURTISS: Yes. I'm pleased with that aspect of it, if that's the case.

Just a very general question on where we go from here as an agency. This is the first IIT report that at least I've been involved in, in this context. From a standpoint of procedurally how we take the recommendations, the material that you've prepared -- and I think it's an excellent report. I'd like to add my voice to the others that have commended the folks who worked on this report -- the

recommendations in the report, the additional thinking that you're going to give to this, the suggestions that were made here at the Commission meeting, procedurally how do we move forward with the formulation of the recommendations, the implementation and the tracking of those recommendations?

MR. JORDAN: Okay. There will be a memorandum prepared for Jim Taylor's signature, coordinated with the program offices, to compile those conclusions and recommendations and turn them into, then, actions by the program offices, including the Regional Office, NRR, Research, and AEOD. So we'll agree on the actions to be taken, and then will be directed then to take those actions --

COMMISSIONER CURTISS: Can you give me a feel for the timing of the memo to Mr. Taylor?

MR. JORDAN: That memorandum will be, I would say, in about a week.

MR. TAYLOR: Very good, sir. Thank you.

COMMISSIONER CURTISS: The right answer, I take it.

MR. JORDAN: I felt the pressure.

COMMISSIONER CURTISS: That's all I have.

CHAIRMAN CARR: Go ahead, Commissioner Rogers.

COMMISSIONER ROGERS: Yes. I just wonder how you feel about the scope of the responsibilities of the outage manager in this situation. Whether the outage manager really had the responsibility, or whether it wasn't clear, to be on top of all of the activities that were going on during the outage, not just those that tend to focus directly on the reactor itself. I'm thinking about what was going on in the switch yard and it's implications with respect to other things that were taking on the maintenance-- other maintenance activities of the diesel generator train being out and so on and so forth.

Do you feel that the outage manager's responsibilities were very clearly broad enough to encompass all of those, or do you think that to some extent that was a gap in the system here?

MR. CHAFFEE: I'm going to have to answer your question this way. I'm going to have to give you a little background. Their outage manager has a parallel responsibility for what's going on with the shift superintendent. He's responsible for the safety of the plant. The outage manager is controlling the activities, but in fact a lot of the scheduling and things like this switchyard stuff, which was just a routine activity, that really gets established months

before they ever go into the outage.

So, a lot of the things that get put in place in terms of how much power you have available at a particular point in the outage is being done in the planning process which occurs months before the event ever occurs. It's back at that critical time when they're trying to plan these things out that they set the stage for what equipment they have available. Then as far as that actual activity of the guy being in the switchyard, that had become a routine thing and people there had really -- they were somewhat ignoring it, that it was just going on.

So, what's true in what you're saying is the outage manager didn't keep a pulse of everything, but a lot of what he was doing had been prestaged. It had been predecided. It had been decided by him as well as the senior manager on-site long before scheduling out these activities and sort of was set in place.

COMMISSIONER ROGERS: Yes, but then the overview of what the implications of these decisions that seem to be benign at the time --

MR. CHAFFEE: Exactly.

COMMISSIONER ROGERS: -- because they were being made serially one by one, not looking at the implication of one on the other. The necessity of

taking an overview of that, who would have that responsibility? Is that the outage manager, the shift supervisor, or whose responsibility?

MR. CHAFFEE: My opinion is that it was shared between the shift superintendent and the outage manager. The shift superintendent is responsible for the safety of the plant, but the outage manager had a very integral role in that, is the picture that I got in Vogtle's case. Interestingly enough, the outage manager was an SRO and so were his two assistants. They were both also SROs. I'm not sure if that's typical at utilities that the person who is outage manager has that type of background. So, that was in the licensee's favor.

COMMISSIONER ROGERS: Well, it's just this question of who's in charge, who really has an overview of the whole thing and the notion that when you're down, it's not a particularly dangerous time. And yet, we're learning more and more that there are significant things that can happen in that period that need the same kind of overview that a plant running at full power requires. So, I wonder if there isn't something here that we could encourage in the way of a broader view of the entire system when it's down than has been the case.

MR. TAYLOR: That's the overall message in this in the broadest sense because there were any-- now, you heard Mr. Chaffee mention by relatively simple decisions there were any number of times where this thing could have been precluded, stopped at the pass, so to speak. That's exactly what you're driving at, stepping back on the activities, the truck in the yard, any energized switchyard or people working in the yard.

CHAIRMAN CARR: Commissioner Remick?

COMMISSIONER REMICK: Yes. When I asked the question if this is the first we used outside experts in an IIT, I meant to commend the staff for doing that because I think it's very valuable. I don't know -- and I'm glad to hear that it worked successfully. I don't know if we had any difficulty in a short period of time lining up those people, but I believe the NTSB, in the use of what I think they call parties instead of outside experts, that they have people lined up in advance in certain areas where they anticipate they might need expertise and have agreements already with institutions, and I guess you do have one with INPO.

But I wonder, do we, to any extent, have people lined up external that might be called in on a

short period of time?

MR. JORDAN: We have consultants and contractors that we could apply for areas of expertise. In terms of industry, the MOU was arranged so that we could, through INPO bring those people in. So, we brought in the two consultants with their member for exactly that purpose, to provide this expertise.

COMMISSIONER REMICK: But you haven't attempted to identify certain areas of expertise that the staff might need to supplement their own capabilities? I realize that's difficult, realizing the broad range of things that could happen.

MR. TAYLOR: Well, we have two choices. We can get our own contract-type assistance on this type of review and that's -- we -- there's a lot of expertise that can be contracted in labs and so on to us directly. So, we have that option. Then the other option was using -- going through INPO to get at industry and they wanted these two additional gents, one from the utility with a good background and experience, and Mr. Wyckoff from EPRI. We asked that they be made consultants because we wanted INPO to be the single -- there's where agreement is drawn up.

COMMISSIONER REMICK: Sure. I understand.

That's right.

MR. TAYLOR: We wanted them to garnish that assistance.

COMMISSIONER REMICK: I just might suggest you look at NTSB, their prearrangements, to see if there's anything that might be beneficial to us. I don't know, but --

MR. TAYLOR: We will.

CHAIRMAN CARR: I've got a few questions and then some philosophy.

In view of the number of similar precursor events, what made this particular loss of AC power event rise to the level of an IIT?

MR. TAYLOR: I believe that as we looked at it over a period of two days, the knowledge and the difficulty of starting the diesel, the loss of power and the complications of why the diesel didn't start caused us to say we had more to learn. Those were the fundamental things, was the inadvertent loss of the transformer followed by the failure of the diesel to start and then great difficulty getting the diesel started and not understanding all those elements was what was laid on my mind.

Would you like to add to that, Ed? You're my consultant.

MR. JORDAN: Yes. I would add the coincidence with being at mid-loop and being in a configuration where containment was open gave us that discomfort.

CHAIRMAN CARR: Well, I guess my innate feeling is if we pull the thread on most any event, we'd get the same kind of findings from practically-- quite a few events that happen out there, you would find all these side things that come into being. That's the only reason I ask the question. Because it doesn't rise to the level of an IIT doesn't mean you can't learn a lot from whatever else is going on out there.

MR. TAYLOR: That's true.

CHAIRMAN CARR: From the report, we see the team consisted of seven NRC staff and three industry reps. What's the total level of effort in manhours to complete the IIT? Did we keep track?

MR. CHAFFEE: We did, but I don't know the number.

CHAIRMAN CARR: Okay.

MR. TAYLOR: Can we provide that later? I can give you an estimate.

CHAIRMAN CARR: You can provide that just for my curiosity.

I've got some problems with our NRC actions and reactions. One, according to the chronological sequence of events in the report on page 218, the resident inspectors departed Atlanta at 10:40 and arrived about 2:30. Were there any NRC inspectors on-site during the event?

MR. CHAFFEE: Yes. I believe there was one.

CHAIRMAN CARR: So, there was one resident there all the time?

MR. CHAFFEE: Yes.

CHAIRMAN CARR: Okay. In the --

MR. CHAFFEE: But that individual was there as a backup because the residents weren't on the site. It was not a --

CHAIRMAN CARR: Yes, but there was somebody there.

MR. CHAFFEE: There was somebody there.

CHAIRMAN CARR: The other question I had was in our manning of our own response center and the region and so forth, we've got a lot of work to look at that because we were -- as you say, we lent a lot of confusion to that because we didn't think it was as serious at the time as to be worthy of an IIT and yet two days later we come up and say it could have been a

problem. So, we'd better look in-house and see what we need to take a look at there.

My opinion is that there was a root cause and there were approximate causes and contributing causes. My opinion of a root cause goes back on your page 3-5 of your report that says the current transformer -- "A relay was wired to the current transformer 600-to-1 turns ratio tap instead of the 400-to-1 turns ratio tap specified on the relay setting sheet." That was the root cause.

"Most current transformers are functionally tested during start-up." This one wasn't. The tests hadn't been performed for the current transformer. "However, work order to do the testing was outstanding at the time of the incident." The implication there is if that transformer had been wired properly, that we wouldn't have lost emergency power. Do you kind of subscribe to that? I mean did the team subscribe to that?

MR. CHAFFEE: The particular thing you were addressing is what caused the tripping of the Unit 2 diesel -- at Unit 2 and the event that we focused on was Unit 1. So, although the fact that they did have it miswired is the reason why Unit 2 did generate a trip.

As far as root cause, I would agree it's root cause in the sense that the licensee had many things that they had not completed and this was one of them. But as far as -- the reason why they lost the reserve activity transfer that lost power to the safety buses, that was -- that occurred independent of this --

CHAIRMAN CARR: But they could cross connect these units, couldn't they?

MR. CHAFFEE: No.

CHAIRMAN CARR: They couldn't?

MR. CHAFFEE: No.

CHAIRMAN CARR: I don't understand why we build units that can't cross connect, but I read your report.

COMMISSIONER CURTISS: They could do it, but with great difficulty. Is that not --

CHAIRMAN CARR: Yes, but it doesn't have to be that tough.

MR. CHAFFEE: But in fact, we didn't talk about it a lot here, but they didn't have procedures in place and they had to go through a lot of contortions to try to get that done. Fortunately, they didn't have to.

COMMISSIONER CURTISS: It would have taken

them longer than 36 minutes to do that.

DOCTOR MURLEY: May I add, that was one of the points that my staff has concluded that we need to look at, is that they did not have procedures for connecting these non-safety and safety buses, for example. There's -- typically we find any loss of off-site power cases that there are power supplies available, but there's not the means or the procedures for connecting them up.

CHAIRMAN CARR: But sometimes there's a plant running right next door.

DOCTOR MURLEY: Very often, yes.

CHAIRMAN CARR: And the last thing you'd want to do is to shut that plant down on loss of power.

DOCTOR MURLEY: So, I think that's one area that we've concluded we need to look at pretty carefully.

MR. TAYLOR: That's the balance between interconnections and --

COMMISSIONER CURTISS: That's right, independence.

MR. TAYLOR: -- independence and single failures and letting yourself get the power.

CHAIRMAN CARR: Well, obviously, the

proximate cause was the guy backing the truck into the --

MR. TAYLOR: That started it.

CHAIRMAN CARR: But all these other things then come into play as contributing causes. I don't think we'll ever be able to regulate common sense in a utility. But certainly the approach to putting equipment out of commission, there's a lot of difference between when decay heat is at its max and you've just shut down and when the core has been removed and you're in the refueling phase. In retrospect, if they looked at that they'd say, "Yes, that was a dumb thing to do." That's the kind of things you learn from the overall case, is we ought to be planning these things different.

We also, early on when I got here, I read an incident that happened where somebody was testing a diesel and -- I forgot what happened to it. But anyway, the reverse power relay was cut out on the test. It turned out that when they tested the diesels in this particular case, they cut out most of the safety systems. And I thought that's dumb. You're not testing the diesel when you -- in the form you need it to work in.

This is a typical case of that.

Evidently, the test that they did didn't show up that this diesel really wouldn't pick up the load.

MR. CHAFFEE: True. I mean in the sense that the testing that they did coming out of the event did not detect the problem they had. But what is interesting is that --

CHAIRMAN CARR: Well, I wonder if the routine test, don't you throw the bypass switch over and start the diesel up because you don't want to interfere with all the rest of the plant? You don't really trip something and see if the diesel will pick up. That's my understanding, but maybe they do.

MR. CHAFFEE: They had an intermittent problem and their system for testing didn't --

CHAIRMAN CARR: I guess what I'm curious about is in our routine testing -- they gave me a piece of paper this thick on testing of diesels, but at the end I never was really satisfied we were doing the right test. But we ought to take a look and see if we're testing them in the mode that they've got to act in rather than just testing them to see if they run.

I can't -- my personal opinion is we need to really congratulate those operators. They were operating without a full deck of cards. They're the

guys who are there when things go wrong. You can't reach out and get those experts at the moment you need them. In an emergency, the operators have every right in the world to expect all their equipment to work properly. When they don't have, for them to figure out how to get that thing back on cooling and back in 36 minutes was a heroic job, in my opinion. All these other things set aside, everything they reached for went to pot and they finally figured out a way to put it back together anyway. I think that's a commendable operation.

My personal opinion, it's fortunate that that truck driver hit that support without any further damage. As you say, the conflagration of the explosion, the things that could have happened in this incident could have been very serious and could have caused problems. As a result, we've got an opportunity here, for all of us, a real opportunity to learn a lot of things. I don't want us to overreact. As I say, I don't think we can regulate common sense. But if there are some things out there that we can do, then we certainly ought to take action to do them.

So, I'd like to thank the team for its report and for this informative briefing on the loss

of power event at Vogtle Unit 1. I'd also like to express my appreciation to the Vogtle operators who, without that full deck to play with, were able to get their job done to protect public health and safety.

Judging from the report, I know that considerable effort went into the incident investigation team's work and the Commission appreciates the dedication and commitment demonstrated by the team.

I would encourage the NRC staff to apply the lessons learned from the analysis of this event to identify areas in which our license requirements may need modification or strengthening.

Any of my fellow Commissioners have any additional comments?

If not, we stand adjourned.

(Whereupon, at 11:39 p.m., the above-entitled matter was concluded.)

CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON IIT REPORT ON VOGTLE EVENT

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: JUNE 8, 1990

were transcribed by me. I further certify that said transcription is accurate and complete, to the best of my ability, and that the transcript is a true and accurate record of the foregoing events.

Carol Lynch

Reporter's name: Peter Lynch

VOGTLE INCIDENT INVESTIGATION TEAM
COMMISSION BRIEFING
JUNE 8, 1990

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- Assistant Team Leader - William Lazarus, RI
- Member - William Jones, AEOD
- Member - Rick Kendall, NRR
- Member - Warren Lyon, NRR
- Member - Eugene Trager, AEOD
- Member - Garmon West, NRR
- Industry - Paul Dietz, INPO
  - Consultant - Michael Jones, CP&L
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AGENDA

- Introduction
- Factors Leading to the Incident
- Licensee Handling of the Incident and Potential Generic Implications
- Summary

FACTORS LEADING TO THE INCIDENT

- Risk Management of Shutdown Activities
  - Control of Switchyard Activity
  - Redundancy of Electrical Sources
- Diesel Generator Reliability

Switchyard Administrative Controls

- Control of Access to Switchyard
- Storage of Equipment in Switchyard
- Failure to use a Ground Guide
- Conflagration Potential

Electrical Power Supply Redundancy

- Unnecessary Scheduling of Reserve Auxiliary Transformer Maintenance During Mid-Loop

- Technical Specifications Allow Minimum (2 of 4) Electrical AC Power Supplies in Any Shutdown Condition

Diesel Generator Considerations

- Calcon Sensor Failure History
  - Calibration
  - Foreign Material (Pipe Thread Sealant and Metal Fragments)
  - Significant Number of Failures

LICENSEE HANDLING OF THE EVENT AND POTENTIAL GENERIC IMPLICATIONS

- Generally Sound Instincts
- Command, Control, and Communications
- Equipment Hatch Closure Issues
- Diesel Generator Trips
- Emergency Preparedness Considerations
- Shutdown Risk Management
- Guidance to Industry and Precursors
- Coping with an Extended Loss of the RHR System

Generally Sound Instincts

- Closed Containment
- Closed Reactor Coolant System
- Lessons Learned From Generic Letter 88-17
  - Redundant Level Indication
  - Core Exit Thermocouples
  - Alternate Cooling Methods

Command, Control, and Communications

- Problems in Notifying Offsite Authorities
  - Loss of Normal State Notification System
  - Backup and Alternative Methods
- Difficult Transition Between Outage Organization and EP Organization
- Pressurizer Manway Closed Inadvertently

Equipment Hatch Closure Issues

- Hatch Closure Time _ 79 Minutes
- Equipment Hatch Closure Analysis
- No Consideration of Loss of Electrical Power

Diesel Generator Trips

- Understanding DG Controls and Load Sequencer Operations
  - Lockout
  - Reset Methods
- Diesel Generator Annunciator Problems
  - First-Out Indication
  - Alarm Windows
- Calcon Sensor Failures

Emergency Preparedness Considerations

- Classification
  - Uniformity of Implementation
  - Appropriateness in Shutdown
  - Applicability of Guidance to Cold Shutdown Ops
- Personnel Accountability During Outages
- Notification Delays Due to Loss of Power

Shutdown Risk-Management

- Need Better Outage Planning
- Electrical Power Availability During Shutdown
- Volume of Work Increases Risk of Equipment Failure
- Based on TS Rather Than Risk Reduction

Guidance to Industry and Precursors

- Large Number of Events and Guidance
- Loss of RHR During Mid-Loop
  - GL 88-17 Did Not Specifically Address Loss of AC
- Loss of Power During Shutdown

Coping with Extended Loss of the RHR System

- Ambiguous Indication of Core Conditions
- Reflux Cooling Behavior Dependent on Initial Conditions
- Effect of RCS Configurations on Core Cooling Options Not Fully Understood
- Industry Guidelines and Procedures Should be Developed

Technical Specifications

- TS not Tailored to Compensate for Additional Risk in Mid-Loop
  - Containment Hatch Closure
  - Electrical Power Redundancy
- Single-Failure Criterion not Applied to Cold Shutdown and Refueling
- Not Based on Safety Analysis

SUMMARY

- The Event was Preventable
- The Licensee Handled the Event Well
- Generic Lessons
  - Shutdown Risk Management Needs to be Improved
  - Need to Complete Incorporation of Existing Analysis and Guidance into Training and Procedures

SUMMARY
(GENERIC LESSONS - CONTINUED)

- Additional Analysis of Shutdown Cooling Configurations Needed
- Feedback to Industry Needs to be Evaluated
- Classification Problems
- TS Need to be Reviewed
- DG System Understanding and Trip Indication Design Needs Review