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DVD 1/4

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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AUGMENTED INSPECTION TEAM EXIT MEETING WITH SOUTHERN CALIFORNIA EDISON COMPANY

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MONDAY

JUNE 18, 2012

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SAN JUAN CAPISTRANO, CALIFORNIA

DVD 1/4

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The meeting convened in the Community Hall at the San Juan Capistrano Community Center at 25925 Camino Del Avion, San Juan Capistrano, California, at 6:00 p.m., Richard Daniel, presiding.

NRC STAFF PRESENT:

RICHARD DANIEL, Facilitator

THOMAS BLOUNT

ELMO COLLINS

GEORGE CRAVER

EMMETT MURPHY

JOHN REYNOSO

JOEL RIVERA-ORTIZ

GREGORY WARNICK

PRESENT: (CONTINUED)

GREGORY WERNER

ALSO PRESENT:

PETER DIETRICH, Southern California Edison Co.

DOUGLAS BAUDER, Southern California Edison Co.

THOMAS PALMISANO, Southern California Edison Co.

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

(10:10 a.m.)

FACILITATOR DANIEL: (Joins during progress) with you tonight. First gentleman to the right -- we'll start to the right -- is regional director for Region IV, the NRC, Elmo Collins.

Immediately to his left is Tom Blount. He is the acting director for division of reactor safety.

The gentleman in the red shirt is Greg Werner. He is the branch chief in the AIP team lead.

And finally the guy with the good haircut there is Greg Warnick, senior resident inspector.

Peter Dietrich, Southern California, soon I'm going to allow you to introduce your own folks.

MR. DIETRICH: Yes. Thank you. Good evening. Pete Dietrich, the senior vice president and chief nuclear officer for Southern California Edison, and we are pleased to be here tonight to be able to talk about the status of our steam generator situations with concerned members of the public and other stakeholders.

MR. BAUDER: Good evening, Doug Bauder, state vice president, San Onofre.

MR. PALMISANO: Good evening. I'm Tom Palmisano, vice president of engineering, projects and site support.

FACILITATOR DANIEL: Okay. So without further ado, I'm going to turn this over to Mr. Elmo Collins. Elmo?

MR. COLLINS: Thank you Rick. I hope the microphone is working.

FACILITATOR DANIEL: Hang on a second.

MR. COLLINS: Does that sound better? I want to make sure that everyone --

Is this better? I hope everyone can see me. I might need a stool you know, maybe. Maybe a pulpit, you know, like church, but not that, I'm not going to do that tonight. Thank you Rick.

Southern California residents, Mr. Dietrich and other Edison employees, members of the media, NRC representatives, good evening. I think I would also like to introduce to you tonight another NRC representative who is here. This is Tom Hipschman. He is a technical assistant for the NRC chairman -- Tom's in the back there -- the NRC Chairman Dr. Gregory Jaczko. So we are glad Tom could join us tonight for the meeting. Thank you, Tom, for being here.

I want to thank everyone for taking the time to come out tonight to hear the Nuclear Regulatory Commission present results of our augmented team inspection.

I can see we have a large crowd. I trust that represents the large amount of interest that you have here in the results and what's going on at San Onofre.

I expect that many of you had to travel to get here and so I appreciate the time, the effort that you made to come and listen to what you have to say to you tonight.

We all know that both units at San Onofre are shut down because of what has proved to be very difficult technical issues which their steam generators.

And I'll just start tonight by saying, so far these issues are not resolved to the NRC's satisfaction. Understandably --

(Applause)

MR. COLLINS: Understandably, I think there is a lot of concern on your part, and I think that concern is warranted.

For tonight's meeting we are here to present the team's preliminary results to Edison, licensee, and to you tonight, and we are going to talk to you about those results, and NRC is glad to be here to share with you what we know so far at the end of this stage of our review.

This is a different public meeting from what we normally conduct. As Rick indicated, this is an NRC inspection exit meeting. This marks the end of the augmented team inspection which we started several months ago and what you are going to hear tonight are the preliminary inspection results.

There's no inspection report yet. That's to come, we are guessing, in about 30 days. But tonight you will hear what the inspection team found. Additionally, the augmented inspection teams are directed to focus on fact finding and information gathering.

We have not yet made any decisions about the resumption of power operations at San Onofre. Nor have we made decisions about whether violations occurred as a result of that inspection.

Those will be indicated to you, there is requiring additional follow-up -- as follow-up items when the team gives its findings. So I ask you tonight to keep the issues that the team describes within that context, remembering that the issues are not final agency conclusions.

Rick talked about the comment and question period we are going to have after we complete the business part of the meeting. I think, at the risk of

stating the obvious, I know there are a lot of questions out there, and so we are going to be here to answer those questions.

We'll tell you what we know and we'll tell you when we don't know, and we'll tell you when we think more work is needed, and I think the questions are going to fall into all three of those categories.

I'll also just indicate for you, tonight's meeting is what NRC views as the first in a series of public meetings that we are going to have to conduct associated with the follow-up on these technical issues.

We are going to be conducting additional inspection. We are going to be getting submittals from Edison in writing that we'll be following up on, so as they work through the issues and the NRC inspects them, we will continue to conduct public meetings with you.

We do believe additional work by Edison is needed and we do believe additional NRC inspection is needed, and that will have to happen before NRC is in a position to make a decision about the acceptability of a resumption of power operations at San Onofre.

I want to thank you again for being here, and we hope the meeting is informative for you, and with that, I think Tom Blount will introduce the Augmented Inspection Team, and we'll get into our presentation.

MR. BLOUNT: Thank you, Elmo. Is this all right for everyone. I kind of thought we'd go through that. Sorry. I would like to offer my thanks and appreciation for everyone coming out this afternoon, or this evening, as well.

Before we get into the inspection results itself, I did want to take just a couple of minutes and give you some appreciation or perspective regarding the team and the team's background.

We recognize that this is an important and pretty serious issue, and the agency as a whole engaged in this inspection team and provided the resources necessary to support that.

We had support from not only Region 4, but from our four other offices as well, including Research and our Nuclear Reactor Regulation. Region 2 also supplies some support.

Some of the talent that we had on this team included a steam generator tube integrity engineer, a thermal hydraulics specialist, steam generator material engineer, quality assurance and control engineer, design and evaluation engineer, all led by a Branch Chief from Region 4, Greg Werner, who is going to give you the AIT results here momentarily.

This team had over 130 years of total

experience that they brought to the table on this issue, not only as the team was doing their work, but we also had the rest of the agency engaged in supporting our efforts.

So I just wanted you to be aware, we took this very seriously and want to get the right resources to apply to this issue and will continue to do so.

With that, then, I'd like to ask Greg Warnick if he'd give us an overview of the event and the steam generators themselves.

MR. WARNICK: Sure, thank you very much. Good evening. I'd just like to give a high level overview of the steam generator tube leak event, the licensee's response to that event, and what I personally observed on January 31st, 2012.

The San Onofre plant is designed to rapidly detect small amounts of radioactivity, small amounts of leakage from the reactor system to the steam system using sensitive radiation monitors that continuously monitor and sample for radioactivity, samples of steam that makes it way from the steam generator to the turbine generators.

Procedures are in place that should, on indication of steam generator tube leaks, actions are prescribed to put the plant into a safe condition to

protect public health and safety.

Finally, operators are trained on these types of events such that they can quickly diagnose problems, implement procedures and make the necessary decisions to minimize any radioactive release to the environment.

On the afternoon of January 31st, I had just returned to my office from performing a plant tour as part of an inspection. At that time, I heard a PA announcement about a secondary plant system radiation alarm.

John and I, John is a Resident Inspector, we were both in the office. We went directly to the control room when we heard that PA announcement. Our offices are less than 100 yards from the Control Room, so we were there within moments.

Both John and I went there and observed actions to ensure that -- to assess the conditions and ensure that the appropriate actions were being taken. Upon arrival, I determined that the plant had appropriately responded to the tube leak by identifying leakage from the Reactor Coolant System and alerting the operators to the abnormal condition before any licensed release limits had been exceeded.

The operators responded in accordance with

their procedures to accurately diagnose a steam generator tube leak. They accurately assessed conditions to determine that a rapid power reduction and a plant shutdown was necessary.

After the plant was shut down, the operators promptly isolated the affected steam generator to terminate the radiation release and continued on to cool down and depressurize the plant.

Because of the plant design, the established procedures and the skill and training of the operators, SONGS Unit 3 was placed into a safe condition and the radioactive release that did occur was minimized.

Our regional experts have independently quantified the release and concluded that it was only a very small percentage of the release limits allowed by the plant license, such that the release associated with this event did not represent a threat to workers on site, to the public or to the environment. Next slide

(Question off-mic)

MR. WARNICK: Excuse me?

PARTICIPANT: What percentage?

(Question off-mic)

MR. WARNICK: It's a very small percentage and that will be a -- go ahead and bring that up during

the question and answer period and I'll be happy to answer that.

MEMBER OF AUDIENCE: And what was it that was released, what kind of radioactivity?

(Question off-mic)

FACILITATOR DANIEL: Folks, hang on a second. We're going to have a question and answer period of time, comments and everything. Let the gentleman finish his presentation and we will take your questions at the appropriate time, okay? Thank you.

MR. WARNICK: Okay, again to reiterate, I work at the plant every day, went to the Control Room and assessed conditions. I'd like to now just talk briefly about the steam generator function and some of the structural components so that you will understand some of the terms as we go through the balance of this presentation.

The function of -- or the purpose of a steam generator is essentially to make steam out of water. It does this by acting as a large heat exchanger that transfers heat from the primary radioactive system to the clean steam system where it boils water into steam.

Hot radioactive water enters into the bottom of the tube area and travels up through the inside of the tubes, around the U-bend, back down to the cold

side of the bowl area and returns to the reactor to be reheated.

The clean secondary water enters into the steam generator, it flows down around the outside of the tube bundle, it is then directed up around the outside of the tubes of the tube bundle region, where it is heated up, it boils into steam and that steam acts as the top of the steam generator to go to the turbine to make the electricity.

Now I'll point out a few other structural components, just, again, to aid in understanding of terms we'll be using throughout the balance of this meeting.

A divider plate separates the hot and cold bowl areas. That divider plate also helps to direct flow of the primary water up through the U-tubes. It also acts as a support for the divider plate and the steam generator internals.

It is hard to see in this picture, but the vertical section of the tube bundle is supported by tube support plates. Those tube support plates provide structural support to that vertical section.

In this picture, again, it's hard to see but there are small holes throughout the tube support plates. There are several of them that go up through

that vertical section. There are also flow channels throughout the middle of the tube bundle region.

The upper U-bend section of the tube bundle is supported by a system of anti-vibration bars and retainer bars. The steam generators are 65 feet tall, they are 14 feet in diameter and they have a little less than 10,000 tubes throughout them to perform that function of transferring heat to the water.

It was one of these tubes in one of these steam generators, one of these 10,000 tubes that developed a leak, and resulted in the event that I just briefly highlighted, that happened on January 31st.

***time test 103406

FACILITATOR DANIEL: Folks, we are going to take a short break here. Basically we have too many people in the room, over capacity and we are going to take a short break and move some folks out in the courtyard on the side -- over on this side of the building.

So, there are speakers out there and I promise you I will come out and take your questions. So if you could slide out the door. So you folks along the back wall, if you move outside.

(Pause for organization of audience)

MR. COLLINS: I appreciate everyone's

cooperation. I apologize that we have to take this pause and it's a disruption to our meeting, but this is, we have been informed, important for safety, and important for adherence to the fire code. So thank you so very much for giving us this consideration.

(Pause while audience organized)

FACILITATOR DANIEL: Gil Leone (phonetic), could you come back so I can speak with you please? Gil?

(Off mic discussion about facility director and fire code)

FACILITATOR DANIEL: For those folks that are still standing there, okay, all right. We are going to continue. Sign down, please. If you want to hold up your sign, you can go outside and hold it up, but not while you are seated.

(Off-mic remarks)

FACILITATOR DANIEL: I understand, but I asked at the beginning, I asked at the beginning, that signs be held in the back, because we are afraid somebody might get hit in the head. We had that happen in another meeting.

Okay, so -- ready? All right. We are going to hear from Mr. Greg Werner here.

MR. WERNER: Good evening. I am Greg

Werner, the Augmented Inspection Team leader. I am going to go ahead and briefly discuss the decision to conduct the augmented inspection.

During the pressure testing of the 129 tubes on the Unit 3 steam generator, eight of the tubes failed to meet the strength requirements necessary for tube integrity.

Because the teams failed, this resulted in conducting augmented inspection. Even before we made a decision to perform the augmented inspection, two Region 4 inspectors were already on site, accomplishing the Unit 2, in-service inspection of the steam generators.

This was part of the normal NRC inspection program. We always complete an in-service inspection that looks at 100 percent of the tubes after the first outage for a replacement steam generator.

After the tube leak on Unit 3, we also brought in Emmett Murphy from headquarters to assist. Emmett has over 30 years of steam generator experience.

SONGS inspected 100 percent of all the steam generator tubes on Unit 2 and 3, almost 40,000 tubes. The NRC independently reviewed and analyzed the results of the tube inspections and based upon our review of the type of flaws on the Unit 3 tubes and the large number

of tubes with deep wear and over a long length of the tube, the NRC had very good reasons to believe there had been multiple failures of tubes on Unit 3.

So even before the first tube failed, Region 4 was working to put together an inspection team and inspection charter. Because of this, we had inspectors on site during the pressure testing.

The Augmented Inspection Team was initially on site for two weeks. However, the team has continued to review large quantities of documents, including the cause evaluations, the 50.59 evaluations, draft operational assessments, thermal hydraulic and vibration computer simulation models, as well as numerous other documents.

In addition, various team members, including myself, have traveled back to SONGS to observe expert panels on the cause evaluation, computer simulation operational assessment.

To date, the Augmented Inspection Team has expanded well over 1500 hours associated with this issue. Next slide, slide 11.

As Tom Blount mentioned earlier, individuals with specialized expertise were brought in from Region 4, Region 2, Office of New Reactors, the offices of nuclear reactor regulation research at

headquarters in Rockville, Maryland.

I'm going to discuss the key items or objectives that the augmented team was tasked to look at. We developed an event time line to look at the design, construction, shipping, installation and operation of both unit steam generators, reviewed information to determine the causes. We looked at the operational activities on the units to see if there was impacts associated with those. We compared the differences in the design manufacturing between the two units, reviewed quality assurance and quality control associated with the design and manufacturing of both units' steam generators. We also reviewed implementation of the generic communications and industry lessons learned, to see if they incorporated lessons learned that we gathered over the last 30 or so years of steam generator use, reviewed the steam generator simulation models. We also collected information for the NRC risk assessment. We also looked at other areas such as radiological controls that Greg discussed.

One of the key areas that we wanted to understand was the differences between Units 2 and 3. Why was there more wear on Unit 3 than Unit 2, because essentially the designs were identical?

It's important to note that for a number of items we not only looked at what SONGS did, but we also gathered information from Mitsubishi. We looked at what the residents collected during the rapid shutdown of Unit 3. We wanted to make sure that the operators of the plant responded appropriately to the event.

The team looked at hundred and hundreds of documents, including design, manufacturing and operational information. We did our own independent comparison of the information between the units. We compared manufacturing information with design information to check to see if the steam generators are built in accordance with the design.

Where there were differences, we reviewed the justification or the associated change authorizations. Slide 12, please.

Now I plan to discuss what the Augmented Inspection Team found. Throughout the US nuclear industry, this is the first time that more than one steam generator tube failed pressure testing.

As I discussed earlier, because of the failure of the Unit 3 tube leak, 100 percent of the tubes were inspected with subsequent pressure testing of 129 of those tubes on Unit 3.

During this pressure testing on Unit 3, eight tubes failed. The pressure testing identified the strength of the eight tubes was not adequate, and structural integrity might not be maintained during an accident.

It is important that both SONGS and the NRC understand what occurred and why. This is a serious safety issue that must be resolved to prevent further failures from occurring again. This information will be shared throughout the nuclear industry.

SONGS did use multiple independent consultants and steam generator manufacturers. Personally I have never seen such a vast collection of experts working together. They had academia, independent consultants, industry experts from different utilities as well as the industry itself, and they also had four different steam generator designer and manufacturers looking at the issues.

Next slide. These next two items that I'll be discussing are really the most important items that the NRC identified during inspection activities. These are the ones that everybody, including us, were interested in.

Actions will have to be taken to address these to prevent the vibration that leads to the

tube-to-tube wear from occurring again.

The team identified the primary cause of the unexpected tube wear was higher than expected flow velocities in the steam generators.

Early in our inspections, we independently developed a simplified mathematical thermohydraulic computer simulation model of the steam generators in Units 2 and 3.

Using this, we determined that the computer simulation used by Mitsubishi during the design of the steam generators had underpredicted velocities of steam and of water inside the steam generators by factors of three to four times.

San Onofre also had three other steam generator vendors conduct computer simulation. The results of their computer simulation also showed significantly higher steam velocities and confirmed our results.

Now the next item that I am going to discuss deals with the differences between Unit 2 and 3. We looked at a number of different items. However we only identified one item that we could essentially determine as the cause.

The cause of the difference in the tube wear between the Units 2 and 3 is associated with the

manufacturing differences of the tubes and anti-vibration bars.

For Unit 3, the anti-vibration bars do not come in contact with the tubes as tightly as they do on Unit 2, along with the higher steam and water flows created to the conditions necessary for the high vibration.

So essentially the tubes are not held in place securely enough so it allows them to slide or vibrate. SONGS has continued to analyze and develop additional actions to fix and prevent this from happening again. Next slide.

Now what I'd like to talk about is the item or the items that the team identified that require additional follow up. However on this 10, we only -- we believe that only two are related to the tube-to-tube wear. I am just going to very briefly discuss these items.

There's a post trip and transient procedure. SONGS did not conduct a formal review of the reactor trip because they considered a plant trip when they shut down the unit. So we are going to look at the procedure as well as the operator actions to assess if it was appropriate.

We are going to evaluate and disposition,

look at the numerous Unit 3 loose part monitor alarms. The NRC needs to review how these alarms were evaluated. We do have concerns that the alarms were treated as what we call nuisance alarms, versus being evaluated in accordance with procedures.

The retainer bar design was not evaluated for vibration impacts. Although this sounds familiar, this wear is not related to the tube-to-tube wear. We are reviewing the design basis of the retainer bars.

We are also going to look at the evaluation of and control of the Unit 3 divider plate repair. This by far was the most significant difference between the two units and it has been discounted as a potential cause for the tube-to-tube wear.

The bowl of the steam generator that directs the reactor fluid into the tubes as well as the plate that separates the hot and cold reactor coolant had to be cut out, repaired, re-welded and re-tested. Again, we did not identify an issue related to the tube-to-tube wear for this repair.

Unit 3 steam generator shipping requirements were changed form what was required as compared to Unit 2. There's nitrogen pressure, dew point, and oxygen contents were not controlled or monitored. These items are supposed to be controlled

to minimize corrosion of the internals of the steam generators.

Item number 6. Lack of tube bundle support for the steam generators during shipment. The shipping specification did not initially have a requirement for a tube bundle support, or it have a requirement for tube bundle support, but it was not used during shipment. So again, we are going back to look at that to see how that was dispositioned.

We are going to look at the shipping accelerometer data for Unit 3. Steam generator 88, which was one of the generators for Unit 3, had all accelerometers register an excessive force, which could indicate mishandling during the transportation of steam generators. The NRC was not able to determine if this was properly reviewed.

We are looking at the 50.59 adequacy. The NRC is continuing to review the adequacy to SONGS 50.59. We did identify a concern with the potential for using a different methodology than what was described in the updated final safety analysis report.

SONGS changed their structural analysis method as well as a tube-stress calculation, and we need to do some additional reviews on that to determine if they should have asked for an amendment.

The next two follow-up items, number 9 and 10, are the ones that the NRC believes are related to the unexpected tube wear. As I discussed previously, the manufacturing differences, Mitsubishi improved the manufacturing process, which sounds like it should be good.

However, they didn't go back and look and see what that would do to the original design dimensions. They didn't go back and compare, should they have reviewed, revised, shrunk the design dimensions. So this resulted in a less rigid tube bundle, which contributed to the vibration issue.

And as I discussed before, item number 10, the computer simulation model. Again, the Mitsubishi model underpredicted the behavior of the steam and water in the steam generators.

Again, as described earlier, the combination of those two, the higher than predicted steam water flow and the less rigid tube bundle for Unit 3, they vibrated and caused the tube-to-tube wear.

The NRC will be conducting additional inspections to review each of these issues. We have been and will be requesting additional information from SONGS as part of our follow-up inspection activities.

This completes my discussion of the

augmented inspections activities. I'm going to let Tom Blount, turn it back to him. He's going to summarize the key points associated with this inspection. Thank you.

MR. BLOUNT: Thank you, Greg. So what we'd like you to walk away from this inspection understanding, is the NRC does understand what the mechanistic causes of the tube degradation are. The thermal hydraulic conditions were not accurately predicted during the design phase.

However, additional actions, as Greg has pointed out, additional actions are being evaluated and developed by the licensee, and these additional actions will need to be inspected by us to ensure that this condition will not exist in the future.

The NRC is not done. We have not reached any conclusion. We have got more inspection to do. We recognize that and we want you to understand that we recognize that. We'll take as much time as necessary to ensure safety, the safety of these facilities, and no decision to this point has been made. Okay?

With that, I'd like to ask Pete Dietrich if he'd like to provide his response.

MR. DIETRICH: Thank you, Mr. Blount. I'm Pete Dietrich, the Senior Vice President and Chief

Nuclear Officer for Southern California Edison.

In our comments tonight, we'd like to update you on the actions Southern California Edison has taken and will take as we work to completely understand the conditions of our steam generators and the effect on San Onofre.

I'll make some opening remarks and then Doug Bauder, our site vice president, will provide some comments about the current conditions of the units, the planned response to the tube leak and our learnings, because we are a learning organization. We learn from all things that occur in our facility. But Doug will discuss our learnings in the area of our response.

Then Tom Palmisano, the vice president of engineering, will summarize our technical evaluation and the conclusions that we have reached to date. Much work has been done, yet we still have much work to do to fully understand and address what we have learned. And then I will provide some closing remarks.

Just to start with, Southern California Edison's overriding interest is the health and safety of the public and our employees. Consequently, both San Onofre units are shut down and will remain shut down until repairs have been made and we and the Nuclear Regulatory Commission are satisfied it is safe to

operate.

We are disappointed that the situation has occurred and we recognize the impact on our stakeholders, including customers of Southern California Edison, San Diego Gas and Electric and the City of Riverside. We are also concerned about the concerns that you have, members of the public and also our neighbors.

So Southern California Edison understands the significance of the unexpected tube-to-tube wear, and we agree with the facts presented tonight by the Nuclear Regulatory Commission.

We appreciate the NRC's insights into this situation and we pledge to continue to work with the NRC to assure any remaining or additional questions are answered promptly.

Early on, we recognized the seriousness of the situation. As a result of the complex technical nature of the wear, we recognized that we needed to assemble the very best team to augment our resources and the resources of the steam generator designer and manufacturer, Mitsubishi Heavy Industries.

As a result, we have brought together experts in thermal hydraulics and steam generator design from around the world to help us gain an understanding

of the causes of this unexpected tube-to-tube wear and potential corrective actions to address it.

The experts include such subject matter experts from companies such as AREVA, Westinghouse and B&W Canada. We have used this assembled team, as well as other industry experts and consultants, to review the progress of our work and challenge the thoroughness and adequacy of our conclusions. And we will continue to do so.

With that, I'd like to turn it over to Doug to discuss the current status of the units and our response to the tube leak.

MR. BAUDER: Thank you, Pete. I would like to cover the current status of the San Onofre units. Unit 2 remains shut down since January the 9th when we started our planned refueling outage, an outage that included a reactor vessel head replacement and planned, full-scope testing of our Unit 2 steam generator tubes.

On January 31st, the San Onofre operators shut down Unit 3 in accordance with plant procedures after detection of a very small tube leak on that unit.

Their actions demonstrated the right, conservative decision-making and focus on protecting the health and safety of plant personnel and the public.

I observed from the Control Room our

operators' response, and I was pleased with their calm, deliberate approach to properly quantifying the leak and the execution of our plant procedures to safely shut down the plant.

In fact, in my discussions with the operators after the event, they told me the plant response lined up with their experience and training on our simulator where they frequently train --

(Sound system interference)

MR. BAUDER: I'm going to switch mics. Everything okay over there? That would be a no.

(Off-mic discussion)

MR. BAUDER: Thank you. So yes, to catch us back up. In my discussions with the operators following the shut down on January 31st, they confirmed with me the planned response matched what they were trained for and evaluated for in our plant simulator. And that evaluation is frequently done before our operators for steam generator tube leaks.

As a learning operation -- organization, we have reviewed our plant equipment, our procedures and our operator training programs as a result of the shut down on January 31st.

We have improved our leak detection capability. We have enhanced our operator training

programs and built the lessons learned from this event into our plant simulator training activities.

We have also reviewed the post-shutdown critique process and we have enhanced the procedures that tied the post-shutdown critique process to any plant trip.

Also, we have shared this information with the industry. As Pete indicated, we are a learning operation. We are all about learning, building things back into our processes and sharing them with the industry.

In conclusion, our operators took prompt, conservative actions to shut down Unit 3, placing the very highest priority on protecting the health and safety of the public.

At this point I would like to turn the presentation over to Tom Palmisano to talk through insights and perspectives on open items, as well as Southern California Edison's technical work so far on our steam generators. Tom.

MR. PALMISANO: Okay. Thank you, Doug. Can you hear me okay in the back? Great. Thank you. What I would like to do is provide an update on the technical work to date on our investigations, and talk about some of the upcoming actions that we have in place.

And as Pete Dietrich has said and the NRC has said, we have more work to do. We realize that. And we're being very deliberate and conservative in our approach to our work.

So first, Mr. Warnick did a good job of giving you an overview of the steam generator's function of the plant design and the steam generator design itself. I just want to point out a couple of things.

Tom, if you highlight the steam generator. Two key functions we're talking about tonight. One is the transfer heat from the radioactive primary system to the secondary side to boil water to make steam that ultimately turns the turbine and generates electricity.

The other key function, and particularly from a safety standpoint, is the function of the steam generator tubes to prevent radioactive primary water from leaking to the secondary side. So, those are the two key functions we are focused on in this discussion and in our current work. Next slide please.

In this slide, a cutaway of the steam generator, we have already explained, or the NRC has already explained the flow path. Just let me reiterate it.

The hot radioactive water comes in through what's called the hot leg at the bottom, flows up through

the steam generator tubes, around the U-tube bend, the top of the tubes, and down through the remaining straight portion and out the cold leg.

The heat from that water is transferred to the secondary side to boil the water to make the steam that exits the top of the steam generator. Of particular importance tonight is what's labeled the U-bend section. This is where the tube-to-tube wear has occurred that caused the tube leak in one of the tubes, and also caused the damage in the other tubes that caused us to do the in situ pressure test and caused the test failures.

So it's the very top of the U-bend that we're going to be talking about where the tube-to-tube wear has occurred. Thank you, Tom. Next slide, please.

So, let me kind of summarize the actions to date at this point. Following the Unit 3 shutdown on January 31st, we performed a comprehensive and rigorous inspection of all 19,454 steam generator tubes in the two Unit 3 steam generators. Each steam generator has 9,727 tubes, roughly 10,000 tubes per steam generator. So we did a comprehensive inspection of all of them.

We've reviewed these inspection results with industry experts and identified the cause of the

tube leak as unexpected tube-to-tube wear. This wear caused one tube to leak and caused the other eight tubes -- there were eight tubes that we talked about -- to fail the in situ pressure testing.

Further inspection showed wear on 326 of the these 19,454 tubes. So I'd like you to have that perspective with those numbers. The wear is in a very localized root area of that upper tube bundle we saw on the previous slide, and based on the finding of this unexpected tube-to-tube wear, we elected not to restart Unit 2. Unit 2 was in the process of completing a refueling outage, had already had all of its tubes inspected, and was in satisfactory condition to operate. We elected not to restart Unit 2 at that time.

We wanted to make sure, given the unusual nature of this tube-to-tube wear in Unit 3, that we took every opportunity to inspect and test Unit 2 to help us understand what was going on with the Unit 3 steam generator tubes. We felt that was very important.

Recognizing the significance of this unexpected tube-to-tube wear, we assembled a team of experts to assist Southern California Edison and Mitsubishi, the steam generator manufacturer.

You have heard this discussed by the NRC and by Pete Dietrich, and in a minute, I'll talk more

about that panel.

To date we have now completed extensive tests and analysis. We have done over 60,000 tests on steam generator tubes in both Units 2 and Unit 3 and have performed significant analysis of the test results to understand the cause of the tube-to-tube wear.

As has been pointed out by the NRC, it's significant to note there are differences between the two units. Unit 3, which experienced the tube leak, had 326 tubes damaged by this tube-to-tube wear. Unit 2 had only two tubes which showed minor indications of tube-to-tube wear, so small it was almost undetectable. It was our rigorous re-testing that identified two tubes that had minor indications.

So Unit 2 is in much better condition than Unit 3. The comments that Mr. Werner had about the differences in the manufacturing tolerances between the units explains partially why Unit 2 is in much better condition than Unit 3 is with respect to tube-to-tube wear.

Next slide. The expert panel. This is significant. You know, in any outage, we start with our own expertise. We start with the manufacturer, Mitsubishi Heavy Industries.

And as we realized the significance and

usual nature of this tube-to-tube wear, we stopped and we formed a group of experts to assist us both onsite and off-site and in expert panels.

We have brought in Areva, Westinghouse and B&W Canada. All of those firms design, manufacture and test steam generators. They are competitors to Mitsubishi.

(Off-mic question)

MR. PALMISANO: Babcock & Wilcox, Canada. Yes. B&W, Canada. We brought in MPR Associates, which is a leading problem-solving firm, both in the nuclear and non-nuclear industry, renowned for their ability to deal with difficult, technical issues.

We immobilized EPRI, the Electric Power Research Institute. This is the electric utilities industry's research group where we do cutting-edge research across the board in the electric utility industry, including nuclear. This is where we share technical information, and in the nuclear side, we maintain some technical standards that we operate and maintain our plants to, particularly for steam generators.

We also brought in other industry personnel from sister utilities with similar steam generators with good expertise to assist us, and as has been mentioned,

some recognized academics and consultants who do serious research in thermal hydraulic analysis, vibration analysis, and steam generator testing.

So, we have assembled a team, and I think it has been alluded to, this is virtually an unparalleled effort in the industry. The sharing, the cooperation, the critical nature of this work has been the best I have seen, and I think Mr. Werner's comments have echoed that.

Now, the team was established not just to assist us, but to also challenge our work. We wanted to make sure that we put in place not just getting good, solid technical assistance, but a good critical challenge.

We used an expert panel board process. The team forms up on site every three to four weeks, and we spend one to two days reviewing the result of our work to date, making presentations, getting critical comments and getting some redirection, if you will, on things that they feel we should investigate more fully.

They have turned out to be quite valuable and we are continuing their use through our remaining technical work and our restart decisions as we formulate our final plans.

Next slide. So what have we determined in

terms of cause? The specific mechanism -- you have heard the NRC discuss this, and I'll use the term -- it's called fluid-elastic instability.

Basically, that is causing some of these tubes, these selected tubes, to vibrate excessively to where they are contacting adjacent tubes. That is not the way these steam generators are designed to operate. It's a vibration mechanism that should not be occurring.

We see this. This is causing the excessive wear and it's in this limited area of the Unit 3 steam generators. It is caused, this fluid-elastic instability or tube vibration, is caused by high steam flow velocities -- and this has already been alluded to -- very dry steam, in other words, very localized areas where there is very dry steam, very little liquid as the water is boiled to steam, and inadequate tube support structure, that anti-vibration bar structure, in the U-bend region around these tubes that are experiencing wear. The tube support structure is not providing sufficient restraint.

So a combination -- high stream flow velocities, very dry steam and the interaction with this tube support structure in the Unit 3 steam generators. Again, we do not see much evidence of this phenomenon

in Unit 2 because Unit 2 clearly has a tighter tube support structure than Unit 3 does.

Our findings correlate very well with the NRC's comments on the thermal hydraulic analysis. These conditions were not predicted clearly during the design phase to be as severe as they are. We are in agreement with the NRC's conclusions on that. And also, the differences between Unit 3 and Unit 2, likely due to manufacturing tolerance differences and manufacturing process differences, seem to explain the difference between Unit 2 and Unit 3, and we are in agreement with the NRC's Augmented Inspection Team on those.

Now, we have a good understanding of the cause of the tube vibration which causes the tube-to-tube wear. Our expert panel has reviewed this several times. They have challenged us and they are in concurrence with our conclusion as far as what is causing the tube-to-tube wear.

Next slide, please. So, the next steps. And again, I'd like to emphasize something you have heard Pete be very clear on and the NRC say, we are taking as much time as necessary to ensure this is understood and that this is properly corrected. So that has been a theme from the start of this investigation.

So, we are following up with the Augmented Inspection Team's additional request. Two of their open items clearly are related to the cause. They have legitimate needs for more information on the other open items and our team is supplying that information as it becomes available and working with the inspection team.

We are designing and implementing our corrective actions to prevent this tube vibration from occurring, based on our understanding of the mechanism.

We are developing additional information as stated in the Confirmatory Action Letter which we committed to prior to restart that we know we need to submit, and we are continuing to work to develop intermediate and longer term solutions to this problem.

As Pete said, we are disappointed in this and we are working on longer term solutions. And those longer term solutions will require extensive analysis, mock-up and testing prior to being implemented.

In summary, we have identified the cause of the unexpected tube-to-tube wear. We are in agreement with the comments as discussed by the NRC tonight.

We continue to take a rigorous, deliberate and conservative approach to completing our remaining actions, and we are taking as much time as necessary

to insure safety.

With that, let me turn it back to Pete Dietrich.

MR. DIETRICH: Thank you. By bringing together experts in thermal hydraulics and steam generator design and --

(Sound system interference)

MR. DIETRICH: tests and analysis mentioned by Tom Palmisano, we have determined the cause of the unexpected tube-to-tube wear.

We are working on different options and solutions for the future. We have

(No audio)

MR. BLOUNT: Thank you, Pete. We appreciate those comments. Looking at our path forward, it's important to note that the NRC still has much more information to review. The cause evaluation has been completed by SONGS and they are working on additional actions to prevent the tube-to-tube wear from occurring again.

We currently do not know what the final actions will be. So for the NRC to speculate on what is going to occur would not be appropriate. However, I will tell you what we do know.

We continue to review information as it

becomes available, and as the Augmented Inspection Team continues to review information, we ask SONGS additional questions, and we request additional information, as you have heard.

Our inspection will continue until we are satisfied we have sufficient or enough information to make a determination. Based on the Confirmatory Action Letter, we will have to complete additional inspections once SONGS informs us that they --

(No audio)

MR. DIETRICH: letter before we will go out and do those inspections.

Portions of our AIT team will be called upon to go out and do follow-up inspections on the 10 items that we discussed earlier that were identified as part of this inspection.

The NRC does plan to have additional public meetings to keep you informed of our activities. As part of our plans, we will have meetings with SONGS designed to present their readiness plan associated in response to the Confirmatory Action Letter.

After we have completed our inspection, we will have another meeting to discuss the results of that inspection. In addition, there are some type of public meeting and press conference that will be held by the

senior management, NRC senior management, to discuss any future NRC decision about the acceptability of resumption of power operations. That decision will be based on discussions with both the Region 4 and NRC headquarter senior management.

And finally, as part of our normal process, and how the NRC does business, we look back at our inspection program and we look to see, are there things out of this event that we should have seen earlier? Are there processes that we should have been engaged in, to help us learn how to get better at what it is that we do? Is there something that we could have been doing do better, or looking at, prior to this event occurring, that would have precluded that event? That is also to help our inspection efforts going forward.

So with that, I'd like to turn it over to Elmo Collins for closing remarks. Elmo?

MR. COLLINS: Well, thank you, Tom. To conclude the business portion of the meeting, I will say thank you to the residents of California for being here tonight and thank you for listening attentively.

I have been quite

(No audio)

MR. COLLINS: how polite and how patient you have been as we move through a lot of information

tonight. So I thank you for that.

I want to thank this Augmented Inspection Team that we have talked about. A lot of hours of work has gone on of people with high expertise. And so I am glad we were able to hear the results of their inspection and I hope it was informative for you.

I want to thank Edison, Mr. Dietrich, for your presentation and response to the information you shared with us. And lastly, I probably would be remiss, if we didn't all express our appreciation to the representatives from the Orange County Sheriff's Office who are here looking out after our safety. So give them a round of applause.

(Applause)

MR. COLLINS: I know --

(No audio)

FACILITATOR DANIEL: Thank you Elmo. you, Elmo. Thank you Southern California Edison and NRC. Thank you audience, ladies and gentlemen, for being so attentive, as Elmo --

(No audio)

FACILITATOR DANIEL: We are going to take a --

(No audio)

FACILITATOR DANIEL: We are going to start

back at 7:20 sharp with a question and comment period. In the meantime, Mr. Collins is going to be doing a media interview, I believe --

(No audio)

FACILITATOR DANIEL: Enjoy the break. We will see you at 7:20. Thank you.

(Whereupon, at 11:17 a.m., DVD 1 ended)