UNITED STATES NUCLEAR REGULATORY COMMISSION

BRIEFING ON REACTOR MATERIALS ISSUES

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Monday

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The Commission convened at 9:30 a.m., Dale E. Klein, Chairman presiding.

NUCLEAR REGULATORY COMMISSION

DALE E. KLEIN, CHAIRMAN

GREGORY B. JACZKO, COMMISSIONER

PETER B. LYONS, COMMISSIONER

KRISTINE L. SVINICKI, COMMISSIONER

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ALEXANDER MARION, Executive Director of Nuclear Operations and Engineering, Nuclear Energy Institute

JEFF GASSER, Executive Vice President and Chief Nuclear Officer, Southern Company and Chairman, Materials Executive Oversight Committee, NEI

JOE HAGAN, FENOC, President and Chief Nuclear Officer, FirstEnergy Nuclear Operating Company and Chairman, EPRI PWR Materials Management Programs Executive Committee

PANEL 2: NRC STAFF

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

CHAIRMAN KLEIN: Good morning. This morning we're going to have two sessions, first, by Industry to hear about the nuclear materials aging and then this afternoon we'll hear -- after this, we'll hear from our staff -- not this afternoon, but after your presentation.

Obviously, the NRC pays a lot of attention to aging and degradation issues. We do it not only in the license renewal, but we also do it in the examinations that we conduct on a yearly basis. Obviously, the plants are aging, so it's very important for us to watch the materials.

I think it's important for industry to watch the aging issues on a day to day basis and also to look at where you might be able to prevent the degradation activities. Aging is just a fact of life, but we need to stay attuned to that.

It's interesting; while I've been here there have been two issues that have come up. One is the circumferential cracking on pressurizers and also the water induced stress cracking that's there. So, clearly this is something that we need to stay attuned to. So, we can't prevent it, but we can certainly stay attentioned. And so, hopefully you all will watch that as well as the regulatory side.

Any comments before we start?

COMMISSIONER LYONS: Looking forward to the briefing.

CHAIRMAN KLEIN: Jeff? Or Alex or whoever is going to start.

MR. MARION: I'll start.

CHAIRMAN KLEIN: I usually look at the victim right across from me.

MR. MARION: Good morning, Chairman Klein, Commissioners' Lyons and Svinicki. I appreciate the opportunity to introduce the industry activities related to the management of materials issues. This has been a very important and significant undertaking by the industry and my objective today is to provide you an overview of our commitment as an industry to establish a pro-active integrated and coordinated approach relative to the management of materials issues. Next slide, please; the second slide.

In our briefing this morning, we have three of us here, obviously. To my right is Mr. Jeff Gasser, who's Executive Vice President and Chief Nuclear Officer of Southern Company. He's also the Chairman of the NEI Materials Executive Oversight Committee.

Next to him is Mr. Joe Hagen, President and Chief Nuclear Officer of First Energy Nuclear Operating Company. He is Chairman of the EPRI PWR Materials Management Executive Committee. Both of these individuals will provide an overview of the activities that fall within their area of responsibility. Next slide, please.

I don't know what the problem is with the presentation. There it is. Is that okay? All right.

Materials issues continue to be one of the top priorities for the nuclear energy industry. In May 2003, we undertook a materials initiative. What an initiative entails is an endorsement by the industry Chief Nuclear Officers of a particular specific course of action and consistency in implementing action in that regard.

It essentially amounts to a commitment within the industry of a unified approach in dealing with a particular issue, a particular policy matter or a particular strategic activity. This initiative is extremely important to the industry and we have been implementing the materials initiative since 2003 and we'll hear details about that over the next few minutes.

At this point, I'd like to turn it over to Mr. Gasser.

MR. GASSER: Good morning, Chairman Klein and Commissioners. I appreciate the opportunity to come talk to you about the industry activities associated with managing primary system materials integrity. First slide.

What I'm going to try and do is give you a high level overview of the materials initiative and the kind of guidance documents that the initiatives produce and how the industry is planning for the future and summarize those results.

My main message to you is that across the industry senior executives are involved in this initiative to ensure safe operation by ensuring the structural integrity of primary system materials. And we are looking to improve performance and we actively share operating experience and learn from each other. And I think that the materials initiative has also helped us improve and continue to communicate effectively with NRC staff. Next slide.

Again, the background of -- the NEI Executive Committee issued a resolution in 2002. A comprehensive self assessment of the materials programs across the industry was performed and out of that some improvements -- significant improvement needs were verified. Those recommendations are listed there.

It established executive oversight groups. It improved the role of INPO in ensuring excellent performance in carrying out these initiatives and improved communications. Most importantly it improved the funding for those materials initiatives.

Just so you know, the way the initiative process works is action is brought before a group of Chief Nuclear Officers at the Nuclear Strategic

Issues Advisory Committee or NSIAC of NEI and it requires an 80% affirmative vote to adopt an initiative. Once that is adopted, all utilities are committed to taking on that initiative. This materials initiative received a unanimous 100% vote when it was adopted. Next slide.

The initiative provides consistent process. It prioritizes materials issues across the industry. It has allowed us to start taking pro-active steps to managing primary system integrity and these approaches are coordinated and it provides the right level of oversight both from a technical level and an executive level.

And what this is allowing us to do is continue with safe, reliable operations from a primary system materials perspective. Next slide.

It's our view that the materials initiative is working and has been very successful. The industry codes and regulatory requirements provide high assurance of structural integrity. The industry documents that have been published and adopted by the materials initiative establish additional inspection guidance beyond code and regulatory requirements and provide even greater margin. And the expectations for these documents, these guidance documents, are well understood and communicated across the industry. Next slide.

To try to give you a little bit of understanding of what this materials initiative is and how we're organized. Aligned under this initiative is the

Materials Reliability Project, the PWR Owners Group Materials Subcommittee, the BWR Vessel Integrity Program, the Steam Generator Program, Non-Destructive Examination, Water Chemistry Control, and Primary Systems Corrosion Research. Next slide.

So, the governance and oversight of those activities on the bottom block on this slide are the issue programs I just mentioned on the previous slide. Each of those issue programs has an Executive Oversight Committee that provides direction and guidance and funding for that issue program.

Those issue programs report to the Materials Executive Oversight Group, of which I am the Chair. That group consists of some Chief Nuclear Officers. It also consists of the primary vendors that provide NDE and work on primary system materials and it includes INPO.

This group, the MEOG, we are accountable to the larger group of Chief Nuclear Officers at NSIAC and we report on our activities and requirements to the larger group of Chief Nuclear Officers. Next slide.

Now, to break that down further, the materials reliability steam generator management, BWR vessel integrity and PWR Owners Group Materials Subcommittee, they develop the guidelines that are issued and implemented by the utilities. Next slide.

The other three issue programs, Non-Destructive Examination, Corrosion Research and Water Chemistry Control, their roles are limited strictly to support and research that forms the knowledge base upon which the guidelines that are developed and implemented are based. Next slide.

So, the NEI 03-08 guideline, it applies to all of the programs that involve primary system materials. It defines the expectations for how we manage material integrity. It establishes policies and oversights, defines the roles and responsibilities and ensures that we have an integrated approach throughout the industry in both research and development and inspection and repair activity when it comes to primary system materials. Next slide.

As we've gone through the implementation of this initiative, we've learned lessons as we've gotten field results and we have provided an addenda to that guideline that includes how we handle emergent issues that we find in our plants. It includes a strategic plan and performance metrics and provides for a self assessment protocol to periodically review how the initiative is working and what steps we need to take to continue to improve it. Next slide.

I think a key element is that when the initiative was adopted, we were in a position of being reactive at that point in time. Since 2003, we've established a strategic approach that defines the industry's priorities and objectives. We have both intermediate and long-term issues that we are working on.

It has identified gaps in NDE technology that we want to improve on, gaps in inspection criteria. As we identify those gaps they become prioritized into what is called the Materials Matrix and Materials Issues Management Table. That's how we identify the open issues, prioritize them and fund them, which gives us a strategic approach over the long term for ensuring primary system materials integrity. Next slide.

So, the results that we're seeing are first of all a very high level of commitment at the senior executive level. The structured assessment guides the priorities for our funding and our research and development activities. We have improved the guidance documents that the industry is implementing.

The industry has developed significant advancements in our inspection capability. And all of this ensures we do it in a high-quality way by including INPO in an expanded role doing what's called INPO review visits. And during these, INPO teams come to sites and they review our implementation of primary system integrity guidance, steam generator management and BWR vessel integrity guidance documents. Next slide.

Overall, the industry since 2003, we have invested over $300 million in research and development on primary system materials integrity. Also since 2003, these efforts have resulted in no challenges to plant safety since the materials initiative was adopted.

The aggressive inspection schedules that we're implementing across the industry has resulted in us finding problems while they're still small before any structural integrity limits are challenged. Next slide.

To give you an idea of one of the more pressing issues that we've been working on is the PWR primary system piping inspections for the nickel alloy butt weld. In the spring of this year, all plants were complete with either inspecting or performing weld overlays of the pressurizer dissimilar metal butt welds.

By the end of this year, welds in the 4-inch to 14-inch diameter will have been inspected or overlaid and then '09 the larger hot leg welds and 2010 the welds in the cold leg will have been inspected. So, a very aggressive schedule that the industry is committed to implementing and the results have been no challenges to structural integrity. Next slide.

So, our expectations for the industry are that we'll continue with a pro-active approach to materials research and development. We are implementing this integrated materials plan that is prioritized. We're implementing program guidance documents as they are developed and published.

We continue to support the programs with funding and performing periodic self assessments to ensure that we're measuring ourselves and getting the results that we expect. Next slide.

In summary, industry executives are committed to ensuring structural integrity of primary system materials. We are resolving challenges that we discover while maintaining safe and reliable operation.

We are continuing to improve performance, particularly in the area of non-destructive examination capability. We openly and quickly share operating experience and we have been effectively communicating with the NRC staff to keep the staff informed of our activities so they can perform their regulatory obligations.

And if there's any questions, I'll be glad to take them before I turn it over to Joe.

CHAIRMAN KLEIN: I'm sure we'll have some later.

MR. GASSER: Okay.

CHAIRMAN KLEIN: Joe?

MR. HAGAN: Good morning, Chairman and Commissioners. I'm glad to be here this morning to provide a briefing for a lot of the work that we've been doing in the industry in terms of materials. Next slide.

What I'd like to do is just kind of summarize what is the EPRI, which is the Electric Power Research Institute and the PMMP, which is the PWR Materials Management Program. Touch on the materials issue programs that we have and then provide a briefing on some operating experience -- recent operating experience. Next slide.

The structure itself is highlighted in blue here is the PMMP or the PWR Materials Management Program. We report to the EPRI Nuclear Power Council. It really is an EPRI organization that has the involvement of all the utilities in terms of what we're doing in the materials area.

I chair the PMMP and all the PWR utilities are members of the PMMP. So, we have a number of meetings a year every year. We have monthly phone calls. I think probably the most important lessons that I've seen is the value of communications in terms of what we are seeing in the industry.

Some examples of that. We're doing steam generator inspections right now -- and RPV head inspections at Beaver Valley. We have found an indication of one of the thermocouple penetrations and the industry knows that already. We have not completed the exams, but when we find things they're reported on a real time basis. So, the industry is aware of what we're seeing.

On the other side, I see it coming in from other utilities myself in terms of what experiences are out there; what are we finding? Next slide.

Some of the priorities that we have as Jeff mentioned. We're trying to be forward looking here in terms of what the issues are and really understanding what the reactor cooling system environment does in terms of materials. We have a lot of protocol in place.

We have initiatives in terms of mitigation that the membership is aware of. They know what the expectations are. We're also working with the Advanced Nuclear Technology, the acronym ANT there, it's also an EPRI initiative, to take the lessons learned from the current fleet and apply them into the materials area for the new reactor designs. That's one of the initiatives that we have in place and EPRI is leading that with utility involvement. Next slide.

Regarding the operating experience, we do require consistent expectations for communicating within the different companies. We try to be timely and have useful information that we supply to the members.

We've seen steady improvement in terms of communications within the industry. As things are found as we describe -- the latest experience, for example is Beaver Valley. We get that information on a real time basis.

We do have formal protocols in place in terms of what steps to follow, which have been supplied -- handbooks that have been supplied to the industry. The members follow those. We have a consistent approach to how we resolve issues. Next slide.

As far as operating experience -- we'll go to the next slide.

Recently at Davis Bessie we did have a decay heat line that we were doing a structure weld overlay on. During that process, we noticed moisture on the weld. We stopped the welding process. We notified EPRI. We notified the PMMP and we notified the NRC in terms of what the next steps were.

And we formed a problem solving decision making team, which actually followed the protocols that are available to the industry. Next slide.

What we found with confirmatory ultrasonic testing was a 1.3-inch axial flaw, which was attributed to primary water stress corrosion cracking. It was what we expected it was and we verified it was an axial flaw.

We actually did a repair in accordance with the established protocol and then went ahead and did the structural weld overlay. Next slide.

Lessons learned. What we found here and we included this in the protocol now to the industry is you need to do a thorough review of the weld history from construction. What we found with this particular weld is if we had done that I think we would have been a little more aware that we may have found an issue when we were doing the weld overlay.

We found that this particular weld, although in accordance with the code, had a lot of rework during construction. So, that's probably what we feel set it up for a stress condition and would have resulted in the primary water stress corrosion cracking that we saw.

EPRI was key in our communications and also key in terms of developing the NDE technique which allowed us to properly characterize the weld flaw that we found. Next slide.

The other operating experience we're going to cover is the St. Lucie pressurizer nozzles. As I'm sure you know, the nozzle was retired from the St. Lucie plant when the pressurizer was replaced, which was part of the program they have for managing materials.

The preliminary NDE was done to see whether there was an area of interest in the nozzle and it was done in a manual fashion; 19 points were taken. We had a plan laid out to do further examination if, in fact, we had found an indication in this weld. Next slide.

Once we did identify that there was an area of interest, we had two separate approaches. One was NDE and the other was an analytical or finite element analysis. That was reviewed to make sure that it was still valid.

We did determine that the defects were not structurally significant and there were no safety concerns. We believe we had a rapid and thorough industry response, which I consider to be a strength, and that was just an example of communication improvements we have made.

The overall analysis that we did, which was in that one week period was completed at a cost of about $1.6 million to thoroughly examine that weld. Next slide.

What this shows is the initial sketch that was done from the manual 19-point NDE that was performed on the nozzle. The red line that's shown -- you can probably see it better on your drawing. The red line was the initial analysis from the level three just based on the manual UT results.

Based on what we saw here, we determined that further NDE was required. We did the encoded phased array and we also did traditional radiology to determine that it was not a flaw as originally projected on the red line, but a series of code permissible indications that were in this weld during construction.

So, I think the initial response and the plan we had laid out I think was understandable from the NRC standpoint. I think the staff convinced us to accelerate our testing. There was testing that was laid out for this, but it would have been a longer time frame.

So, I think the staff -- their insistence that we accelerate this was appropriate. Where we are now is doing destructive examination of this weld and those results will be available shortly. In fact, they're getting confirmation right now from independent level three examiners. And I will brief the NSIAC on those results in June.

Of course, we will share those results with the NRC. We are doing this in cooperation with NRC Research. So, you'll have that information at the same time we do.

With that, I'll turn it over to Jeff who's going to brief you on the Farley Nuclear Plant and their experience.

MR. GASSER: I'm going to talk a little bit about some Southern Nuclear specific operating experience in the area of primary system materials. First, I think that we have demonstrated our commitment to proactively addressing these nickel alloy materials issues. At Farley, we replaced all of our steam generators in 2000 and 2001. We also replaced our reactor vessel heads in 2004 and 2005. And we've taken on these significant capital replacement projects to improve safety and reliability before significant problems occur at the site. Next slide.

Actually, with all respect, Chairman, when you -- your opening comments said -- inferred that degradation is going to happen and we can't stop it from happening. Our belief is that we can. We are investing significant money in research to understand it better and demonstrate that conclusively that we can.

On the BWR side, we have through hydrogen water chemistry and through noble metal chemistry the research that went on in those areas have proven very effective in preventing or arresting any type of degradation or many of the types of degradation that occur.

On the PWR side, we are currently doing significant research in the area of zinc addition to the reactor coolant system to prevent the initiation of primary water stress corrosion cracking. Farley Unit 1 was the first commercial PWR to add zinc to the reactor coolant system. Of note, Farley 2 -- there were five plants with the material heat that's specified there and four of those five plants experienced cracking in their reactor vessel head penetrations.

The Farley Unit 2 head was the only head of that material heat that experienced no cracking. Because of that, when we replaced that reactor vessel head before the industry had authorized the funding for the research and development, Southern Nuclear knew the potential -- recognized the potential value of getting samples from that reactor vessel head.

And before we disposed of that, we cut samples from those penetrations so that they'd be saved and subsequently the industry approved funding for additional research on understanding how the zinc may be a factor in preventing the onset of primary water stress corrosion cracking. Next slide.

Additionally, a year ago Farley Unit 2 due to the geometry and configuration, we are able to perform code acceptable nondestructive examination of the welds on the pressurizer. So, we opted to perform those examinations and not perform the weld overlays in 2007 and do those weld overlays in 2010.

As we went into that refueling outage, before we ever shut down, we developed a decision tree basically thinking through every single potential outcome that we could discover as we went into those examinations and deciding ahead of time what our action would be based on various scenarios. So, we had that laid out.

We shared that with NRC staff before the outage ever started, so we got feedback from the staff. We went into that with a very good game plan. In fact, when we performed that non-destructive examination, we identified an actual indication in the pressurizer surge nozzle.

So, we executed the next step of that game plan and used the phased array encoded non-destructive examination. The axial indication was confirmed and an additional circumferential indication was identified.

Based on those indications, first we did an analysis and demonstrated that the as-found condition was acceptable; that is the previous operating cycle, while we were operating there was no structural integrity challenge while we were operating and then went through the next step of our plan, which was to perform the weld overlay of that nozzle weld.

Before we ever shutdown, we asked the questions of depending on what we find should we cut a sample -- our decision ahead of time was that we would not cut a sample and for very solid technical reasons. The configuration of many of these welds are such that if you cut them -- if you cut them in the field, there is no authorized code repair mechanism.

So, as we prepared for this inspection, we examined the potential of cutting a sample, looked at the benefits that we might get, but also looked at the technical down sides. And we determined that the appropriate technical approach, there being no known repair technique for this configuration, we determined that the safest decision was to proceed with a weld overlay and not put ourselves in a first of a kind field engineering and development and repair scheme with our primary system integrity.

So, all of that was thought out long before we shut down and then when we got into that refueling outage we executed that plan as we discovered the results. Next slide.

In the fall of last year on Unit 1, based on other utilities operating experience, we performed inspections of the pressurizer heater sleeves. We discovered a very, very small white powdery substance at these penetrations of these heater sleeves. Again, we're talking about something that was of a pin head type size.

Because of the operating experience and the training that we have provided our inspectors, they're very sensitive to anything like this. We were able to get a very small sample. It's important that the physical characteristics of what we discovered were actually very unlike other primary system leaks that have been identified.

All of these other leaks when they're identified, the boric acid residue is very tightly adhered to the wall, the pipe wall or the vessel wall. This was very powdery and came off very easily.

Now, the chemistry sample indicated that there was some boron present. While the characteristics of what we discovered, it was highly unlikely that it was an actual primary system leakage path. We went ahead and we cut the heater sleeve. We put a non-destructive examination probe up through the heater tube to inspect the weld that was in question and we verified that there was in fact no cracking indications; that that was a structurally sound weld at those two heater sleeves. And then went through with the repair after we've done that inspection. Next slide.

At plant Hatch, our boiling water reactors -- this spring in our Hatch Unit 1 refueling outage based on industry operating experience before we went into this refueling outage we went back and we examined previous weld inspections that we had performed on the primary system welds.

Based on the operating experience and those reexaminations, we identified additional welds beyond our normal inspection scope that we wanted to go look at. So, we expanded that scope and in fact that expanded scope did identify on a capped control rod drive return line nozzle that identified a circumferential oriented indication on a weld.

Again, we confirmed that indication through the nondestructive examination center and then proceeded with our contingency plan and performed a weld overlay. Again, I think it's a very good example of using operating experience to make smart, expanded smart inspection plans that identify an issue long before it becomes a threat to structural integrity. Next slide.

So, we think that the lessons we've learned are to implement a proactive response to industry operating experience. We take a very conservative approach to our decision making trying to lay out the potential decisions were going to face long before we get into the outage, so that we're not reacting, but we are implementing a well thought out plan.

Prompt communications with the industry is essential and with the NRC. And then following through with lessons learned from outage season to outage season. Next slide.

What I see across the industry is that the industry's response to emergent issues is very effective. There's conservative decisions being made when we see the results of the examinations we're performing. People are very quickly sharing experience and lessons learned and the experience that we're gaining is being fed back into the industry guidance documents and we are making revisions as necessary based on that operating experience.

And that's the end of our presentation.

CHAIRMAN KLEIN: Thank you very much for that presentation. I'm sure since Commissioner Lyons was Acting Chairman when the St. Lucie nozzle, I think slide 32 appeared, that he may have some questions on that one. I was in Europe attending some examinations of some facilities in France and later on in Germany. So, I think some questions on that will probably come. So, we'll start with Commissioner Lyons.

COMMISSIONER LYONS: Well, my thanks to the three of you. It's a good briefing and I'm very pleased to see that industry is taking this area very, very seriously. Obviously, it needs to be taken seriously.

The examples that some of you gave, the Davis Bessie response most recently, I think is very positive. It was certainly an interesting time when the St. Lucie results became known to us as the Chairman indicated. But I think from the time they became known until -- there's probably a week in there of pretty frantic work, I think that industry's response working with the NRC was very positive. And we did succeed, I think, in coming to a thorough understanding with everyone's help.

I think, Jeff -- I'm not sure if it was Jeff or Joe that mentioned that destructive analysis is in progress on the St. Lucie welds. Personally, I'll be very interested in what that destructive analysis shows.

That perhaps raises a question in my mind as to whether there are additional opportunities being taken to look at components as they are removed from facilities. That gives us a real opportunity to go back and perhaps understand real components that have been subjected to real conditions.

Jeff, you mentioned at least one or two examples where that was being done. Are there other examples that you could point to?

MR. HAGAN: We had that discussion as part of the PMMP in the reactor coolant system and the steam generators in terms of continued investigation. Ongoing right now, we have the St. Lucie pressurizer which we're working in conjunction with NRC's department of Research. There's also a North Anna control rod drive nozzle that's undergoing some NDE investigation also from lessons learned.

So, that is something that is discussed as part of the agenda for the

PMMP. In fact on the monthly call, we have now added to our agenda what ongoing testing is being done and what's being planned so that we're not caught -- I think we were caught as an industry somewhat by surprise with the results with the St. Lucie nozzle.

Now, I think the lessons learned that we did take away from that was we need to approach each one of these as if we're doing them in a plant. When you do that, you have a whole list of contingencies laid out. If you find this, you do this. If you find this, you do this. I think we could have improved that when we did the St. Lucie pressurizer nozzles.

I think it would have provided a little more structured approach because we were caught in a reactive mode. We did a lot of work during that week, but it's not something that we'd want to do. So, it's one of the lessons learned we took away from it.

COMMISSIONER LYONS: Well, I agree. It was a reaction at that point in time and you've stressed throughout your talk the importance of trying to move towards a pro-active stance, which I can only agree with.

I do think that to the extent there are opportunities for evaluating components removed from plants; certainly my encouragement would be to both industry and to our own Research organization to take those opportunities and potentially learn some very useful bits of evidence that could help us further.

As another question, there were two different organizations that were described. Jeff, you talked about the industry materials organization and Joe you talked about the EPRI organization. Just curious how those two communicate and coordinate with each other.

MR. GASSER: The industry -- the Materials Executive Oversight Group, we provide oversight to ensure that all of our efforts are properly coordinated and prioritized. The issue programs get their funding through EPRI, which is through the utility. So, the EPRI Chief Nuclear Officer is a member of the Materials Executive Oversight Group. So, we have that coordination.

Also, Joe is the chairman of the PMMP. I was the Chairman before Joe of the PMMP. I continue to be on the executive group.

COMMISSIONER JACZKO: I'm sorry. Can we try not -- I think we'll quickly lose anybody watching.

MR. GASSER: I'm sorry. This is a PWR Materials Management Program.

COMMISSIONER JACZKO: There we go again, PWR.

MR. GASSER: Pressurized Water Reactor Materials Management Program. I was the past Chairman. I continue to be on the executive committee and so we have executives on these various issue program executive committees and some of them also participate in the Materials Executive Oversight Group.

So, we have a great deal of coordination to ensure that the right funding is provided and that that funding goes to the proper prioritized activities.

COMMISSIONER LYONS: Thank you. As another question, the focus today is certainly on primary system components, but I'm curious if any of you could describe what is being done for areas like underground piping or in particular cable degradation, which the cable degradation certainly can have safety impacts as well.

MR. MARION: I'll speak to that. On cable degradation, we developed a paper in May of 2005 and distributed that to the industry as well as to the NRC. It focused primarily on medium voltage underground cable. At the time, some plants, a couple of plants, had experienced failures due to what was perceived to be water drain, which is a phenomena that I won't go into at this particular point in time.

But anyway, we developed that paper to serve two purposes. One, to educate the utilities that there's a potential problem developing with these cables because the cables were approaching an end of life condition. They had been in service for 25 or more years and also gave them some suggestions on what kind of things can be done in terms of inspection and monitoring the cables so that you can determine some mode of degradation, if you will, prior to catastrophic failure.

Also, there was a generic letter, generic communication was issued by the NRC, I think in 2006. With regard to underground piping, there is a focused effort in evaluating through inspection and nondestructive examination techniques the condition of underground piping. This is a program that is being spearheaded by EPRI equipment reliability group and that's a very important program for current plants and it's also being transferred into the license renewal aging management program.

COMMISSIONER LYONS: Thank you.

CHAIRMAN KLEIN: Commissioner Svinicki?

COMMISSIONER SVINICKI: Thank you all for very interesting presentations. Obviously, there's a lot of work that's been done here and as someone who's trying to come up to speed and become current on all the work that you've been doing, I was looking at a report that's dated 2006 and it was prepared by Brookhaven National Laboratory for the NRC. It's the expert panel report on pro-active materials degradation assessment. It concludes in some of its findings with the statement, if you'll bear with me.

It says, "Adequate resources are needed to develop and maintain technical expertise and experimental capability. This seems obvious, but in light of the significant impact of materials degradation over the last 30 years, the level of funding, the available expertise and up to date experimental facilities have all decreased."

And it ends with this italicized statement. "It is imperative that these resource issues be addressed worldwide by government organizations, utilities, vendors and support organizations and by universities and national laboratories."

I was wondering if any of you have any opinions on it. You've talked about a $300 million investment that's been made since 2003. What is your assessment of progress against this finding in particular?

MR. GASSER: Well, I guess this is my opinion. I think this is an area where greater coordination and collaboration could be achieved. We are trying to -- with our funding through EPRI we are trying to take steps to improve that.

I do think there are further opportunities across National Labs, the university research infrastructure and the industry research organizations. I think that there are opportunities to continue to improve our collaboration and coordination so that we are funding and doing the right research that's going to help answer some of these questions that we're facing.

COMMISSIONER SVINICKI: Do any of the other panelists want to address the topic?

MR. MARION: If I might just add to what Jeff said. We are currently conducting an assessment of the effectiveness of the materials initiative. What that involves is interviewing about 15 to 20 individuals -- I forget the exact number -- who were involved in the development of this initiative several years ago and who are currently involved.

And the assessment focuses on have we positioned ourselves as an industry to be proactive? Is there more that needs to be done? If we had it to do over again, what would we do differently? And we expect the assessment to be completed toward the end of May.

We intend to brief Jeff and Joe on the results as well as the Chief Nuclear Officers at their next meeting in June. We'll be more than happy to brief the staff and the Commission as well on those results.

COMMISSIONER SVINICKI: I'd be interested in those results. Thank you. Thank you, Mr. Chairman.

CHAIRMAN KLEIN: Well, I have a question following up on one that Commissioner Lyons had indicated and I guess Jeff, since you answered the first one, I'll come at you for the second one.

Commissioner Lyons asked about the industry EPRI communication and how you do that. Can you tell me a little bit about how you communicate with ASME on their codes and standards?

MR. GASSER: I'm not a code expert, but I think I'll try and answer this. The code and standard process is a consensus process. And so code committees that are developing or reviewing modifications to codes and standards consist of a diverse group of technically qualified people; that includes people from the utilities, it includes academics. It includes the technical experts from the various vendors; that is manufacturers and vendor service folks.

And so, it's a very broad based consensus building process that results in codes and standards that provide significant safety margin in ensuring structural integrity? So, the way we communicate with that is we have the technical experts in our companies that sit on these issue programs, the Pressurized Water Reactor Materials Management Program, Steam Generator Program, the Boiling Water Reactor Vessel Integrity Program.

The technical experts that sit on those -- that make up those issue programs are usually also our representatives on the various code committees.

CHAIRMAN KLEIN: Is there anything that -- I guess my concern is that you openly and adequately share everything with ASME because that's sort of a broad based activity. Is there anything that limits your sharing of information with ASME?

MR. GASSER: I think we do have some challenges when it comes to proprietary information that's developed at points in time. We try very, very hard to ensure that we can execute the right kinds of agreements that allows all of the knowledge to be available for the code committees.

Our desire is to ensure that we don't let proprietary type information or challenges prevent us from fully and opening openly sharing that information and knowledge with code committees.

MR. MARION: If I may just add a couple additional thoughts in response to the question. I'm on the Board of Nuclear Codes and Standards for ASME and I have personally briefed them on the initiative and the status of the initiative over the past several years. We'll continue to brief them in the future.

In addition, we need to make it very clear that a lot of the inspection activity that we're implementing goes beyond what the requirements are in the code today. We have individuals who are working on code cases to integrate some of those inspection activities that we believe need to be incorporated into the code -- integrate them into the code and that work is in progress right now.

CHAIRMAN KLEIN: Have you seen any evidence of any proprietary information that was not shared that has a safety significance?

MR. MARION: I haven't been monitoring it very closely, but I have not -- I typically hear about problems and difficulties and I have not heard about anything along those lines thus far.

CHAIRMAN KLEIN: I guess as an action item, I'd like to see if there's any non sharing proprietary that could have a safety implication.

I guess, Jeff, on slide 8 you talked about industry codes and regulatory requirements. What's your view of the pressurized thermal shock, the proposed rule 50.61a that's being discussed?

MR. GASSER: You've got me. I'm not fully up to speed on the contents of that rule.

MR. MARION: We believe that rule is a positive step in that it incorporates the latest insights from research and development into the requirements for reactor vessel integrity and that's extremely important.

So, we think the rulemaking is a positive step. We can also discuss probably for the next hour the content of the regulation, but I don't want to get into that.

COMMISSIONER JACZKO: I think that would be very interesting.

CHAIRMAN KLEIN: One of the -- Joe, I guess you had on your slide 32 that showed the St. Lucie initial concern of the circumferential crack. You said that the results would be out shortly on the destructive testing.

MR. HAGAN: That's correct.

CHAIRMAN KLEIN: Did you say June is when you expect some of those results?

MR. HAGAN: It will be formalized. We'll get the preliminary results -- I expect that in the next couple of weeks. It will be written up. This will be a level three report. So, there's time allocated for the actual writing of the report and then submitting it.

So, the written report will be done in June and I will brief the NSIAC which is the CNO's on the results of that.

CHAIRMAN KLEIN: I assume our research people will be --?

MR. HAGAN: You'll have it at the same time that we do, yes.

CHAIRMAN KLEIN: Okay. Thank you. Commissioner Jaczko?

COMMISSIONER JACZKO: Thanks. I just want to say starting out I certainly agree with the comment that Commissioner Lyons made about the need to really be proactive on a lot of these issues. I think there's some things that are going on here.

From where I sit, however, there still seems to be a level of lack of pro-activeness, I think, in some of these areas. In particular, in the research areas. I only look back to Wolf Creek and there was a lot of uncertainty about what exactly to do with Wolf Creek, I think, when it initially happened. There were a lot of surprises that came out of Wolf Creek that was not anticipated that we would find the circumferential cracking that was identified.

Again, I think, Jeff, as you indicated these were not necessarily issues that had at that point challenged structural integrity of the piping systems, but nonetheless, it challenged our assumptions about leak before break, which I think was a significant change and one of the reasons that I think the staff felt the need to move forward in resolving these issues more proactively.

So, in that vain I just have a couple of questions to try and explore this a little bit. The first one goes back to St. Lucie a little bit. Maybe Jeff or anyone who wants to comment to this can talk a little bit about this; about how we got to where we are on St. Lucie.

It was my understanding that when the pressurizer -- the welds were originally available that these were initially offered to industry to do examination on. Is that correct?

MR. GASSER: I believe that's correct.

COMMISSIONER JACZKO: What was your decision in that case then? Did you initiate investigations at that point or not?

MR. GASSER: Our decision was that we believe and we still believe that we have in place inspection and mitigation guidance documents that every utility was implementing and was going to be complete with the pressurizer by the spring of 2008. And so, our belief was that our efforts and resources were better directed towards other priorities because --

COMMISSIONER JACZKO: You choose not to do investigation?

MR. GASSER: We chose not to at that time because we were, quite frankly, continuing research and development on an issue that we are wrapping up, basically, which is the pressurizer. We felt like our resources were better spent being more proactive and working on things like other reactor vessel internals, research and development.

COMMISSIONER JACZKO: Well, I certainly appreciate and I always want to focus on things that are important, but obviously the work that was done to do examinations at St. Lucie identified some issues, the least of which was perhaps we have a better understanding of how to identify these, I guess -- what do they call them -- fabrication flaws versus cracking.

I hope that that is data that's come out of there because the tests that were done on those welds and then ultimately on the destructive examination of what we're doing afterwards. Again, as I said, that tends to indicate to me a lack of pro-activeness and here was an opportunity to really go out and do some research.

That research wound up being done by the NRC and we identified some issues.

MR. GASSER: If I could -- respectfully, so far and I might be proved to be wrong, but so far I do not believe any of the work on the St. Lucie pressurizer has added to the body of knowledge that we had or have about dissimilar metal weld cracking. So, it's --

COMMISSIONER JACZKO: That may well be true and I think that's certainly a good thing, but what it is certainly is the opportunity to learn about NDE techniques to actually be able to go out, which is what we're doing now. We're going out and we had a series of NDE examinations that were done with the manual methodology.

MR. HAGAN: The original was a 19-point manual examination.

COMMISSIONER JACZKO: Which identified what appeared to be --?

MR. HAGAN: A potential area. Then we used the technique that we have in place now which is encoded, encoded phased array -- which proved that these were not connected.

COMMISSIONER JACZKO: Absolutely, all of which is good, experimental data. Now we have the ability to actually go out and do destructive examination on those welds to better qualify, to better verify and validate the techniques that are used.

MR. GASSER: We did not deploy any new technology with the St. Lucie pressurizer. So, what we did with the St. Lucie pressurizer is exactly what we did at Southern Nuclear in the spring of 2007 with the Farley pressurizer.

So, the technology has been demonstrated in the lab. It has been demonstrated prior to the St. Lucie pressurizer in the field. And so what we did with the St. Lucie pressurizer was exactly what we have been doing in the field, so that technology was proven --

COMMISSIONER JACZKO: Again, I think we're -- perhaps you're missing my point. I think this might be part of the problem. The point here is that here is an opportunity to do -- we have actual welds for which we can do good inspections. We can then do examinations. We can then do destructive examinations.

If nothing else, this is an additional opportunity to verify and validate techniques that are being used in the field because these are in fact -- were not welds that were in any facility. They were not welds that posed any safety threat, but they provided an opportunity to do an investigation and understanding of what was actually going on in welds.

I think as I recall from the original examination that the conclusion was that in the field these welds would have been -- if these were identified -- the indications identified by the original examination would have led to in the field an overlay and a repair of the weld; that that would have been the indication that was taken.

MR. GASSER: No, sir, that's not correct.

COMMISSIONER JACZKO: That was the statement written by the examiner. That we can go back and check, I don't have it with me here, but that is what in fact was recommended by the examiner who did the examination of the welds.

MR. GASSER: I am not familiar with that specific point.

COMMISSIONER JACZKO: I am. That is what it said and that is what the recommendation was by the examiner who did that. So, again we have perhaps a disagreement on the facts and again I think my point is this is an opportunity to go through and look at this information and go out there and get a better understanding of how they behave and how the examination techniques behave that we use with them.

I want to get onto some other things, so I don't want to belabor this much longer. This is perhaps a broader question involving -- Alex, I think you mentioned pressurized thermal shock. As I look out there right now from our regulatory standpoint, we talk a lot about life beyond 60.

At this point, I don't know that we have any idea what that really is going to mean and what the kind of criteria are that we need to be looking at to assess that.

Of course, pressurized thermal shock is one of those areas where that 40 to 60 time frame even that area becomes interesting if we don't have a change to the rule that is now being proposed.

I'm wondering as a broad question what you see right now as the kind of criteria that we should be looking at to determine what are the acceptable kinds -- pieces of information that we need in order to be able to make determinations about long-term ability to manage components and systems beyond 60 years at this point?

MR. MARION: That's an excellent question. Unfortunately, I don't think there's anyone who’s smart enough who can give you a straight answer today.

There was a workshop that was held in February, I think it was in February, with DOE, NRC and representatives from industry to talk about what needs to be done, what needs to be investigated going forward so we can pursue operating plant life beyond 60 years.

And that's in its initial phases in the reactor vessel and its capability over that time period is one of the key components that's going to require further research to enhance the understanding and determine what needs to be done.

MR. GASSER: I participated in that workshop and I think the NRC staff is being very proactive in getting those discussions to identify what those issues are so the appropriate research can take place in the timeframe to support any decisions along those lines.

MR. HAGAN: The lead for us within the industry will be our research, which is EPRI. They're looking at exactly what should we go look at, how are we going to test and this is going to be good for additional -- what's are the limiting factors?

COMMISSIONER JACZKO: Thank you. No more questions.

CHAIRMAN KLEIN: Commissioner Lyons?

COMMISSIONER LYONS: Let me follow up to some extent on the direction that Greg was going in some of his questions. To the extent I understand the St. Lucie issues, we have the manual UT which gave some indications, raised concerns and then the advanced UT was instrumental in resolving and better understanding that.

And then Jeff, you referred on Farley to some initial measurements which had been made with conventional -- I don't know if it meant manual UT -- and then more advanced, I guess, the encoded phased array gave additional indications of potential cracks including identifying the circumferential.

I guess my question is from this data and perhaps a lot of other data that you're aware of, is there guidance coming out of your groups across industry to recognize the limitations of the older UT technologies and to move, I would hope aggressively, toward the use of the advanced UT technologies that I know EPRI and perhaps others have been working on developing?

In other words, are we learning from this and applying this to advanced -- to encouragement or requirement for advanced UT examinations?

MR. GASSER: Yes, we are. What we've seen in the actual experience in 2007 and into 2008 is just this protocol, which is when a weld is first characterized using the manual UT and then based on what is seen, it is further and more completely and definitively characterized using the advanced UT. That is the protocol and technology that sites have been deploying as we've gone through 2007 and 2008 spring outage season.

COMMISSIONER LYONS: If I understood what you just said, Jeff, you said first you see an indication on the manual before you go to the phased. I thought your comment on Farley was the phased array picked up additional indications that haven't been detected at all on the manual.

I'm just wondering is there some compelling reason why we just don't -- why industry doesn't just go to the advanced UT examinations in the first place.

MR. GASSER: Again, I'm not an NDE expert --

COMMISSIONER LYONS: Neither am I.

MR. GASSER: -- but my understanding is that it's not that one is completely better than the other. They complement each other and so they work in a complementary fashion. One doesn't just completely replace the other as a better product. So, that's why we continue to try to come up with a more - I'd call it - complete package of non-destructive examination techniques so that we get the best information possible.

MR. HAGAN: Some of it has to do with the geometry of the weld, too. If it's a limiting geometry, then the phased array -- the encoded phased array may not work until you profile the weld or profile whatever your area of interest is so that you can use that technique.

The industry is pretty much using -- a part of a protocol within these groups that we have to go to the encoded phased array. That's the examination of preference. That's what you should be using.

It doesn't say that if you do a manual exam and you see nothing, it doesn't mean that there's something wrong with that. If you want to go look at it in terms of additional knowledge of that particular weld, then you go to a phased array. That's pretty much what the industry is doing.

MR. MARION: If I might add, the phased array technique was qualified last year. So, two years ago it wasn't available. And now it is available and it's being used.

COMMISSIONER LYONS: That's what I was reacting to. There seems to be a number of indications that it truly is a substantial advance. I guess consistent with Joe's comment of using it where it's possible to use it, I would suggest that we should be using it wherever possible and benefiting from that information. Thank you.

CHAIRMAN KLEIN: Well, I have a couple of follow up questions. Jeff, on slide 34 you talked about the Farley 2 vessel head was the one that did not have any cracking. Do you know why?

MR. GASSER: Well, we believe -- our theory is that the zinc addition that we have been using for the reactor coolant system is effective at preventing the onset of primary water stress corrosion cracking.

CHAIRMAN KLEIN: So, on Farley 1, you did have cracking, but you didn't start adding zinc on that before?

MR. GASSER: We did not have cracking on Farley 1 either; it's just that that was not the same heat material as the other four units that experienced cracking. It was a different heat material. What we think is significant is that while Farley 1 and Farley 2 were the same age and same temperature, the Farley 2 head was the same heat material as the four heads that actually experienced cracking. And so, that's why we think it's significant.

CHAIRMAN KLEIN: You think the zinc is what helped in Farley 2?

MR. GASSER: Yes, sir.

CHAIRMAN KLEIN: On slide 36 you talked about the residue that you had found on the heater sleeve and you said that the test indicated boron and cesium 137. What caused that?

MR. GASSER: We think that it was probably some outage activity previously of draining reactor coolant system or emergency core cooling piping near there, we believe, caused some splash or some dripping of water is the likely cause. It was not leakage out of the reactor coolant system.

CHAIRMAN KLEIN: What would have caused the cesium 137?

MR. GASSER: My recollection is cesium 137 is a fission product and so that's why we -- that indicated that it was actually reactor coolant system water and that it had one fission byproduct in the sample. And so that's what led us to confirm that we in fact had no issues and those welds were structurally sound by doing the nondestructive examination.

CHAIRMAN KLEIN: Have you seen any residue on any other heater sleeves?

COMMISSIONER LYONS: We have not.

CHAIRMAN KLEIN: Across the whole industry?

MR. GASSER: Across the industry, actually we had seen some heater sleeve residue and indication of a crack. I believe it was one of the Exelon plants. That was the basis for the inspections that we were performing at the Farley plant.

CHAIRMAN KLEIN: But nothing similar to what you saw at Farley?

MR. GASSER: We have not seen anything similar to Farley. No, sir.

CHAIRMAN KLEIN: Okay. Thank you. Commissioner Jaczko?

COMMISSIONER JACZKO: It's always good to go to the data, I think. I asked my staff to grab -- this was the St. Lucie pressurizer nozzle DM -- dissimilar metal -- thanks -- weld examination project internal office report. This is the second paragraph from the conclusion on that.

What they said was "the UT indications recorded in the three safety nozzles contained multiple plant reflectors' which appear to be vertically stacked and extend from the ID surface to a significant thru wall depth. These indications are indicative of corrosion cracking, but could also be attributed to multiple stacked inclusions in the weld material left over from construction. Performing automated UT on these three nozzle welds would allow for better flaw mapping analysis; however, under normal field NDE conditions these three welds would certainly be reported as containing 360-degree linear planar flaws of significant thru wall depth which would require immediate repair."

So, again, there may be some -- this examiner may have not properly followed what industry guidance would be in this, but that was the information that I was recollecting.

I did want to turn to another issue. This is, I think, something that came out of the issues again with Wolf Creek where we had some discussions about what would be the perfect time to allow for extensions of the staff's determination that the welds needed to be inspected and overlaid by the end of the last calendar year.

One of the things -- and I'll just read this again because I think it's probably easier just to read it. One of the conclusions that ACRS had in their letter and this was specifically on the use of the finite element analysis to try and better characterize what was happening with these particular types of flaws and what the potential would be of allowing an extended operation beyond December of last year.

They said, "Even with this increased capability to model the growth of cracks" -- and this was their conclusion -- "there will still be large uncertainties and important variables that affect the results such as the welding residual stresses, the applied loads on the welds and the population of cracks that could be present in nozzle welds that have not been inspected. It may eventually be possible to formalize the valuations of these uncertainties through Monte Carlo simulation, but the present problem will have to be addressed through sensitivity studies. The staff and industry have not yet settled on how to determine what will constitute an acceptable demonstration that a likelihood of violation of the leak before break principle is acceptably low. And this may not be possible till some of the results of the plant analysis are available."

And just to be clear, the ACRS agreed with the staff determination to allow it to go forward. I'm more interested in your senses on how some of these issues the ACRS raised here are being addressed or will likely be addressed in the next several years. If you can comment on any of those?

MR. MARION: I would have to read that letter. I remember receiving it, but I don't remember the details. So, I don't feel comfortable discussing that. I know that as we go forward in communicating with the NRC on inspection results and associated analysis, et cetera, we will be addressing concerns and questions related to uncertainties and confidence levels in the analysis. What specifically is being done to be responsive to the ACRS letter I'm just not aware of at this point in time.

COMMISSIONER JACZKO: Do you see greater use of things like finite element analysis in analyzing some of these different --?

MR. MARION: I do.

MR. GASSER: Yes.

MR. HAGAN: Yes.

COMMISSIONER JACZKO: I think -- I don't want to speak for ACRS, but I'll say how I interpret some of these words and I interpret this to mean the most important thing is knowing what's in these pipes, I guess, and what's in these welds. And understanding and characterizing those is very important because that in a way forms the boundary conditions for whatever we put into these finite element analyses.

The models may be excellent, but if we have no idea of what the population of flaws is, we can model things that are completely unrealistic with what actually out there. So, I think it's an important area to continue to explore. Again, I think back with the theme that I started on, which is really focusing on being proactive in this research area and getting out in front of these issues is really going to be important.

So, I think the finite element analysis was developed as a way to allow for several plants to continue to operate beyond December and I think the information that came out of that was useful information. But continuing to do that not in reaction to specific events and specific deadlines, I think, would provide me with a lot more certainty that these issues are being addressed at the right level.

MR. MARION: One of the follow up activities that EPRI is pursuing is developing mockups to address some questions relative to that finite element analysis. I'm just not familiar with the status of that effort at this point in time.

COMMISSIONER JACZKO: Great. Thank you.

CHAIRMAN KLEIN: Well, I'd like to thank you for your presentations today. I think the industry is doing a good job in looking at aging and degradation issues. I'm sure that both you and the regulator will stay on top of those issues. I think this is an area that we certainly cannot become complacent in as these plants do get longer lived. We need to just look at different things that we might not have thought about when they were new.

So, I would encourage you to stay proactive and stay on top of that and keep doing -- keep the antennas up so we don't become complacent. Thank you very much.

PANEL 2:

CHAIRMAN KLEIN: Well, we look forward to hearing from the staff now that we've heard from the industry's perspective on material issues. So, Luis, we're ready for you.

COMMISSIONER JACZKO: Mr. Chairman, can I just make a comment before we start? I believe this will be --

MR. REYES: One more, one more.

COMMISSIONER JACZKO: Oh, one more. Sorry!

MR. REYES: Don't I wish.

CHAIRMAN KLEIN: The clock is ticking, but it's not the final.

COMMISSIONER JACZKO: I have nothing else to say.

MR. REYES: Good morning, Chairman and Commissioners. The staff is ready to brief the Commission on our actions regarding material issues. Last time we briefed you was February of 2006.

We have an active regulatory and research program regarding the management of material degradation issues and today you'll hear presentations from the Office of Nuclear Reactor Regulation and the Office of Nuclear Regulatory Research. I want to turn over the presentation to Jack.

MR. GROBE: Thank you, Luis. Good morning, Mr. Chairman and Commissioners. My name is Jack Grobe. I'm the Associate Director for Engineering and Safety Systems in the Office of Nuclear Reactor Regulation.

The reactor coolant pressure boundary represents one of the barriers to release radioactive materials from the reactor core in the unlikely event of a core damage accident. Consequently, the staff places a very high priority on assuring that appropriate regulatory controls are in place regarding the integrity of the reactor coolant system, operating experience is understood and acted on promptly, and necessary advances in our understanding of materials science and metallurgy issues are being pursued. Slide two, please.

These activities affecting operating reactors are accomplished through close coordination between the Office of Nuclear Reactor Regulation and Nuclear Regulatory Research. Today, we're going to brief you on significant materials regulatory and research activities that have occurred in the past two years since our last update to the Commission.

The principal speakers today will be Michele Evans on my left and Dr. Jennifer Uhle on Luis' right. Michele is the Director of the Division of Component Integrity in the Office of Nuclear Reactor Regulation. Jennifer is the Director of the Division of Engineering in the Office of Nuclear Regulatory Research. Among other technical areas, Michele and Jennifer are responsible for material science and metallurgical engineering activities affecting our operating reactor fleet. Slide three, please.

Michele will be discussing the operating experience and status of regulatory and industry actions associated with primary water stress corrosion cracking in reactor head penetration materials and dissimilar metal butt welds. Michele will also discuss actions the staff is taking regarding reactor pressure vessel neutron embrittlement and pressurized thermal shock.

In addition to her presentation on NRC research in the areas of proactive materials degradation management and nondestructive examination, Jennifer will also be discussing the initial work regarding potential materials issues that warrant consideration should plant life extension be considered beyond the current 60 year license renewal period.

I will conclude the staff presentation with some brief remarks regarding human capital challenges in this area. I would now like to turn it over to Michele Evans.

MS. EVANS: Thank you, Jack. Good morning, Chairman, Commissioners. As Jack indicated, today I will be talking about two regulatory issues related to the management of materials degradation. These regulatory topics are in the area of primary water stress corrosion cracking known as PWSCC, and reactor pressure vessel aging caused by radiation embrittlement.

PWSCC has been observed since as early as the mid-1980s and the industry and the NRC have been dealing with it since that time. NRR's activities on PWSCC have involved all locations in the reactor coolant system where susceptible materials are found. These materials are dissimilar metals welds made with alloy 82, 182 and penetrations made with alloy 600.

Today, we'd like to highlight NRR's activities on PWSCC and reactor vessel upper head penetrations and dissimilar metals butt welds. The next slide.

The first area of PWSCC deals with our actions coming out of the Davis Bessie reactor vessel upper head corrosion event. First, I'd like to give you a little bit of background about how the issue developed and then talk about where we are now.

PWSCC in reactor vessel upper heads occurs in nozzles or their welds. The safety concern is the development of cracks that could lead to corrosion of the head or structural failure of a nozzle.

During the spring of 2001, circumferential cracking was identified at Oconee Units 2 and 3. Since the cracking was circumferential the safety concern was structural failure.

In August of 2001, the NRC issued a bulletin 2001-01, which recommended visual inspections of all heads. Davis Bessie identified their head corrosion event in March of 2002. The corrosion occurred due to a leak from a PWSCC flaw in a nozzle. As a result of this event and other findings of PWSCC in upper heads, the NRC issued an order in February of 2003 which required visual inspection of all heads as well as nondestructive examination of the nozzles and the welds in all heads in the U.S. PWR fleet. Next slide.

Since that time, each plant has performed detailed inspections of each nozzle in every head. These inspections have verified the structural integrity of all heads currently in service.

Beyond these initial or baseline inspections, the order requires reinspection frequencies based on a time and temperature susceptibility model. Almost all of the cracking identified in the upper head nozzles occurred in high or moderate susceptibility plants.

However, cracking was identified in one nozzle of approximately 1500 nozzles inspected for low susceptibility plants. The NRC staff performed an assessment of this finding and concluded that the current inspection requirements provide reasonable assurance of structural and leakage integrity.

The upper head inspection results have shown that the susceptibility model continues to be an effective tool to prioritize inspection requirements. Next slide.

The most efficient method of preventing PWSCC in upper heads is through head replacement with materials more resistant to PWSCC. To date, no operational experience of PWSCC has been identified in these resistant materials.

However, the Office of Research continues to conduct studies focused on determining the long-term effectiveness of the materials. About half of the PWR fleet has replaced their heads. Licensee feedback shows that all plants with heads that are consider to have a high or moderate susceptibility to PWSCC are expected to replace their heads as schedules allow.

A few plants with low susceptibility heads have or plan to replace those heads. Next slide.

As I previously mentioned, our current inspection requirements for the upper head are under an NRC order. However, in accordance with the Commission SRM, the staff has worked with the ASME code to establish long-term inspection requirements.

In 2006, ASME Code Case N-729-1 requirements were finalized and with some NRC conditions it is being approved for use in lieu of the order requirements.

Current rulemaking to update the applicable version of the ASME code in 10 CFR 50.55a includes a provision to change the official regulatory inspection requirement from the order to the code case.

There are expected to be further adjustments to these requirements as additional experience is gained in their implementation over the next few years. The NRC staff will continue to review operational experience and research developments to ensure adequate inspection requirements are maintained. Next slide.

The second area of PWSCC which I would like to highlight today pertains to PWSCC in dissimilar metal butt welds. In 2000, PWSCC was first observed in dissimilar metal butt weld because of a leaking axially oriented crack at the V.C. Summer plant. Prior to 2005, inspection of dissimilar metals butt welds was performed under the ASME code section 11 requirements.

In late 2005, the industry implemented an initiative for inspection of dissimilar metal butt welds to be performed on a much more frequent basis than that required by the code. This initiative is known as MRP-139 program.

The staff has evaluated the MRP-139 inspection program for managing PWSCC in butt welds and has been monitoring industry's implementation of the program. To do this, the staff recently issued temporary instruction for regional inspectors to verify that all PWR's with dissimilar metal butt welds are implementing MRP-139. Next slide.

For the longer term, the staff requested ASME section 11 to develop a code case for inspection of dissimilar metal butt welds in PWR's. ASME has been actively working on the code case and has been responsive to NRC input.

The code case is nearing completion and based on the progress to date, the staff expects that the code case would be acceptable for referencing in our regulations.

If the staff determines that conditions are necessary, they will be included when the proposed rule is issued. We expect that a proposed rule with this code case will be issued in the next calendar year. Next slide.

Now, I'd like to take a minute to talk briefly about some recent operating experiences. In October of 2006, inspections were performed at Wolf Creek prior to weld overlays being applied to the pressurizer welds. Large circumferential flaw indications were found in those wells. Based on the industry and NRC advanced finite element analysis, NRC staff agreed to industry's original plant inspection schedules for the 2008 spring outages.

Recently, two B&W plants identified PWSCC indications in decay heat drop line welds. The staff evaluated these two experiences and concluded that no changes to the current inspection schedules were required.

Also, as we've discussed, in early March a potential safety issue was identified that was related to inspections of nozzles in a retired pressurizer. These inspections caused the staff to question whether the advanced finite element analysis would still support the spring 2008 pressurizer inspection schedules.

The staff concluded that the flaws were fabrication induced and that there was no structurally significant PWSCC in the welds. As you can see, the staff continues to monitor and evaluate operating experience to ensure that the current inspection schedules are adequate.

Overall, the staff considers the current program of inspection and mitigation of susceptible welds provides reasonable assurance of integrity of reactor coolant system butt welds. Next slide.

In addition to what I've previously covered regarding RPV head issues, I'd like to also address developments in the area of reactor pressure vessel aging by radiation embrittlement. The significance of maintaining RPV integrity cannot be overemphasized given the potential consequences associated with RPV failure.

There are four key NRC rules or regulatory guides which provide the regulatory framework for protecting against the potential for RPV failure from the effects of radiation.

These are, first, 10 CFR Part 50, Appendix G which addresses two issues: operating limits to protect against brittle failure and material property limits to protect against ducktail failure.

Second, 10 CFR Part 50, Appendix H, which requires licensees to implement a surveillance program to monitor the material property changes due to radiation exposure.

Third, 10 CFR50.61 which establishes criteria for protecting PWR's from failure due to pressurized thermal shock events.

And fourth, Regulatory Guide 1.99, which supports these regulations by providing a methodology for evaluating the effect of neutron radiation on reactor materials. Next slide.

Based on our current understanding of all of the issues which affect RPV integrity, the staff concludes that the current regulatory framework is more than adequate to maintain RPV integrity and nuclear safety. However, as our current regulatory structure is built on technology and evaluations from the '80s and '90s, it includes conservatism beyond that necessary to ensure adequate protection.

The impacts of this excess conservatism may include the potential for plants to have to cease operations sooner than necessary, restrictions on plant operations such as longer times required to heat up or cool down, or the need for licensees to implement unnecessary core management strategies or plant modifications. Next slide.

Both the NRC and the U.S. Nuclear Industry have invested many resources over the last 25 years to improve our overall understanding of reactor vessel integrity; however, additional work is warranted in certain areas.

One area would be to obtain and evaluate additional data on the effects of high neutron radiation exposure levels on RPV materials. This will ensure that the NRC can evaluate RPV integrity issues before the operating fleet of reactors reaches the end of extended licenses.

The NRC staff intends to implement advancements in our understanding of RPV integrity issues through rulemaking activities to improve our regulatory framework.

An example that is under way is the implementation of the alternative pressurized thermal shock rule, 10 CFR 56.61a. In the future, the staff will seek to also modify Appendixes G and H as well as to modify and update Regulatory Guide 1.99.

This concludes my remarks regarding our regulatory activities. Now, Jennifer Uhle will talk about research activities. Thank you.

MS. UHLE: Thanks, Michele. Michele just talked about development of the technical basis to reduce unnecessary conservatism from 50.61, the pressurized thermal shock rule which will contribute to some licensees' ability to renew their license for an initial 20 year period under Part 54.

As you have heard, the industry is also interested in pursuing subsequent license renewal periods to potentially allow operation from 60 to 80 years or so-called life beyond 60. Therefore, both the NRC and the industry need to understand the implications of aging out to 80 years.

To help prepare for this, the NRC and DOE jointly sponsored a workshop back in February 2008 that Alex had alluded to earlier where we discussed potential research and development issues related to ensuring safe, long-term operation. The workshop was widely attended by members of DOE, the international community, academia, National Laboratories, for instance.

It was determined that several areas required additional study to understand the implications of aging and I can give an example here. The performance of concrete under high temperature and a radiation field for prolonged exposure periods was one area. Thermal embrittlement of -- stainless steel was also another area.

The industry may also have to develop new technologies to support long-term operation. An example there was repair and welding procedures for aged materials. Although it's not NRC's responsibility to develop these technologies, we must understand them in order to develop an appropriate regulatory position regarding their use.

At this point and time, the NRC and DOE are preparing a summary of the meeting which will be issued in a report shortly and we are pursuing collaborative efforts on an aggressive schedule. So, next slide please.

I'll now talk about the Office of Research's activities related to materials performance and reliability. I'd like to start with a bit of history.

As a result of materials related events, such as Davis Bessie, the agency recognized that the majority of actions that we had taken to ensure safety and reliability with respect to materials degradation tended to be reactive and that is to say that degradation was detected in a response the agency took regulatory action to resolve the issues.

We also recognize that since materials degradation is a phenomenon that will always require industry and agency attention since the plants operate under conditions of high pressure, temperature, radiation field in a chemical environment, our management programs could be improved by taking a more proactive approach. And by proactive I mean we could anticipate -- we could aim to anticipate materials degradation issues before they became a safety significant concern so that we could resolve them in a timely fashion.

So, at any rate, in 2004, late 2004, the Commission directed the staff to develop a proactive approach to materials degradation. So, the Office of Research conducted a study using an expert elicitation process to identify those mechanisms likely to degrade nuclear power plant components.

The process was conducted using eight international experts and was documented in the NUREG-6923 in 2007, early 2007. The report received both internal and external peer reviews and it lists the PWR and BWR components and rates their susceptibility to 16 forms of degradation.

It provides a basis for these findings and it also rates our level of knowledge about the degradation mechanism. For instance, in the report we may say that we have low knowledge about a degradation mechanism and that means we do not yet understand the mechanism enough to 100% prevent it. So, this information is being used by the agency to help prioritize our research activities as more attention is required for components that are fabricated from a highly susceptible material to a particular degradation mechanism when there's uncertainty in our fundamental understanding of that degradation mechanism. I will refer to these cases as high susceptibility, low knowledge throughout the rest of my talk.

The industry also performed a similar study and we did compare the results of those studies to ensure that they were consistent. Next slide, please.

Research then reviewed our research programs to ensure that they were appropriately focused on topics categorized as high susceptibility, low knowledge and that the subject component was safety significant.

We met representatives from the industry and compared our research programs to identify areas where we could exchange information and plan future collaborative efforts. We wanted to make sure that there was no duplication of effort and we also wanted to make sure our programs were going to be resolving the issues in the order of their priority.

We continue to meet several times a year to enhance this coordination. Although we coordinate with industry to develop a common data set, we do independently analyze this data to ensure that we are maintaining our independence and making our own respective decisions. Next slide, please.

We have focused a great deal of attention on the usefulness of the NUREG. I don't have it with me, but its 4,000 pages. And as you can imagine if you've ever published a NUREG, it's not easily updated.

Since we eventually want to get to the point where we are running the materials engineering program from this information, so that topics categorized as high susceptibility, low knowledge are resolved in order of their safety significance, we need to keep the information current.

So, therefore, we took the information from the NUREG and we've constructed a database with links, hypertext links, to supporting information. We're coordinating with NRR's Operating Experience Group so that as events occur we can update this information and provide links to event reports; licensee event reports or operating experience.

We'll also update the information as the industry and the agency develop a more fundamental understanding of these degradation mechanisms. This database will enhance our ability to integrate the research results into our regulatory program and we also believe that it will enhance our ability to factor operating experience into our research programs.

This database will also greatly improve our knowledge management activities. One can envision a recently graduated engineer being asked to review a licensing action related to a primary water stress corrosion cracking and going to the database, clicking on the degradation mechanism, getting a list of all the components that are susceptible to that degradation mechanism and the basis for those findings; clicking on other links to get NUREGS, discussing the fundamental mechanism of the degradation mechanism, reviews of licensees' mitigation activities, Standard Review Plan sections, all within seconds. So, we feel that this will greatly improve our knowledge management.

We have found already that this type of communication enhances the agency's regulatory programs. As an example, for the past few years Research has maintained an in-service inspection website that provides the most up-to-date information to the program offices and regions regarding nondestructive examination techniques and in-service inspection programs by the industry.

We have received feedback from the regions and the program offices that they believe this is providing a more effective and uniformly implemented in-service inspection oversight program.

We believe that the roll out of the proactive management of materials degradation database will also enhance this type of communication, but expand it to all areas of the materials engineering arena.

So far I've stressed coordination domestically, but we have also engaged the international community at three separate meetings and several bilateral exchanges. Based on communication we've received from the international community since the release of the NUREG, we believe that at least seven other countries are interested in pursuing collaborative efforts.

They've asked that we clearly outline the manner of how this exchange would occur and also how the research programs and results would fit into the regulatory programs. We plan to meet with representatives from the international community early next year where we will demonstrate the database and the links to supporting information and we will also propose to the Commission hopefully at the end of the meeting a cooperative program with clearly identified deliverables, participants and dates.

So, we would like this program to be very efficiently run with the aim of resolving those topics listed in the proactive materials database in order of their priority. Not only will this help defray costs associated with this research, it will also greatly enhance our access to international operating experience, which is a significant contributor to our proactive efforts. Next slide.

A goal of the proactive management is to anticipate degradation and resolve it through appropriate regulatory action before it becomes a safety significant concern. Resolution can be achieved in two ways.

One is to avoid the degradation, but in cases where that cannot be avoided, then we have to be able to reliably detect it and then repair it -- repair its effects. Therefore, research is also doing work to evaluate the accuracy and reliability of nondestructive examination methods used in the industries in-service inspection or ISI programs.

Recent experience with cracking and reactor vessel penetrations in dissimilar metal welds that Michele has discussed and the industry has discussed as well has resulted in an increased focus on NDE.

In addition, the industry is attempting to decrease the time required to inspect various components in order to reduce exposure to the radiation fields by the ISI inspectors and also to reduce the length of outages. Therefore, the effectiveness and the reliability of the NDE techniques has become ever more important as a tool for ensuring safe operation.

So, the next slide discusses some agency initiatives and Research's and the agency's response. For instance, the industry is applying weld overlays, as Michele indicated, to mitigate the effects of PWSCC of dissimilar metals welds of safety related components and the metallurgical and geometric features of these overlays can cause some NDE responses that can be misinterpreted.

So, Research has been conducting confirmatory research to ensure that the techniques deployed by the industry are capable of detecting cracks through these new weld features.

The industry is also attempting to reduce micro biologically induced corrosion in steel safety related service water system piping by replacing the steel piping with high-density polyethylene piping. To support this use, the industry must demonstrate both sound fabrication and structural integrity.

Research at this point is reviewing the operating experience from other service industries and is also performing some limited experimental work to determine the effectiveness and reliability of NDE techniques used by the industry or proposed to be used by industry for this piping -- this high density polyethylene piping.

Finally, Research is the host of an international program on the inspection of nickel based alloy components, such as reactor vessel penetrations and dissimilar metal butt welds. As part of this program, a number of mockups with embedded flaws were distributed to a variety of international inspection organizations around the world.

Inspection round robin results are being analyzed to develop probability of detection of flaws by the in-service inspection techniques used by the industry. These values of probability of detection will be used by the agency and the industry as well in probabilistic fraction mechanics analysis for component integrity.

The probability of detection data will also inform NRC's views regarding the effectiveness of industry's training programs for NDE inspectors.

So, in summary, the staff is developing a research program to anticipate and address materials degradation issues in a proactive manner. We're pursuing collaborative efforts with the international community as well as the domestic industry. And we are maintaining our independence as appropriate for a regulator.

We are instituting a database that will play a key role in knowledge management activities and will also assist us in disseminating research results and operating experience to the materials engineering community.

These efforts will inform NRC's regulatory review of life beyond 60 and the database will also improve the coordination of NRC's activities related to materials engineering thereby helping to make the regulatory process more effective and efficient.

That concludes my remarks and Jack Grobe will summarize.

MR. GROBE: Thanks, Jennifer. That really excites me all this talk about life beyond 60 with minimal age related degradation.

CHAIRMAN KLEIN: That's only for reactors, Jack.

MR. GROBE: Darn. Slide 20, please. The hiring development and retention of personnel with strong backgrounds in the area of materials is an ongoing challenge for us. The availability of specialists in certain sub areas of expertise like fracture mechanics, nondestructive examination and welding is limited. The level of staff expertise remains sufficient to carry out the NRC's mission.

Over the past two years the need for materials expertise within the NRC has expanded. Aggressive recruiting and training steps have been initiated and are paying dividends. Multiple tools including detailed qualification and training plans, teaming of senior and junior staff and mentoring are being used to train and develop the staff.

As discussed by Jennifer, the proactive materials management software will provide a significant tool for staff use in knowledge management and a comprehensive reference for our technical staff. Ongoing activities to promote materials engineering technical consistency among the offices of Nuclear Reactor Regulation, New Reactors and Nuclear Regulatory Research have been effective.

These include regular cross office interactions and meetings at the senior staff level, supervisory level and managerial level. In addition, these activities have fostered cross training of staff from the various offices.

This completes the staff presentation. Luis?

MR. REYES: Chairman and Commissioners, that concludes our prepared remarks and we're looking forward to your questions.

CHAIRMAN KLEIN: Thank you very much for that good presentation. Thanks all of you. Commissioner Lyons?

COMMISSIONER LYONS: Those were three excellent presentations. My compliments to all of you on each of the presentations. Although it didn't specifically come up in the discussions today, I just wanted to add some kudos to the staff on the model of the Davis Bessie degradation, which is now completed. I'm not sure exactly where it resides right now, but I think for anyone who has questions about the importance of issues discussed today, they have only to look at that model. I certainly find it very sobering. I'm glad we have a model and I hope we can use it effectively.

Some of the questions I planned to ask were really very well answered. I wanted to ask about how we're utilizing international experience and cooperation. That was certainly well discussed. I also was going to ask about the mechanisms by which we maintain independence in collaborative work with industry. And again, I think Jennifer you covered that very, very well.

You talked about the importance of independent analysis in order to ensure that we maintain the clear separation between our responsibilities and industry's. So, those are the two questions I won't ask.

A question -- I'm not sure to whom to address this, but there's been some discussion in the past about changes in water chemistry to address chemical effects in sump clogging. I'm just curious how those changes in water chemistry are evaluated within the NRC from the perspective of how they might influence or impact any of the material related degradation mechanisms?

MR. REYES: Commissioner, are you talking about the chemical additives?

COMMISSIONER LYONS: Yes.

MR. REYES: Those chemicals are additives that will come to the containment through the containment spray systems, so they're not in the reactor coolant system per se. But if you were to have an actuation of the containment spray with the chemical additives that become part of that, then you would have to make sure that before the plant resumes operation that there was proper clean-up, et cetera, et cetera.

I don't know if I'm answering your question, but if you're talking about the chemicals that are there for the containment spray scrubbing action, those are not in the reactor coolant system.

COMMISSIONER LYONS: I thought we were also making some changes in the reactor coolant as well. Maybe I'm wrong on that?

MR. GROBE: No, not in the actual operating reactor coolant. We are evaluating a variety of different buffering agents. Two of the considerations in evaluating the buffering agents include iodine scrubbing as well as materials effects -- post accident materials effects.

MR. REYES: That's external to reactor coolant systems.

COMMISSIONER LYONS: Okay. Thank you. I was curious if we are seeing any trends either positive or negative in material degradation condition reports. I'm recalling that there was some indication of actual decreases in those reports in the last year or two, but can anyone comment on that?

MR. REYES: Not in terms of the numbers, but in general terms if you look -- I think the industry does have an aggressive program in this area. If you look at the replacement of components and the aggressive nondestructive examination, you would have expected where we are now that you don't see an increasing trend.

We know most of the mechanisms and the efforts to look are prioritized per the intelligence. I don't know how you count the nonconformance reports that are written, but the program is very aggressive. The industry portrayed it correctly this morning.

MS. UHLE: I'd like to add that improvements in nondestructive examination techniques over time may detect flaws that were not detectable earlier, but certainly that we know now that the NDE techniques are effective at detecting flaws that are anywhere near structurally significant. I wouldn't say that it's an increase in degradation; rather it would be potentially due to the increase in the effectiveness of the ISI program.

COMMISSIONER LYONS: The only other question I had was just to ask if in addition to high density polyethylene piping are there other new materials on which we don't have experience that are being proposed for use in either operating or new plants?

MS. UHLE: We are working with the Office of New Reactors and I think Mike Mayfield can answer that question.

MR. MAYFIELD: Good morning, Commissioner. I'm Mike Mayfield from the Office of New Reactors. And with the exception of the polyethylene piping that we keep hearing about that hasn't actually been proposed yet. In terms of primary pressure boundary there are no new materials. There are some new fabrication techniques. For example, the single piece forgings being proposed for the EPR for the primary piping.

Again for the EPR the use of the ultra heavy forgings where the primary piping nozzles are actually forged into the nozzle shell, of course, as opposed to a welded fitting that's inserted.

So, there's some new fabrication techniques, but not so much new materials. The one exception comes from the liner. There's a duplex stainless steel being proposed as a liner material for the spent fuel storage tank. That's storage pool rather. That's the only real new material that's being proposed and the staff is working with the industry looking at the corrosion susceptibility of that material.

MR. REYES: The secondary side has been extensive replacement of the piping with alloys that are much, much resistant to erosion/corrosion, which is an earlier behavior and aging issue that came on the secondary side piping. That's pretty well understood and that's not something that's new in terms of innovative. There's been a lot of extensive replacement there of piping.

COMMISSIONER LYONS: Thank you. Thank you, Mr. Chairman.

CHAIRMAN KLEIN: Commissioner Svinicki?

COMMISSIONER SVINICKI: Thank you. I'd like to add my compliments to those of Commissioner Lyons to staff for very informative presentations. It answered some of the questions I might have had. I think I just have one comment and one question. Dr. Uhle, am I pronouncing that right? I'm familiar with challenging last names.

MS. UHLE: I think mine is harder than yours, but that's right.

COMMISSIONER SVINICKI: You referred to the proactive management of materials degradation tool and I was provided with some screen shots of the development of that. I just wanted to second what you indicated. I think this can potentially be a very useful tool to folks and I think that we're moving away from the days of a lot of dusty manuals on the shelf. I compliment you for development of this tool.

I think it will be very helpful.

The question I had as we heard from the industry panel and we've heard you mention as well, the need to prioritize issue resolution. I asked the industry panel about resources available for overall investment in this. There is a significant investment being made.

What I would be interested in is your views of the general harmonization between staff priority setting or your prioritization of issues to be resolved and industry's. Is there a good harmonization there?

And I guess I neglected to ask the prior panel how are you setting priorities? I'm just intuiting that it is both susceptibility as you're talking about, but also safety significance. Could you talk a little bit more about that?

MS. UHLE: I'd like to address your first question with regard to prioritization from the industry perspective and the Office of Research and NRC's perspective. That is, we did compare our programs as well as the results of the various studies and they are very, very well aligned. We continue to meet frequently throughout the year to respond to any operating experience that may arise to make sure that we're comfortable with again the priority of our programs.

We did in the report or the NUREG that summarizes the results of the expert elicitation study, we have competence ranked by susceptibility and then also by our knowledge of the degradation mechanism. Like I said, the worst would be if you're highly susceptible and there's not a lot of knowledge.

But we also recognize that there are some components that are potentially more safety significant than others. At this point in time, we're looking at not only the likelihood of degradation and how well it is currently mitigated by the industry because the report -- I just want to highlight that the NUREG report does not talk about any actions by the industry and whether or not they've already developed mitigation strategies.

However, obviously, they'd have to have a pretty high knowledge if they've developed mitigation strategies. So, you can infer from that. At any rate, we're taking all the information, the safety significance, the susceptibility and also looking at the operating experience because that is also a benchmark to our view of susceptibility and we are prioritizing accordingly.

At this point in time, it's very well aligned with the industries. There are some areas where the industry is working that we are not, but we are kept aware of that so that we're watching that. We're making sure that of the areas that we are most concerned about, they are being addressed. I would point to socket welds as an example where the industry is doing work and the staff is not.

COMMISSIONER SVINICKI: Would you characterize that more as slightly different emphasis as opposed to any disconnect in the overall priority?

MS. UHLE: Yes, exactly.

MR. REYES: The industry -- socket welds is a good example. Those are operational impacts that would put the generating asset out of service, but not necessarily a big safety concern. So, there's a reason why they have included on their list of things more than we have included. That would put the operation of the unit in jeopardy versus a reactor coolant system that will get you to the right type of issue.

MS. UHLE: They are connected to the RCS. Their failure would be a potential transient. So, they're not completely non-safety concern, but they're not as high priority as say dissimilar metal welds on the pressurizer, for example.

COMMISSIONER SVINICKI: Okay. Thank you.

CHAIRMAN KLEIN: I guess my first question is for Michele. Obviously, the analysis of the St. Lucie pressurizer weld was fairly dynamic for a while. Other than having that not occur during RIC, what do you think is the most important lessons that the NRC learned from that exercise?

MS. EVANS: I would say we learned that our staff has a very questioning attitude. We received the first report in February and then another one in March, but we got the additional information because we continued to question what came in the first time. Concerns were elevated to management and at that point driven to the industry indicating we need more information to be able to resolve whether or not there was a safety concern there.

So, I think that the lesson that continues to be shown is that we rely on the staff to filter through and look at what's coming in and raise the concerns.

MR. REYES: If I could add to that. I think in terms of constructive criticism, when you have interfaces between units in an organization, you always have this coordination information sharing and coming together with actions.

If you look at the area in EPRI that was doing that, it was more slanted to the research group versus the operations group. They didn't have the same sensitivity in terms of what would this mean if you were finding this in an operating side of the house.

Internally to the NRC, I think we could have done much better to try to link that through. So, it’s the old issue with organizations and units talking to each other and understanding different perspectives on the same science that was being pursued. So, I think we took that lesson to heart and the industry, I know, took it to heart. We didn't want to work the weekend.

MR. GROBE: I think one additional lesson. It's very difficult to communicate regarding -- metallurgists have their own language. They talk about flaws and indications and cracks. Each one of those words has a very different meaning and it's difficult to communicate to non-metallurgists the specific details, technical details of nondestructive examination results.

I think we learned through the process of ongoing emerging issues better ways to communicate regarding performance demonstration initiative, qualified techniques, what does an indication mean, what does a flaw mean, different aspects of how you communicate about metallurgical issues. I think that was a useful learning out of the effort.

CHAIRMAN KLEIN: Thanks. Well, this is a question probably both for Michele and for Jennifer. But on Michele's slide 13, you talked about planned implemented improvements through rulemaking for the pressurized thermal shock, the 50.61a. I assume that's risk informed. Is that correct?

MS. EVANS: I believe so.

CHAIRMAN KLEIN: Have you had much dialogue with other countries and how they're addressing pressurized thermal shock?

MS. UHLE: I can help out a little bit there. Through Nuclear Energy Agency and I don't want to have to pronounce CSNI because it's in French. So, sorry, Commissioner Jaczko.

COMMISSIONER JACZKO: That's okay.

MS. UHLE: We have a program in place that is looking at the reactor pressure vessel integrity and various ways of calculating it and there's pretty much a benchmark analysis going on that will take a look at the technical basis we developed using a risk informed approach as well as our fracture mechanics code, called FAVOR, that's at the Oak Ridge National Laboratory. We will be comparing the results that various organizations would have predicted.

So, there's an interest certainly in comparing the calculation approaches. Other countries are not as risk informed as we are. I think the other countries that are following would be Spain and Sweden, but we are keeping abreast of the calculational approaches which are important, obviously, any time we do risk informing.

MR. REYES: We have the most comprehensive regulatory requirements in that area. The industry does not agree that it has to be that comprehensive, but we do have it on pressurized thermal shock. No question about it. We have the most detailed low temperature protection, the administrative controls that we mandate at the plants in terms of the pumps, et cetera, et cetera. When the unit goes down its very thorough. I haven't seen anything even similar to that in other countries.

CHAIRMAN KLEIN: Thanks. Commissioner Jaczko?

COMMISSIONER JACZKO: I'll start with a brief comment and then have a couple of questions. This is more of a philosophical point, I think, more than anything, but I do wonder somewhat when we talk about life beyond 60 and this 60 to 80 year. I'm not quite sure and as I asked the panel earlier if we start to really think about what that's going to mean and what the criteria are that we're really going to look at. I'm not quite so sure that we're going to get the answer in a technical program.

I think in the end this is going to be some kind of a discussion we're going to have really at a high-level policy level about what it really means to continue to allow operation. I think that's the question that as I said I don't know that we're ultimately going to answer through research and other technical fields, but I certainly think it's important to continue to do the work in the materials area.

A couple of questions that I had. Going back to some of the issues that -- we just wrapped up the first-round of inspections -- or the first round of activity on the part of licensees to address the first wave of the dissimilar metals welds. And I'm wondering -- this is a question I probably should have asked the earlier panel -- but to what extent are we doing investigations of this welds before the overlays -- utilities are going in and doing overlays without doing -- those welds that have been identified to be susceptible? I don't know if you have information about that?

MS. EVANS: I don't have exact information, but generally they're not doing the inspection ahead of time prior to doing the overlay. In some cases, it's configuration and whether you can actually do the NDE. So, decisions are made to just go ahead and do the mitigation.

COMMISSIONER JACZKO: Okay. I guess I bring that up again. Certainly, if there are configurations where it's not possible I think that in many ways it's probably unfortunate because it probably would have given us information about better characterizing what was really going on in these welds. So, I think that it's a little bit unfortunate if there were welds for which we could have done -- or for which the licensees could have done.

This is a question -- you may not be the group to answer this, but I'll ask it anyway since it's somewhat related to this meeting. In two of the Babcock and Wilcox plants we had this drop line, I guess, indications of -- this is, again, in the next round and next level of susceptibility we had indications of cracking in this drop down line.

My understanding is not an area that's isolable -- if that's the right term -- in the event that there were in fact a crack there. I asked this question when this first came up with Davis Bessie. The overlay that was being done was done while there was still fuel in the core and the pipe was not in service. I guess I would just throw that out there as a question.

Has anyone given thought to should that kind of activity be postponed until -- in this case, I believe in this outage there was intention to do an offload of the core and they would have been, I think, drained most of the systems and then been able to do that activity without the pipe being in service.

MR. REYES: When you get into the outage in the pressurized water reactor, the first 96 hours are the ones that you get the most concern and we have some curves and time to boiling. When you look at the licensee's risk monitor, they will tell you that. That's how the decision is made, but realize that you are now at atmospheric pressure, so you're not going to have -- an active failure of a pipe is not a credible accident by our regulations. So, the fact that you may have a few drops or drips of water, it's not a safety concern.

When you get to the shut down mode an active failure of the pipe is not a credible accident by our regulations in the United States. What you're worried about is decayed heat removal from the spent fuel with the used fuel. If you're at a point that you have sufficient ways to mitigate it, then we don't take an issue with that. That's why they use their risk assessment to do that activity.

MR. GROBE: The regional offices had those dialogues with facilities when they were in the mode of making those decisions to understand what considerations they were making.

MR. REYES: And what countermeasures they had in case something went wrong. That's typically part of the planning.

COMMISSIONER JACZKO: Actually, I had talked to I think it was Region 3 at the time and asked them about this. It was something that they at the time said they hadn't looked at too much and asked those questions about the timing of that. It is something that I think -- again, I appreciate the answer and that certainly makes sense. Did you want to add?

MS. UHLE: I just want to add that we do have a research program that will be looking at various mitigation strategies, looking at overlays and their effectiveness. So, as the ASME code works to develop a code case that NRC would ultimately review, there is ample opportunity for interaction on the part of the NRC.

COMMISSIONER JACZKO: If I can just do one more question. One of the points that Mr. Gasser brought up earlier, which I thought was a very good point, was the situation they encountered, I think it was at Farley, where there is not right now an ASME code case or any kind of analysis of how we would do a repair of one of these systems if you had to take out the weld as you discussed.

Is that something that is in process to be addressed? Is that something that will be addressed with the 50.55 rulemaking? Again, I maybe should have asked this question earlier, but if anybody else wanted to address it.

MS. UHLE: Whenever there is not a relief -- excuse me, a repair technique that is in the code, the licensees are free to come in to request NRR review of a relief request and the staff reviews that in great detail with the materials engineering experts to determine whether or not it provides for adequate safety.

However, the ASME code and we're working -- the agency is working with the ASME code to identify areas where we would like the ASME to focus and certainly areas such as mitigation of primary water stress corrosion cracking is an area that we've been asking for them to pay attention.

COMMISSIONER JACZKO: Would that fall under this category?

MS. UHLE: Yes.

MR. REYES: No code repair. A non-ASME code repair may be acceptable to the staff, but our review of that is completely different than when they do a repair. As we're doing this repair for this ASME code and we do verify independently or monitor it completely different. When it's a known code repair they have to come to us. We have to do a thorough review and make sure it's adequate. Then that authority gets vested to NRR to be able to grant the code relief.

MR. GROBE: During outage season, spring and fall outage seasons, a significant amount of our staff time in NRR is spent doing relief requests where there is not a specific code provided for a certain situation that a licensee comes across. I don't think you can have codes that specify all the potential things that you can come across. We do a lot of code relief request reviews during outage season.

MR. REYES: There's a delay time in implementing the technique that we know is susceptible to making it to the code and then we endorsing it in the regulation.

COMMISSIONER JACZKO: How long is that on average?

MR. REYES: Once it gets to a -- I won't speak for the code, but once it gets to the code it's two to three years for us to get into the 10 CFR 50.55a. Whatever it takes for the code and they prioritize their work, too, so there may be some things that are nice to do that take a little bit longer.

COMMISSIONER JACZKO: Thank you.

CHAIRMAN KLEIN: Well, Commissioner Jaczko had a philosophical question about whether reactors should operate beyond 60 years. Mine's more of a practical one and I think our job as a regulator is to really look at the technical aspects of the safety and the security to see whether they can do that.

In that regard, I think your job is looking at materials degradation and aging and those things is very important that we as a regulator don't become complacent, that we stay diligent and we stay on top of those things. I think life beyond 60 will have a big technical impact as to whether -- for the reactors, Jack -- whether those are able to continue.

MR. REYES: I think what you have to reflect -- and I tell everybody is that when you talk about life beyond 60 the people are not beyond 60. The pumps are not beyond 60. Most everything is replaced and is not beyond 60.

There are some components that may be aged that we have to make sure in fact -- and Jennifer mentioned concrete on the high temperature, high radiation. That building would be there, but a lot of things are not of the same age.

CHAIRMAN KLEIN: Well, thank you very much for a very good presentation. I think we will continue to watch these as we age as well as the plants. Thank you very much for a good presentation.

(Whereupon meeting was adjourned)