UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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BRIEFING ON RESOLUTION OF GSI–191, ASSESSMENT OF DEBRIS ACCUMULATION ON PWR SUMP PERFORMANCE

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WEDNESDAY,

OCTOBER 25, 2006

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The Commission met at 1:30 p.m., in One White Flint North, 11555 Rockville Pike, Rockville, Maryland, the Honorable Dale E. Klein, Chairman, presiding.

COMMISSIONERS PRESENT:

DALE E. KLEIN, Chairman

JEFFREY S. MERRIFIELD, Commissioner

GREGORY B. JACZKO, Commissioner

PETER B. LYONS, Commissioner

INDUSTRY REPRESENTATIVES:

TONY PIETRANGELO, Vice President, Regulatory Affairs, Nuclear Energy Institute

JOE DONAHUE, Vice President, Nuclear Engineering and Services, Progress Energy Chairman, PWR Owners Group Executive Committee

AMIR SHAHKARAMI, Sr. Vice President, Engineering and Technical Services, Exelon

NRC STAFF:

JIM DYER, NRR

WILLIAM KANE, EDO

TOM MARTIN, NRR

BRIAN SHERON, RES

ALSO PRESENT:

LEON WHITNEY

ERVIN GEIGER

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

CHAIRMAN KLEIN: Well, good afternoon. We'll get to hear about a subject that part of us heard from the ACRS, the issue of sumps. Obviously, having been fairly new in this position, I was not here for the last discussion on the sumps, so I'm looking forward to that.

I would like to point out that Commissioner McGaffigan is not able to be here today, but he did express interest that it's a subject that he's very concerned about. He wanted to make sure that, we follow through. And so his absence today has nothing to do with lack of interest on the subject.

So, with that opening, any --

COMMISSIONER MERRIFIELD: Yes. No, I would -- Mr. Chairman, I would underscore that. Ed had really been one of the champions of making sure we kept our eyes on this issue, and I know he would like to have been here. But certainly, we will, nonetheless, proceed without him.

COMMISSIONER JACZKO: I'd just say I think this is an extremely important issue. I think as I've said in a lot of other fora, I think this is an issue that for a long time has been out there, and I think it's important for us to resolve it and move forward. We have a lot of plants that right now have a licensing basis that has an assumption of about 50 percent sump blockage for the sump screens. That has clearly turned out to be an assumption that's inaccurate.

And I think all the work we see now is to try and understand what the appropriate response is to that, and really how we

handle the changes that are going to occur, and then what kind of effects we may see from the changes that occur.

So I think there's still a lot of work that's going to happen in this area, and I look forward to hearing from people -- the first panel, and the staff as well -- about what outstanding issues there are and how we resolve all of them as quickly as possible.

CHAIRMAN KLEIN: Thank you. Tony?

MR. PIETRANGELO: Chairman, Commissioners, good afternoon. Let me begin just by saying that we trust our materials arrived in sufficient time for the Commission to be adequately briefed, and I can assure you that we have no additional materials to give you this afternoon as we begin.

COMMISSIONER MERRIFIELD: Tony, I thank you very much.

(Laughter.)

NEI is back on a solid track record, and I assume you will be continuing that well into the future.

MR. PIETRANGELO: We will strive to comply.

COMMISSIONER MERRIFIELD: Very good.

COMMISSIONER JACZKO: Apparently, news travel faster than material sometimes.

(Laughter.)

CHAIRMAN KLEIN: Well, if they hadn't, we were going to blame Marv anyway.

(Laughter.)

MR. PIETRANGELO: With me at the table today are, to my right, Joe Donahue. Joe is the Vice President of Nuclear Engineering and Services at Progress Energy. He is also the Chairman of the Pressurized Water Reactor Owners Group Executive Committee. Joe also has a number of BWRs at his plant.

And to my left is Amir Shahkarami. He's the Senior Vice President of Engineering and Technical Services at Exelon. Amir also serves on the Pressurized Water Reactor Owners Group Executive Committee, and also chairs the Boiling Water Reactor Group Executive Committee.

So I have a lot of experience on either side of me today that hopefully will give you a good industry perspective on what's going on here.

Really, this is an issue that not only affects the pressurized water reactors in this country but other countries, and we have endeavored to work together with other nations -- and I know the staff has with other regulatory agencies as well.

The Commission has set high expectations for GSI-191 to achieve closure by December 2007. I need to tell you that the industry, as well as the NRC staff, has worked really hard to meet these expectations, and we know we have a lot in front of us to go yet. But that's a pretty high bar you've set, and we're striving to achieve that in the face of some of the uncertainties we'll talk about during the briefing.

Can I go to slide 3, please?

This is an overview of the presentation. I want to start

with the evaluation methodology. What was developed to resolve GSI-191 was a highly conservative deterministic approach, and I'll get into some of the specifics of that in a moment.

In addition, some of the test protocols and methods that are being applied, in particular with regard to chemical effects, are equally conservative. In spite of that, licensees are moving forward with significant design and operational enhancements. I think Joe and Amir's presentations will give you some plant-specific examples of exactly how these guys are dealing with that issue, and I think it's pretty representative of what other plants are going through as well.

And, finally, we're as anxious as you to achieve closure on this issue. The bottom line here is trying to get reasonable assurance of long-term cooling, and we think we have a plan in place to get there.

Slide 4, please.

The evaluation methodology that we started with for GSI-191 is NEI-04-07. It was issued in May of 2004. It was really developed as a very conservative screening analysis to identify areas for licensee actions, and it's simplified to guide plant-specific actions depending on their plant-specific configurations.

The reason it's so conservative is that there's a lot of differences that really defy a unified approach to resolution of GSI-191, from the insulation materials used to the configurations of containment to the chemical buffers that are employed at each plant, really leads to plant-specific evaluations. And the methodology that was developed was intended to bound all those different circumstances. So that's most of the

reason why this is such a deterministic, highly conservative approach.

CHAIRMAN KLEIN: Just as a comment, I assume that you support standardization?

MR. PIETRANGELO: Absolutely, Chairman. Absolutely.

CHAIRMAN KLEIN: Just thought I would throw that out as we move forward into this next event.

MR. PIETRANGELO: The other point I wanted to make with regard to the evaluation methodology is at the time it was issued it did not include any guidance on chemical or downstream effects. Those resolution activities started in parallel with the issuance of that document.

And just going back a little bit, from a historical perspective, we sent the evaluation methodology to the staff for endorsement in May of 2004. The Generic Letter 2004-02 was issued in November of 2004, and the SER endorsing our guidance was actually issued in December of 2004. And that started the clock for licensees to respond to Generic Letter 2004-02.

The first joint industry NRC testing, which we refer to as ICET, or integrated chemical effects testing, took place in November of 2004. So the decision was made to move forward with resolution and not knowing what was going to come out of those tests. And we'll get into chemical effects in a moment.

We didn't stop at that point to say, "Okay, let's go do chemical effects and wait to see what happens." We moved forward with resolution.

Next slide, please.

This slide is just some examples of the bounding assumptions that are in NEI-04-07, starting with the worst break and the worst location, and by that I mean you select the break that maximizes the debris and head loss that you get at the screens. That's a very, very low probability event, the double-ended break of the largest pipe. In addition, there was no credit for leak before break, which was used in other aspects of the regulatory framework.

It's a spherical zone of influence. You take the double-ended break, up to 28.6 times the diameter of that pipe is the zone of influence that assumes the destruction of all the materials in that zone. Within that zone, all the qualified coatings on any of the equipment is assumed to fail in transport.

In addition, outside the zone of influence, all non-qualified coatings within containment are also assumed to fail. And then, another bounding assumption was that we'd assume 100 percent transport of all the debris to the screen.

Now, some licensees have done additional computational flow dynamics if that was a problem at their plant. Some plants can live with 100 percent of transport to the screens, and I think you'll see that in some of the plant-specific examples.

Next slide, please.

Chemical effects. I'm going to spend a little bit of time on this slide. Let me start with how chemicals get injected into PWRs.

The chemical buffers used, its primary purpose is to absorb iodine post-accident from core damage, and that's done in order

to meet the Part 100 limits. This is injected through containment spray in some cases. In other plants there are baskets within containment that have different buffers that are absorbed in solution post-accident.

The Pressurized Water Reactor Owners Group developed guidance for the plant-specific chemical effects treatment. This was bench-top testing. I should back up one moment. The joint industry NRC tests at the time it started in November 2004 were basically designed to demonstrate whether chemical effects were real or not.

At the time our evaluation guidance was developed, it was still an unknown whether we would even have chemical precipitants or not, so those joint ICET tests, the design was to demonstrate whether chemical effects were -- there was a potential or not.

In the testing that the Owners Group performed, there was, again, conservative estimation of the precipitant formation, and neglected any inhibition effects from silica or -- and also assumed very high aluminum corrosion rates.

So the problem we have today is that if you take a very high combination of high fiber load, together with high precipitant formation, you can get significant head loss. Another way to look at that is if you encapsulate a screen with fiber, and impose chemical precipitants on that fiber, you will get head loss. And I think that's been demonstrated in a number of tests.

The industry is pursuing a number of actions to resolve that, and we'll get into that in some detail later. But it's really a combination of refinements to the evaluation methodologies, the test

protocols, as well as looking at some other design changes.

And these would be in the areas of debris generation, transport and settling, chemical precipitant models, and some of the design changes the licensees are considering include jacketing some of the insulation, fiber removal, as well as changes to the operation of the containment spray system.

The key point I want to make here is that the effort is really aimed at trying to continue to work to get more realistic conservatism into our evaluation models and test protocols in order to get the reasonable assurance of long-term cooling finding that we all want.

But I, again, want to add that while all this is happening, these plants are moving forward with design changes, even in light of this uncertainty.

Next slide, please.

The next two slides really are a prelude to Joe and Amir's presentation. You're going to hear a lot about the analysis that has been performed and some of the testing that's being done in support of the strainer replacements, and you're going to find that there's many activities that go well beyond just the installation of large strainers.

Many plant-specific design changes -- really, again, the plant-specific situation is a driver in the resolution path, but I think by the first quarter of 2008 every PWR in the United States will have enlarged their screens from what they were.

Next slide.

This is just, again, actions that licensees have either taken

or are under consideration, with the common denominator being the installation of very large screens. But there's others here, I won't read them all, that licensees have taken or considered.

The one I wanted to spend a little bit of time with on this slide is the water management initiative.

COMMISSIONER MERRIFIELD: Can I, I'm sorry, just before we get there, just a clarification. The last bullet on slide 7 talks about the installation of new screens has begun and will continue until the first quarter of 2008.

Now, does that mean that they will be done by December 31, 2007, or will they be done -- completed sometime during the first quarter of 2008?

MR. PIETRANGELO: To the best of our knowledge -- and I'm not even sure this is complete -- all but one plant will be done by the end of December 2007, and even that one may be done by the end of 2007.

COMMISSIONER MERRIFIELD: Okay. And also, my understanding is that some -- and I don't think -- I don't know if this is in your slide -- that the timing of some of that is limited because of the number of vendors who can do this work. And so not everyone can get through the pipeline so to speak all --

MR. PIETRANGELO: Well, I'm only aware of one case where there has been a delay in the delivery of the replacement strainers at this point.

COMMISSIONER MERRIFIELD: Okay.

MR. PIETRANGELO: But that could be the case, Commissioner.

COMMISSIONER MERRIFIELD: Okay.

MR. PIETRANGELO: I did want to spend a little time on the last bullet of slide 8 on the water management initiative, and that really means the operation of the containment spray system and pressurized water reactors.

Why do we have a containment spray system? It's really designed to control containment design pressure and temperature post-accident, whether it's a loss of coolant accident or a steam line break. And it also serves as a means to inject some of the chemical buffers we talked about.

If you put the blinders on and just look at containment spray operation in GSI-191 space, I think you'll see that it only has negative impacts for GSI-191. It uses water inventory from the refueling water storage tank that would usually go straight to the core for cooling post-accident. It shortens the time that we get to the recirculation phase, which is not a good thing. More time means operators have more time to react to the accident.

It generates more debris as well as facilitates the transport of debris to the screens. It increases the approach velocity to the screens once you're in the recirculation phase. Again, it injects the chemical buffer, and it increases the NPSH requirements at the screen. So there's really no use for containment spray in GSI-191 space.

COMMISSIONER MERRIFIELD: NPSH, again –

MR. PIETRANGELO: Net positive suction head for the pumps.

COMMISSIONER MERRIFIELD: Okay. For the acronym challenged.

MR. PIETRANGELO: Okay. We're very interested in the water management initiative. There are two pilots and possibly three that have already expressed their intent to the staff to pursue the water management initiative. This is really a commercial for the rulemaking on 50.46(a), a much more rational treatment of some of the assumptions, the design basis assumptions, that go into different parts in the plant.

It's really an opportunity to sit back for a second and see what's conservative in one area isn't necessarily conservative in another area. And I think the 50.46(a) rulemaking gives us an opportunity to do more rational thinking about the integration of some of these assumptions and what their impacts may be.

With that, I'm going to turn it over to Joe for his presentation. Joe?

MR. DONAHUE: Hello. My name is -- and, once again, I appreciate being here on this very important discussion. My name is Joe Donahue. I represent both Progress Energy and as Chairman of the Pressurizer Owners Group.

As you may be aware, the PWR Owners Group is a combining now of all of the pressurizer water reactors in the United States, and we do have many international, which includes both the AREVA plants, the Westinghouse, and the Combustion Engineering. So I'm

speaking from the fleet of PWRs in the United States and our international members.

We've been doing significant work, and I'll touch generically and then I'll get a little bit into what Progress Energy is doing.

One of the key areas that the PWR Owners Group has worked on is where could we come up with those areas which have specific generic guidelines that we could give to the PWR fleet. And I think you'll see both from Amir's discussion and mine we've had to use different solutions potentially for the actual sumps, but where they are common we've used the Pressurizer Owners Group for the guidance.

Some of the things we've done is we've taken a look at operator action. And, obviously, we do not want to burden the operators and give more operator actions that are unnecessary.

But what we have taken a look at and given guidance on, in making sure we've looked at the EOPs, is things like ensuring we proceduralized as soon as we get into an accident condition and it looks like we'll get into recirc, that we start to fill the RWST. One of the things is water is a very important item.

Second, we're looking at if you do not need, based on the particular accident and the pressures, both trains of ECCS in service, shutting one down, leaving it in standby, and having the second. That also allows us a longer time for water.

We've also worked with the industry and many of the utilities have looked at, how could we train our operators in the simulator to see the onset of potential containment clogging? We've added that to

simulator, and added that to the scenarios, because that's important for our operators, if it did occur to some extent that the operators know what to look at.

The other thing we've looked at in the Owners Group is coming up with generic models and guidance on debris generation and transport. We've taken a look at very specific tests. We've worked with various separate utilities and with groups like STARS and groups of utilities to do various testing in both the area of debris generation and downstream effects.

Downstream effects is taken a look at. If the debris does get past the sumps, can it affect anything else, ECCS pumps, seals, throttle valves, and other valves. And we're also now working with both major fuel vendors on potential blockage of fuel. And is there a problem, and what does it mean? And we're doing that analysis in a collaborative approach.

And then again, depending on the plants, you'll see Amir talk about that he's going to be changing a few throttle valves. In my case we do not have to due to the plant-specifics, but we're developing the guidance as to how to go look for that.

Chemical effects, and Tony mentioned we have developed some standard tests working with the staff. We developed some tests where we've tried to take the most common chemical and the most common types of fibers and do some benchmarking tests.

The problem is, as you may aware, there's a lot of different -- we use two main buffers in the industry, but we have quite a

few different vendor names and vendor type insulation. And so we've tried to take the most popular and the most common and use that and to do standard testing.

From that, we've developed a spreadsheet which predicts what the chemical loading may be. And Tony had mentioned many of the conservatisms – I'll give a couple examples in a couple minutes where we have very -- a lot of conservatisms in there that I think we need to work with the staff to see what's reasonable.

We need to leave some conservatism in there. We can't go to zero margin. But I think we need to discuss the different things that are in it.

The other item is the PWR Owners Group has worked on alternate buffers. We're predominantly a trisodium phosphate plant, which is a static, and an NaOH, sodium hydroxide. We've looked at four different particular types of buffers, one of which is the same buffer we put into the ice condenser plants. At least one plant is looking at a buffer change, and the buffer does play into the chemical effects.

And we've started to take a look at the water management issue. And I think both in the case of buffer and water management both have their places for consideration. We need to look at them very deliberately, and we need to, as people move forward and they do their modifications and work with the staff, if in particular water management would need staff approval, that we do it in a way that we ensure we don't have any unintended consequences as we move forward.

Some of the other things, that we have basically have tried

to do is take uncertainties on each individual, whether it's debris, whether it's -- again, as we talked, 100 percent of the debris gets to the sump.

We've taken that conservatism. We've taken 100 percent of the chemical participation gets on the sump, and we've stacked all of the uncertainties up in a very layered approach, and that's very high conservatism. So we need to make sure we understand those.

Next, let me switch a little bit to the activities that Progress Energy in particular is doing. Progress Energy has one boiler, which we've gone through some of this in the past with the boiler fleet. We also have three pressurized water reactors. I'll talk in particular -- I have slides here for Crystal River and the Robinson plant, I'll also touch on Harris.

First of all, our Crystal River plant -- Crystal River was a pilot plant with the NRC for taking a look at sump change outs. We did change our sump out in 2005 and actually started to do the modification work in early 2004.

We tried to put the largest sump that we could put in that was reasonable based on what we knew at the time, as we continued to work with the industry on taking a look at these other tests. And we're continuing to test our sump and making sure we understand the margins.

Original design was 86 square foot. Today, the sump at Crystal River is 1,140 square feet, some 13 times the original size. We're using a design that's called the concentrical rolled and perforated plates, top hats, the kind of fashionable name.

We've totally added as many of these large vertical assemblies into the existing sumps. That has left us with around 50

percent screen loss margin for when we do all the tests from the guidance of the PWR Owners Group, while we continue to do additional specific testing.

Crystal River, we have analyzed the types of insulation that we have, and we are looking, as we continue to move forward, to add margin to Crystal River, for example in some future outages where we're changing the steam generators.

I think we know what -- what insulation is better positioned in the area of this question, so that we have margin in our design now. When we go into our steam generator, we're looking at changing that out in the future. We are taking a look at some other small locations where at this time we can change out insulation.

A couple of additional things for Crystal River. That particular design we have added a DP gauge, so that we can see potentially the onset of flow blockage at the --

COMMISSIONER MERRIFIELD: DP?

MR. DONAHUE: Sorry. Differential pressure gauge on either side of the screen, so that if you did have some blockage you would see an increase of pressure. That would tell the operator that that's occurring, which would then allow them to go into the operator action, such as shutting off one train.

Or, in this particular design, we have the ability to take the stored refueling water and actually flow it back through the sump and actually potentially flush out any debris. So we're incorporating those types of additional margin into the procedures.

Quickly about Harris -- there's not a slide -- the Harris nuclear plant will change its sump out in 2007. It is using the same technology as Crystal River -- top hat design, large verticals. The design for Harris today is 400 square foot. We'll add sufficient of these vertical top hat designs to go to two 3,000 square foot sumps.

We're also adding an additional feature, because we're more knowledgeable, we're adding integrated mesh screens to the top hat, which will further preclude bypass of debris.

COMMISSIONER MERRIFIELD: Can I ask you a couple of clarifying questions here?

MR. DONAHUE: Yes.

COMMISSIONER MERRIFIELD: You have a picture here of the Crystal River top hat screen around slide 11. It's somewhat difficult to tell how tall that is, although I suspect it's probably over six feet. Do you have --

MR. DONAHUE: I don't have that number directly with me. I can find that for you here in a second, so --

COMMISSIONER MERRIFIELD: You never know when you see something like that by itself how it relates to human size.

And this assembly here, which is four across and eight -- about 32 elements in that top hat, does that comprise the totality of the 1,140 square feet? Or is that just one of multiple --

MR. DONAHUE: It's one module that we've added into the sump space. We took the existing sump space and put as many of the top hat cylindrical cylinders in it that we could.

COMMISSIONER MERRIFIELD: Okay. So how many of these -- I mean, I just want to get a mental picture. How many of these modules would make up --

MR. DONAHUE: I'll have to get you that number. I have it here.

COMMISSIONER MERRIFIELD: Okay.

MR. DONAHUE: Top hats. And, again, at Harris, we've done basically the same design. We just have the larger sumps, and we've gone to 3,000 square foot. And we've left Harris with 100 percent margin for chemical effects as we move forward.

H.B. Robinson is our third pressurizer reactor. We're using the top hat design with --

COMMISSIONER JACZKO: If we could just go back. Maybe you can perhaps define what you mean by 50 percent margin and 100 percent margin for chemical effects. I'm assuming what that would mean is if you were to use the information from the chemical effects testing and assume that a portion of the screen were blocked as a result of the chemical effects that you would still have the ability to move the normal volume of water through the remaining screen area.

Would that be 100 percent margin for chemical effects testing -- I mean, for chemical effects? Or perhaps you could just explain what that means.

MR. DONAHUE: What we're basically doing is from a fiber loading perspective, we have 100 percent margin left, in terms of the net positive suction and the Level 4 supplying ECCS. Then, as we do the

chemical effects testing and see what its effect on head loss is, we have that margin available for us to use as we complete plant-specific chemical --

COMMISSIONER JACZKO: So the margin is in net positive suction head, not in surface area or screen area.

MR. DONAHUE: Right.

COMMISSIONER JACZKO: Okay.

MR. DONAHUE: And, again, at H.B. Robinson, roughly the same design. The difference is the cylindrical cylinders are horizontally mounted, and it's 4,200 square foot available to us at the Robinson plant, and it's around 36 times its original size.

When you take a look at the slide associated with it, slide 13, you can just see a graphical presentation. It's both in the outside the annulus region to the containment wall and also inside the D-ring.

Kind of lastly, some of the other things that Progress Energy has continued to do across our fleet, in the area of material head loss testing, we're completing plant-specific testing right now at both Crystal River and Harris. We're doing additional testing as we speak with our particular vendor.

We're using our prototype top hat designs. We're using plant-specific debris and debris sources, and we're using design velocities. And, for example, at the Robinson plant the design velocity is around an equivalent of moving a piece of debris -- it takes about an hour to go eight feet.

So we're continuing to work with -- that's a very important

part, because, again, we're assuming all the debris gets to the containment sump.

The other thing in terms of conservatisms, so you can understand the protocol, in our actual test it's the sump material indicates -- in this case, the top hat is put into a tank. We put full debris loading in it. We actually have to stir up the debris and keep it stirred up until it all gets on to the screen.

By itself, you would get some actual buildup on the lower side. So we have to stir it up continuously to get a full loading on it. So that adds conservatism to the calculations.

And the other thing we've seen in some tests -- and this is something we have to continue to quantify -- when we shut the pumps off, some of that debris actually falls off. And the key is you want to have available some space and not be totally encapsulated by debris. So that's more conservatism that I think we need to understand as we move forward.

We've done screen penetration testing, how much of the debris actually gets through the sump. We've done destructive testing with several of the utilities on containment coatings and understanding the effects of the coating falling off and where does it go.

Followup actions, we're continuing --

COMMISSIONER MERRIFIELD: I'm sorry. Before you -- can you just characterize -- you say you've done that testing. Can you characterize that testing at all?

MR. DONAHUE: Basically, what we have found is that for

the zone of influence for -- we have found that we need roughly -- the standard guidance is 10 diameters of your largest pipe break. What we have found that we could use, at one of our plants we've had to use only four standard type pipe diameters. One of our other plants is five, and one we're using 10.

So it's getting more specific as to actual -- if you have coating, and you actually have a blast of pressure up against it, what's the zone of the coating actually coming off. And I think both in our research and the staff we've also found that coating generally gets in chips, generally falls, and it generally actually doesn't transport to the containment sump. So those are the kinds of conservatisms and continuing to understand the particulars.

Last things that we're doing --

COMMISSIONER MERRIFIELD: I'm sorry. I don't mean to keep badgering you here but, screen penetration testing?

MR. DONAHUE: Yes. What we're looking at that is to make sure as you have the debris to encapsulate the outside of the first screen, do you have bypass? Do you have any of the actual debris get past that, and then continue to move on in a downstream effect?

And we have found with the new integral mesh that we've added that we limit the amount of debris that gets through the screen and continues on. And, again, that's another very plant-specific testing for the design.

Three other things we're quickly doing. We are continuing to look at aluminum. Aluminum is the key kind of material in containment

that gets in a participant. We're taking a look at where does it make sense to remove aluminum, and where do we have aluminum we can remove?

We're also taking a look at, again, various locations that we can remove additional fibers of different types at all three of our plants to continue to lower our fiber loading. And we will continue to monitor the industry for buffer change outs in water management, and we'll follow the pilot plants and see how those opportunities might continue to increase margin for our fleet.

COMMISSIONER JACZKO: Can I just ask you a question on the aluminum? I thought aluminum tended to only be a problem when you have the sodium hydroxide as the buffer. Are there problems with TSP buffers as well with aluminum?

MR. DONAHUE: It is more prevalent in sodium hydroxide, and I have two sodium hydroxide plants. So that's one of the reasons we're taking a look at it.

COMMISSIONER JACZKO: Okay.

MR. DONAHUE: I'd like to turn it over to --

COMMISSIONER MERRIFIELD: Before you do, just one -- the technology that you've chosen, the top hat design, who is the manufacturer? And do you know how many other plants are utilizing the same design?

MR. DONAHUE: It's a design from our engineering organization, Entercon. And I believe it's -- Tenco is the contractor. And then, we use Alon Testing to do the testing. It's a fairly common --

MR. PIETRANGELO: One-third of the PWRs are using

that design.

COMMISSIONER JACZKO: Okay.

MR. DONAHUE: Amir?

MR. SHAHKARAMI: Thank you, Joe. Good afternoon. I think I want to get back to a question Commissioner Merrifield asked about the fabrication of this strainer. It has been difficult fabricating those domestically and internationally. And you have people that are stationed at those places to make sure these are coming all together at the right time to be installed.

But the innovation of making those modular has helped us really to get them in a place that you usually couldn't get a big piece of the strainer. So I think that has been a good design, and I'd like to touch base on a couple of those things. But it hasn't been easy to get those materials on time on site to install.

Under Exelon PWR, we have Byron, Braidwood, and Three Mile Island. And I'd also like to cover Salem Unit 1 and 2, as part of our operating license, which we provide oversight for those units.

In respect to Three Mile Island, I'm not going to cover the strainer design, because that's the exact same design as Joe discussed on Crystal River. It is the same design.

However, based on recent testing by vendor, and that is being done, we feel that we didn't mix up sodium hydroxide and aluminum on fiber bed, and TMI is going to be challenge of ending up to do some upstream and downstream modification to compensate for those challenges. And what makes that even more complex, we have a steam

generator replacement coming up at TMI in 2009, same as Salem, 2008.

In respect to Byron and Braidwood, we have finished all the evaluation and sump design. As a matter of fact, we just finished installing those screens in Byron Unit 1. It's very, very tight compartment. If you look at it, both of them probably are not larger than this room. So maybe a small hole on top of the opening, you have to be able to get all these pieces in there and start building bottom up and make sure it is done right.

And the chemical testing, we have completed that per PWR Owners Group guidance. And we virtually have no fiber loading on a sump screen at Byron and Braidwood. One of the reasons for that is when we changed the steam generator on Unit 1 at Byron and Braidwood, we put fiber material and we're removing that within a zone of influence. So I think that's going to pretty much take care of the chemical impact.

If you look at the size and the cross-sectional area of what it was and what it is now, you would see even from 150 square foot to 6,000 feet that -- square total, and this gradual outline below shows that Byron is completed. Braidwood 2, will be doing that right now. We are in a refueling outage. We are finishing that up, followed by other two units in '07.

Some of additional hardware modification that we're looking at Byron and Braidwood, as I said, is remove and replace the fiberglass insulation within a zone of influence, reflective metal insulation. Those are only applicable to Unit 1 and within a zone of influence.

And also, install trash racks for large debris interception

right over the roof. These are huge suspended steel grading, so it would prevent any kind of large metallic object to get through.

We also have made enhancements to operational area. Actually have identified every debris that is of concern, about how we're going to do surveillance and prevent them. And we also change our modification process that anything that gets changed goes through the same rigor to make sure we're not introducing something new and maintaining the configuration as designed for this strainer.

We have also changed the emergency operating procedure to increase the cool down rate for a small break loss of coolant accident per bulletin.

Next slide, on page 18, shows the strainer in a training building. We actually did a mock up at the facility, which is in Switzerland, and make sure it all comes together right. We send it to the site. We build the mock up at the site, train people, and pretty much most of those people are the same people going unit by unit installing these things. And, as I said, the beauty of this is the modular aspect, that we can actually design and install.

COMMISSIONER MERRIFIELD: Okay. At this point, can I ask you the same question I asked of Joe. Do you have any understanding of -- I think I can gauge how big they are. But how many other utilities are using this design? And who manufactures them?

MR. SHAHKARAMI: As I said, the size is pretty much both sump -- as big as what we see in these four columns.

COMMISSIONER MERRIFIELD: Yes.

MR. SHAHKARAMI: The number I'm not sure. I can provide that to you, exact number of the strainer, because some of them are -- depending on configuration, you have to cut some of them short width, some of them wider width.

COMMISSIONER MERRIFIELD: Yes.

MR. SHAHKARAMI: So I don't know the exact number.

MR. PIETRANGELO: Another third.

COMMISSIONER MERRIFIELD: About another third?

MR. PIETRANGELO: Yes.

COMMISSIONER MERRIFIELD: Okay.

MR. SHAHKARAMI: It seems to be a magic number.

COMMISSIONER MERRIFIELD: I mean, is it -- not to be -- is it breaking down one third, one third, one third, in terms of the design?

MR. PIETRANGELO: I just hope it's not four-thirds, because that's going to --

(Laughter.)

COMMISSIONER MERRIFIELD: I'm the lawyer that no supposed to be able to add so I expect that you guys can. Maybe, I mean, what's coming out of this is it would be instructive to get a little better understanding, in sort of gross terms, how folks are breaking out, so I get some sense of it.

MR. SHAHKARAMI: Okay. Let me move on to Salem Units 1 and 2. Again, the slides that you're seeing are from 85 square foot to 5,000. Design is complete. We are planning to do chemical effect next month on those units. Based on what we know due to the high fiber

loading, we anticipate we have high load chemical effect on a strainer.

And that would require to remove some of the insulation at Salem as well. As I said, that's compounded by upcoming '08 modifications that we have to replace those generators.

One point to notice is that, as we install in this -- this screen in October '06, we will still be doing chemical testing post that installation, because of some of the issues I just discussed.

Some of the hardware modification is to remove and replace calcium silicate and maintain insulation within a zone of influence with reflective metal insulation. There are relatively a small quantity compared with the fiberglass. However, I think we're going to remove those. And also, installation of trash racks for large debris interception.

We don't expect to have any equipment modification for the downstream effect. Salem has done some work in the past that we're going to leverage the work that they've done.

And, again, you see in this unit pretty large area to work on, and it was much easier to transport and install these screens around the outside annulus of the containment. And the trash rack actually will be installed right in front of these screens.

Any questions before I turn it to Tony?

MR. PIETRANGELO: Okay. Thanks, Amir. Last slide, bottom line, what we're trying to achieve is closure. And that equals reasonable assurance of long-term cooling.

We've tried to, through the presentation today, put GSI-191 in context. Relatively speaking, this is a low risk-significant event.

There has already been a significant number of safety enhancements since the bulletin was issued in 2003.

Clearly, the challenge in front of us relates to chemical effects. There is no silver bullet for chemical effects. You know, we've considered the no buffer alternative, but that -- you still have boric acid present in the coolant, and it's injected through the RWST. And it raises other issues with regard to radiological protection.

So we can go there, but it also will challenge other assumptions and other analyses. So that would take a multi-disciplined effort to work our way through that. It has to be done deliberately, so that, as Joe said, we don't get any inadvertent consequences from that.

I think licensees, in light of the uncertainties with chemical effects, have tried to move forward with their screen designs by incorporating margin, and other actions as well that you heard about. And, really, the effort now -- and I think we had a meeting last week with the staff that went quite well -- is working to get more realistic treatment in some of these assumptions in both the debris generation transport, head loss, as well as chemical testing.

Just as an example. With these large screens being installed, it's significantly reducing the approach velocity of any debris to the screens when you do get to the recirculation phase. If we take the worst-case scenario, which is the double-ended break of the largest pipe in the reactor coolant system, at a minimum, it would take 20 minutes to empty the RWST essentially and form a pool in the basement of the containment building, at which point the recirculation pump would start

drawing water off the sump.

With the size of the screens that are being installed on average, and it's -- I think it's lower in some cases, slightly higher in others -- the average approach velocity to these screens now will be on the order of .01 feet per second. And in concrete terms, that would take about a half an hour for that debris to move from Ms. Vietti-Cook to Ms. Cyr.

So it's moving quite slowly. And that's in the worst case, 20 minutes to allow settling in that pool. In more realistic scenarios, you could be there for hours or days before you'd even start the recirculation phase if you had to.

So that's one of the areas that we intend to work with the staff on in terms of more realistic treatment.

Again, I think at the end of the day, is the recognition that the actions we're taking to put more realistic treatment of these phenomena into the evaluation methodology as well as the testing is the path to closure here, and recognition of those actions is the way to go.

With that, that completes our prepared presentation.

CHAIRMAN KLEIN: Thank you. Commissioner Merrifield?

COMMISSIONER MERRIFIELD: Tony, to get back to, you know, earlier in the discussion you noted that you believed everyone would get these in by the first quarter of 2008. And, really, it appears there may be one licensee that may be having some reasons for not being able to meet the end of December 31, 2007.

I think that -- I think there are seven -- seven units that will

not meet the December '07 deadline.

MR. PIETRANGELO: To be specific, the other units that requested extensions already did some modifications to their screens in order to get --

COMMISSIONER JACZKO: But not the complete modification.

MR. PIETRANGELO: There may be other actions beyond the screens, yes.

COMMISSIONER JACZKO: Okay. So there's one unit that will not --

MR. PIETRANGELO: I'm not quite sure of that either. They may all be done by December 2007.

MR. WHITNEY: There are six extensions outstanding where the full configuration screen will not be in by December 31, 2007.

COMMISSIONER JACZKO: Okay. Thank you.

MR. WHITNEY: There may be more plants, one extension covering a number of plants. But there are six extensions of the full configuration design.

COMMISSIONER JACZKO: Okay. Thank you.

COMMISSIONER MERRIFIELD: For the purposes of the transcript, could you identify yourself? We had someone speak out of the audience. Can you come to the microphone, please? Generally, we try to discourage folks from shouting out from the audience. We're happy to recognize our staff.

MR. WHITNEY: Leon Whitney. I'm with the Safety Issue

Resolution Group, DSS, NRR.

COMMISSIONER MERRIFIELD: Okay. And do you want to repeat that? Because I'm not certain the Court Reporter got that.

MR. WHITNEY: There are six extensions having been granted where the full configuration of the screen is not installed by December 31, 2007.

COMMISSIONER MERRIFIELD: Okay.

MR. WHITNEY: Now, some of those extensions cover multiple plants. I haven't counted plants in the few moments I had to look it up, but there are six extensions outstanding that have that as the reason. And there are, I might point out, interim strainer sizes for most all those. Or their existing strainer was somewhat significantly larger than the ones we've been talking about today.

COMMISSIONER MERRIFIELD: Okay. Thank you for the clarification.

I guess my question, having burned through about three or four minutes of my time, you noted that industry is pursuing a variety of actions, resolve the losses due to clogging caused by chemical effects, changes in chemical buffers being among some of the possible things you may deal with.

Will the refinements to the protocols that you talked about in the design change, maybe not the implementation, but will the design changes be complete by December 31, 2007, in order to close out GSI-191, absent the insulation, which we've given some waivers to? And, if not, what is the current thinking of when we will be able to close that out

realistically?

MR. PIETRANGELO: I don't know when all of the design changes are going to be done, Commissioner. But what I can say is that, as Leon stated, the strainers are being modified. In most cases, the permanent strainer is going in before the end of 2007. In a few cases, we're partially there. Okay?

COMMISSIONER MERRIFIELD: Okay.

MR. PIETRANGELO: There could be other design changes. I think we talked about the water management initiative. I think there's other potential cases for removal of fiber insulation, depending on how the chemical effects are done. So it's hard to say at this point that every single design change will have been worked through by the end of December 2007.

COMMISSIONER MERRIFIELD: Is it fair -- I'll ask a question. Do all of your members have plans in place to try to address that? Are there -- we heard from both Exelon and Progress where they've been conducting -- building the units, testing them to determine chemical effects, to determine effects of fibrous materials. Is that typical of the process being used by the totality of your representation?

MR. PIETRANGELO: Yes, I think Joe and Amir can confirm this, but with every strainer vendor, as part of that contract there's a testing part that looks at the chemical effects issue that's done in flumes on a plant-specific basis, with those particular materials and that specific configuration of the strainer that's going in. And look at both the chemical effects as well as the bypass testing that Joe alluded to.

COMMISSIONER MERRIFIELD: So in that regard, I don't want to put a pejorative on it, but do you think there is a plan in place so all of the licensees would be able to represent to the agency that they had fully vetted this issue, and presumably including the downstream effects and concerns?

MR. PIETRANGELO: Yes. I think every licensee wants to be in a position to justify the technical basis for what they put in their plant.

COMMISSIONER MERRIFIELD: Okay.

MR. PIETRANGELO: Okay? And part of that will be done through the testing, part of that will be done through other design mods to look at the conservatisms in the evaluation analysis. So it's a combination of those things. It's going to be a little bit different for each plant, I think as the presentations hopefully illustrated that it's not one solution that fits all.

COMMISSIONER MERRIFIELD: Right. You know, obviously, it's clearly -- I mean, I understand it's very plant-specific.

MR. DONAHUE: Commissioner Merrifield, the PWR Owners Group is coming out of the meetings we had last week with the staff and we're working. That's our number one priority right now is to take a look at our prediction models, look to where we propose that there is conservatisms, look at what test data we have that may point to that some of those conservatisms, should we need to address, and then we can sit down with the staff with specific items and say, "We recommend these particular areas we consider."

And I think that's where our focus needs to be here in this

next short period of time, because that's going to be very important to us to know, is the 50 percent or the 100 percent margin, or the margin we put in, is that sufficient? So that's really the focus the PWR Owners Group has taken.

Like I said, individual utilities are continuing to test specific configurations in their plant, and that's ongoing as we speak.

COMMISSIONER MERRIFIELD: Well, you know, clearly, you have been struggling, we have been struggling with trying to get this issue to bed. And the sooner we can get a clear idea from the totality of the licensees that NEI represents as to the time line of when they anticipate resolving those issues, so that we really can have -- great credit for the fact that folks are installing sump screens, and I don't want to take away from that.

But to be to say not only do we have the increased screens, but we have also addressed what we think may be the downstream concerns, what may be the issues associated with fibrous materials, and what may be the chemical effects with a coherent time line to give a communication to the Commission as to where things are.

And I'm going to finish with one final question, because we ate up some time. Can you give me some sense, having analyzed some of this -- and maybe the plants you talked about today are a good example -- how much core damage risk has been decreased by the installation of these larger screens?

MR. PIETRANGELO: No. This fact wasn't even modeled in most of the PRAs, because we're dealing with phenomena that we're

actually doing testing on now.

COMMISSIONER MERRIFIELD: Okay. Would you anticipate at some point down the road being able to capture that information?

MR. PIETRANGELO: I would. But given that this is driven by -- primarily by large break LOCA concerns --

COMMISSIONER MERRIFIELD: Yes.

MR. PIETRANGELO: -- the increase in -- the reduction in -- CDF won't be that significant, because the initiating event is very low.

COMMISSIONER MERRIFIELD: Fair point. Fair point. Thank you, Mr. Chairman.

CHAIRMAN KLEIN: Commissioner Jaczko?

COMMISSIONER JACZKO: Maybe a follow up on Commissioner Merrifield's point. I think we'd also -- I'd have to recognize I think the assumption that we have built into all our models right now is that there is 50 percent screen blockage. That's the assumption. And that with that screen blockage you would still have a workable, viable sump system.

So I think it would be very difficult to say that we could -- we would improve our core damage frequency with this change. In essence, what we're doing is our damage frequency really is not as good as we think it is, because of the faulty assumptions we have right now.

So I think, one of the issues that continues to concern me is where we are with chemical effects. I'm going to attribute this to Carl Papierello, who was our former head of the Office of Research -- and if it

was somebody else who said it, please correct me. But I think he said, really, the way we're going to have to deal with a chemical effects problem is with a chemical solution.

And I think that that's important, and I think a lot of what we've heard today is some of the things that are going on. I think that that -- chemical solution involves two things. It involves the buffer, and it involves some of the insulation material and doing things we can to reduce the chemical interactions that have led to the problems that we've seen. So I certainly think it's good to see a lot of the work.

The one thing that I perhaps would ask as a question is: has the PWR Owners Group given thought to having a program whereby at every outage you go through and do replacements of insulation, of fibrous insulation, with metallic insulation where it's appropriate, and places where there's aluminum, replacing that with an appropriate material?

It seems that that's done on kind of an ad hoc basis if we're improving or have a major component upgrade, a steam generator replacement, that you're using steam generators that don't have fibrous insulation. So has there been any thought given to doing a systematic replacement of that material?

MR. DONAHUE: I don't know of any particular thought to say systematically. I think most of the PWRs -- let me speak for our fleet -- our opportunities over the next two or three outages in containment due to MRP-139 inspections and major equipment overhauls are --

COMMISSIONER MERRIFIELD: I'm going to keep

challenging you on acronyms.

MR. DONAHUE: I'm sorry. In our --

COMMISSIONER MERRIFIELD: MRP-139?

MR. DONAHUE: The Material Reliability Group, EPRI's LO-600 inspection program, will avail us the opportunity to go in and do inspections on piping where we remove insulation to do that.

I believe the other item on which we do have to balance is some plants have asbestos or unibestos, the particular product name, and we need to manage both dose to take it off and asbestos. But, again, I think we need to balance all of that, and I think we know now today better insulation material, that where it makes sense to use that and maintaining containment temperatures where they need to be, that we know which material we need to move to. And I think that we're moving it.

Amir, I know you've done some things with your modification process.

MR. SHAHKARAMI: Yes. It is really not only getting those out, but also not letting them get back there. And that's the -- you know, within our processes we have actually put the specific line item, and you do any modification, you've got to be thinking about, how can you improve or how can you eliminate introduction of some of this material back into the containment?

COMMISSIONER JACZKO: Right. But as of now, there's no industry guidance on that? There's no --

MR. SHAHKARAMI: No. As far as I know, there is not.

COMMISSIONER JACZKO: At least PWR-specific, I

guess I would say.

MR. DONAHUE: We'll take that under advisement.

COMMISSIONER JACZKO: And along that same note, I mean, one area of importance I think is really the situation with coatings and what the status is with coatings in containment. I'm wondering what your view is on how we should really verify containment and -- I'm sorry, verify coatings and containment as we go forward and look at this issue.

You know, is there -- perhaps you could educate me on how we -- do we visually inspect coatings in containment right now? Or what's the process that we look at that?

MR. PIETRANGELO: Yes. Currently, it's being done per the standard that has been endorsed by the NRC. There are some additional methods that are going to be looked at in the pilot project starting this fall, to look at more destructive testing of the coatings. And the staff is working with us on that. We'll get the results of that and plow that back into the standard process. So we're always looking to improve the methods.

COMMISSIONER JACZKO: Okay. The final question I would raise, and perhaps this is something more for the staff as well, but ACRS sent us a very interesting letter on this issue back in April of this year.

And ACRS has -- I think it's good to take a look at the things that ACRS has said, because I think for a long time ACRS was encouraging the staff and the industry to do the chemical effects testing that I think eventually was done. And I think, by and large, their

prognostication turned out to be a good indication that there was an issue there.

One of the issues that they have raised is that essentially we're going through now with a lot of facilities, and we are making the screen -- the surface area of the screens a lot larger, which will have the effect of allowing coolant to flow through to the vital areas and to the reactor at some point.

But potentially, if we have a lot of this debris and we have a lot of material and solution, and as this moves through, that material may end up somewhere. And I think ACRS's concern is it's going to end up in the core, it's going to end up -- I think their concern so much isn't right now that it's going to end up in valves and pumps and cause problems there. But what happens if you start to have debris accumulation in the core?

And I'm wondering if you can kind of describe to what extent you're doing research in that area and what you think -- what the state of the art is right now in answering that question.

MR. DONAHUE: We have in the PWR Owners Group -- this is Joe Donahue. In the PWR Owners Group, we do have an initiative to take a look at working in both our two major fuel vendors -- Westinghouse and AREVA. Looking at each of the individual particular designs, because there is also internal designs and individual fuel type designs, to take a look at exactly those issues of flow blockage and what's it do, and how does it play out, or does it play out in the field? So those studies are ongoing.

COMMISSIONER JACZKO: Okay. When do you

anticipate having some -- some kind of conclusion, or at least information, from those studies?

MR. DONAHUE: Well, we believe we need that information as we try to drive through here by 12/07. So I'll have to get back to the Commission on -- those studies have just been kicked off here recently. The individual plants are looking at the internal studies, so --

COMMISSIONER JACZKO: But right now you're under the operating assumption that you're going to have information prior to December '07?

MR. DONAHUE: Well, a better understanding.

MR. SHAHKARAMI: In the case of Salem, as I indicated, you know, they are concerned about fuel blockage, and we actually undertook an evaluation through Westinghouse, a detailed evaluation, to ensure that you're not going to have a fuel blockage. And that study is complete, actually. So case by case, I think we need to go address that.

MR. DONAHUE: Yes. You've got really two issues. You have flow blockage, and then you've got, what's the impact of the fuel. We're putting our time first on the flow blockage. I think impacting the fuel may take longer, but flow blockage is really the concern, because you want the flow back to the core.

MR. PIETRANGELO: Besides increase in the surface area of the screens, you also noted the change in the hole size. And then, at that approach velocity on average, if you allow some time for settling, I think the downstream effects are clearly not as significant as the initial problem.

COMMISSIONER JACZKO: Okay. Thank you.

CHAIRMAN KLEIN: Commissioner Lyons?

COMMISSIONER LYONS: Commissioner Jaczko mentioned the ACRS views on this, and I'll certainly focus on this more with the staff. But does industry have a perspective on the difference of opinion between our staff and ACRS on the need for the agency to continue research in this area?

MR. PIETRANGELO: Yes, we do. We put it in context that we spent an awful lot on an area that's not terribly risk-significant. So we don't really see spending additional resources on something of this nature as really being terribly valuable.

I think this issue has been out there for a long time. The labs have been working on this first with the BWRs and then the PWRs for quite some time. There has been a lot of resources devoted to this issue. I think there's other issues that maybe your money is better spent.

I think Commissioner Jaczko is right. The ACRS has asked some very pointed questions and pointed out some things that led to some discoveries. But, to try to generate plant-specific models, and then validate this in the testing, is just a step beyond I think where we want to go at this point.

We refer to it as the unified theory of sumpology in our shop, and it's very difficult with 69 different PWRs to come up with a model to predict exactly what's going to happen in this area. And our focus has been on actions that licensees can take to address the key assumptions and the evaluation for their specific plants, and demonstrate that there's

adequate margin to address this issue.

COMMISSIONER LYONS: I appreciate your point of view. I'll certainly get into it more with the staff. But just for now, let me note that I do share Commissioner Jaczko's point of view that because of these uncertainties, particularly from the standpoint of any possible effects within the core, while it's certainly true that we're reducing them, reducing possible effects with these changes, we don't know what we're reducing it from. So I still have real questions in this area.

And I guess, Tony, you partly touched on something that I wanted to follow up on. This was an issue with BWRs in the '90s, and I simply don't know the history. And I'll ask the staff this, too. Why did it take us I don't know how many years to figure out that this was also a potential problem with PWRs?

MR. PIETRANGELO: I hope Joe can address why BWRs went first. I think when you're --

COMMISSIONER LYONS: Well, I understand there was an incident at a BWR. But they're still sumps. I'm missing the point here as to why it took a while.

COMMISSIONER MERRIFIELD: That may be more appropriately directed to the staff, honestly. I don't know.

COMMISSIONER LYONS: Okay. Believe me, I will be asking the staff, too. But I am puzzled by it, because certainly it would be of interest to the staff, but it would also an interest of industry if there's sump interest –sump concern raised, at least of my level of understanding -- and there may be good reasons why I'm just wrong -- but to me, if

there's a problem on BWRs, then it's logical to look at PWRs, too.

I guess one other question. Tony, on your last slide, you talk about the importance of closure, and I very much agree with you. At least in my mind, though -- and I'm just curious if this is consistent with what you're thinking -- closure requires not only the larger screens, but it also requires understanding -- better than perhaps certainly I do now -- the chemical effects, both on the sumps and in the core.

To me, those are all required to say we have closed this. Is that consistent with your --

MR. PIETRANGELO: Yes. I think we've demonstrated that if you don't have a fiber mat that encapsulates the screen, then chemical effect is not an issue. They simply pass through. And once they get through some pretty high pressure pumps, that's not an issue going forward in the rest of the system. Okay?

The issue is when you restage and encapsulate the screen and fiber, and then add the chemical precipitant. That's why I think if you're an all reflective metallic insulation plant, you could do the testing and show you're okay. It's the plants that have fiber where it's more problematic. The screens are designed to try to incorporate the uncertainties associated with the chemical effects. So that's where the issue is.

COMMISSIONER LYONS: One other comment I'll be making with the staff, too, as the industry looks at potential chemical changes in the buffers or elsewhere, and as the staff evaluates that, I hope that we take time to view the chemical system in a holistic way,

because that's largely how we got into some of the current issues, is it was a one-step-at-a-time fix without ever looking at what was the overall impact.

And while some plants are moving fairly quickly to change the chemistry, I hope there's enough thought going into the holistic view.

MR. PIETRANGELO: We couldn't agree with you more. I think design changes made at nuclear powerplants need to be very deliberate, and make sure there's no unintended consequences. And I think part of the box we're in now is, again, when you focus in on a single area and pile a lot of conservatisms in every stage of that methodology, you can see where maybe you're not so conservative with respect to other phenomena in the plant.

And, again, I think 50.46(a) rulemaking really affords an opportunity to do that more rational holistic approach to how these different things fit together. So I think in Joe's remarks we're not going to change the buffers willy nilly without an integrated evaluation of it.

And, again, this would involve multiple disciplines in terms of reviews, radiological consequences, etcetera, before a change like that is made. And something like that is not going to get done by the end of 2007.

COMMISSIONER LYONS: Thank you.

CHAIRMAN KLEIN: On page 5, I was intrigued by your bounding assumptions, having been an experimentalist. You have a lot of maximum assumptions that tend to potentially have a very conservative impact when you look at an instantaneous double-pipe break, all the

coatings fail, and 100 percent transport. Is that -- I mean, is that your assumption for all of these cases?

MR. PIETRANGELO: That's the baseline analysis, which was really used as a screening methodology to point out where some of these are problematic for certain plants, and to try to focus their actions on resolution in specific areas.

Now, you could take from that baseline, do more testing, or do more analysis to try to reduce some of those assumptions, and some of the plants have done that. But that's what we started with to bound the problem.

CHAIRMAN KLEIN: Have you done any testing to find out how much of the coatings you think might fail, or how much might be transported?

MR. PIETRANGELO: Yes, I think there has been some coatings tests done where not all of the coatings fail when it's hit with a pressure stream.

MR. DONAHUE: For example, the zone of influence, the standard was 10 pipe diameters. And some work with this, some of our colleague utilities has allowed some of us to go to a zone of influence of four or a zone of influence of five.

But basically -- and that's where we have to step back and look at the conservatisms, because we are assuming all debris -- and we've got a very conservative population of all, gets to the sump and then encapsulates the sump, and then the precipitation all occurs and gets on there.

We'd need to take a look at that and be realistic. Building margin in would be realistic, and we've just got all of that stacked up at this time, and I think that is why we have to take a look at that in conjunction with, if we don't have to change buffers to solve the problem because it's a conservative problem, that may be where we want.

It may be an element of where we need to do some water management, some buffer changes in a very deliberate means, and some removal of the insulation materials that precipitates out, and be realistic to be a very holistic approach. This is a system-related aspect when you're into potential chemical effects. And that's really the conclusion we're coming to.

CHAIRMAN KLEIN: You had indicated that this obviously is an issue that impacts our international partners as well. What's happening on the international front with sumps?

MR. PIETRANGELO: EDF is a member of the -- Electicite de France, is a member of the PWR Owners Group. We've also had interactions with other nations on this and tried to share experience. My understanding is that they're seeing the same things in their tests that we are.

I don't think they're on quite the accelerated schedule that we are currently on. I think they have pushed this back quite a bit. So we're a little ahead of the curve in that regard, Chairman.

COMMISSIONER JACZKO: It may be helpful, too, on EDF – for instance, they have gone to much larger sumps several years ago. So in terms of larger screen area, that issue has been resolved by

most of our international partners, who have PWRs, so --

COMMISSIONER LYONS: No, I think they're way ahead of us in going to larger sumps --

COMMISSIONER JACZKO: Yes.

COMMISSIONER LYONS: -- is my understanding.

COMMISSIONER JACZKO: Yes, they've done that in the past.

MR. PIETRANGELO: Their existing screens are slightly larger, but they're enlarging those screens as well.

CHAIRMAN KLEIN: In making the next leap, assuming that there are new reactors built, I assume that there's been considerable thought that this issue will be addressed in the design phases as opposed to retrofits?

MR. PIETRANGELO: God, I hope so.

(Laughter.)

In a passive design, I think that's probably not a big issue.

MR. DONAHUE: In fact, on at least one particular reactor design, that is an open COL item, to address this issue consistent with that plant design.

CHAIRMAN KLEIN: On pages 11 and 18, on some of your examples that you've shown -- Commissioner Merrifield had noted this earlier -- it's difficult to tell what physically those sizes represent. But I was at Fort Calhoun recently, and it appears that they have some space challenges.

Is that the case of most of these plants? Do you have

challenges getting these screens in place?

MR. DONAHUE: Right. If you take -- let me use -- we started off with the Crystal River site. It's around 10 to 12 feet height, and we started with it because we did these designs, really, in 2004.

We had available some space, so we said, "Let's put as much of this top hat design and increase the square footage as much as we can within the existing sump area." And that allows us -- because we know where the water level fills up in the containment, and you really want to flood totally the screens, so you get maximum use.

So that was a constraint to us, at least initially, was to use just what was in the sump area. That's exactly what we've done with Harris. We just had a larger sump.

As you take a look -- I think if you'll look at a couple of the designs that Amir talked about and in our Robinson, the design there meant we had to go and move it out into the floor, because that design did not have a pit sump arrangement. So we are taking containment floor space up with these sumps, and we tried to go as maximum as we could.

And really, in essence, as I look at it, built a false floor, and then put the grading on top, so that we can have the sump. And, again, in our design, we have the top hat design laid down on the side, and I think -- you know, Amir talked about the construction concerns that he had with -- or constraints that he had with his particular design.

MR. SHAHKARAMI: But Byron and Braidwood, before we installed the design, we did consider actually cutting the concrete -- the roof out and be able to expand it. I mean, that's how confined the area

was. But since we did the analysis and we felt pretty good with the margin we developed, and we only had maybe a couple more of these we can add in a pit. Otherwise, we just must do it all over. But our design, we feel pretty comfortable, because lack of fibrous issue and need for additional margin.

CHAIRMAN KLEIN: Okay. Thanks. Commissioner Merrifield?

COMMISSIONER MERRIFIELD: I would say -- and I don't want to discourage people from using pictures in the future, I think it's very useful, actually, just putting it into context would help. But overall, I don't want to discourage that.

I think -- well, I know there's at least one other design, because I was at South Texas earlier this week and saw the third design that may be the other third, which is more of a -- for lack of a better word -- sort of sandwich form with a series of plates with perforations on each side, all of which seem to be different methodologies to accomplish the same task.

It does strike me that, you know, I think there's a -- obviously, the staff is grasping to try to keep us briefed in terms of where things stand. You all, through your members, have been attempting to meet the requirements and the date.

I think this is sort of a perfect example where some type of a matrix outlining where all of the utilities are, the designs chosen, the timing and when they're going to be installed, when you expect the chemical testing to be done, when do you expect the other testing to be

done. If that kind of information were available in an easy-to-digest way, it would certainly make it easier for me to understand where you all are going.

Now, on the comment, Tony, that you made regarding the unified theory of sumpology, the only -- you know, having heard what ACRS said on that matter, and recognizing where you all are coming from, I mean, I'm informed a lot more today about the depth of the research that you have underway to address those issues through what appears to be the three major vendors who are -- and maybe more, but there appears to be three major vendors of these systems at the plants.

It strikes me one of the things that we try to grapple with is the issue of transparency. You've got access to that information. You're making decisions based on that. For us, as the regulator, you know, what we're grappling with is trying to understand all of that.

And to the extent that more of that information could be made a bit more transparent in a way so that it would address some of the confidence concerns about, are things really going along the right track, and I would argue that perhaps some of the questions being raised by ACRS in a challenge to have the staff do more research could well -- I don't want to make any promises, but it certainly could well be tampered by better information about what you all have underway right now.

MR. PIETRANGELO: Well, the ACRS has been along every step of the way throughout the evaluation of GSI-191. There have been at least two separate vendor presentations before the ACRS on the specific screen designs and on the test protocols that each -- each are

used.

Dr. Wallis even went out to witness some of the testing. NRC staff has witnessed almost all the testing that has gone on a plant-specific basis on this. So I don't know how we could possibly even be more transparent with the ACRS than we are now.

Plant specifically, each licensee will supplement their Generic Letter response with their technical basis. They'll look at the request for additional information that the staff had issued previously and defend what they have in their plant. And there's a certain schedule that has been laid out to do that. That's all publicly available.

So I'm struggling with, how do we be more transparent than we are now with not only the ACRS but with the staff?

COMMISSIONER MERRIFIELD: Well, as Commissioner Lyons has already mentioned, this is -- this is fair game for our staffs to discuss as well, and I look forward to Jim Dyer perhaps sharing some of his views, and Brian -- sharing some of their views in that regard.

Thank you, Mr. Chairman.

CHAIRMAN KLEIN: Commissioner Jaczko?

COMMISSIONER JACZKO: Well, I think we had the ACRS here just last week, so it was useful I think to have the meetings close to each other. One of the things that I understood ACRS was saying was that part of the reason they're thinking the staff should do additional research is really to be able to verify some of the research that has been done in the industry.

This is a very complicated problem, and it's not a -- I

guess I always get a little bit nervous when we want to try and talk about realistic assumptions and realistic models, because this is a very difficult situation to model and to discern what exactly would happen in the event of a LOCA situation.

And I think, you know, trying to put too fine of a number on this is a very dangerous proposition, because it really is -- this is, I think, really, you know, taking the best engineers out there, using their best judgment about what might happen, and then trying to come up with a good solution.

And I think as the ACRS has really said, they support the path that the staff has gone down to increase the sump size. Often, I think the best way to look at this is let's figure out what we all pretty much agree on.

And I think everybody agrees that the sumps that are in PWRs right now are too small. And we have some sumps that, although they may have already been changed, that were on the order of tens of square feet, a couple of these coffee mugs stacked up, you know, about this high, and a couple of them were the size of some of the screens.

So that's kind of I think what we started with, and from there, the staff moved forward to say we need larger screens. I think in doing that, the ACRS pointed out -- and I think the staff recognized, that there may be other issues to consider, then, and I think that's going to be a difficult task to make sure that we have the right decision.

And this may be an issue that's going to take some time. And I think it's important that we not rush to get closure on something, but

continue I think to get research where we need it and to look at workable solutions.

I did have one quick question, if I could, and I apologize if I say your name wrong. Shahkarami?

MR. SHAHKARAMI: That's correct.

COMMISSIONER JACZKO: You mentioned that at one of Exelon's sites, I believe -- or Mr. Donahue -- that you have a procedure to do a back flow. Maybe you could describe a little bit more about what that is to -- I guess the idea is if you start to get some blockage in the sump, that you can reverse flow or provide some kind of flow that would --

MR. DONAHUE: We can basically flow the refueling water storage tank through the sump, which in fact acts as a back flow. It's not something we directly tested. The piping capability is there, and it's where we're taking a look at, where do you have potential and opportunity? That is not something we have on our other two designs.

COMMISSIONER JACZKO: And is that something that is that unique to your facilities, or are the configurations of some plants unique enough that that's something that could be used at other places?

MR. SHAHKARAMI: I think there are probably cases. I don't think it's a generic issue that everybody has that capability.

COMMISSIONER JACZKO: And I'll probably just ask the staff later, then, if they've looked at that and have any thoughts on whether that's something that would fit in with some of their analysis. You can save that for later, if I forget to ask it.

MR. PIETRANGELO: In some of my early construction days, we used to flush the header from the RWST down to the sections of the containment spray pumps and residual heat removal pumps. Some designs have motor-operated valves as isolation. Some use check valves. If you've got a check valve there, you're not going to flush down to -- you wouldn't be able to employ that in that kind of circumstance. So it depends on how the containment isolation design is at each plant.

COMMISSIONER JACZKO: Okay. Thank you.

CHAIRMAN KLEIN: Commissioners Lyons?

COMMISSIONER LYONS: I don't know that I have a question, but just a comment -- that I'll be very interested as you -- as you collectively present your information on the chemical testing. And I say that because I've been sufficiently concerned about this that I have visited each of the labs that's involved in this testing. In fact, I think Greg and I went together to Argonne.

And if I could perhaps say the one thing that impressed me the most was the incredible dependence on initial conditions. They seem to get such a wide range of chemical effects, depending on the precise assumptions made on temperatures, on the extent of mixing of the various constituents before the flow started. It struck me as a very complex problem, so I'll be very interested to see your responses to that.

CHAIRMAN KLEIN: I think my comments are similar. In listening to the ACRS, in terms of their research program that they discussed, having crawled through a lot of plants, this is applied research, not theoretical research, because it will depend on configurations,

assumptions, particular plants, and it's an area that it would be very difficult to come up with an exact model for each particular plant, just because of the way these plants are configured.

MR. PIETRANGELO: I'd go back to your initial plea for standardization. If they were all the same, we could do a lot more testing that would be applicable to the fleet of plants. In this case, it's hard to get -- maybe for Byron and Braidwood you can do that -- but across the fleet, you're really challenged to try to come up with research that can be applied beyond just the one plant.

CHAIRMAN KLEIN: This is another reinforcement, as we move forward, for standardization and a lot of standardization.

MR. PIETRANGELO: Yes.

CHAIRMAN KLEIN: Any additional comments?

COMMISSIONER MERRIFIELD: Well, it could be worse, Mr. Chairman. We could have all chosen a different vendor for the sump screen.

(Laughter.)

At least they narrowed it down to a smaller subset on that particular side of the house.

CHAIRMAN KLEIN: At least they're making progress.

COMMISSIONER MERRIFIELD: Indeed.

CHAIRMAN KLEIN: Well, thank you very much, and I think we'll now move in and -- and I think Commissioner Lyons has a list of questions for Jim Dyer already.

(Laughter.)

CHAIRMAN KLEIN: Well, obviously having the benefit of hearing the previous discussion, in the list of questions that are already prepared we'll move on. Bill, do you want to start?

MR. KANE: Yes, Mr. Chairman, Commissioners. We're pleased to be here today to provide the staff's assessment of the current status of Generic Safety Issue 191. We have at the table Office of Research, Office of Nuclear Reactor Regulation, and also others that are here to provide support.

I know you have a lot of questions for Jim Dyer.

(Laughter.)

MR. KANE: So with that, I'll turn it over to Jim Dyer.

MR. DYER: Thank you, Bill.

Good afternoon, Chairman, Commissioners. The purpose of this afternoon's presentation is to report to the Commission on the progress we have made in addressing the Generic Safety Issue 191 concerning debris induced clogging of the pressurized water reactor containment sumps during loss of coolant accidents. I think that eliminated all of my acronyms for the day.

We also discussed our planned path forward to address closure of this generic issue and the remaining challenges that we see before us, and as said earlier, I last briefed the Commission in March of 2007 on this subject, and at the time we were just beginning to understand the significance of the chemical effects testing that had been identified in 2005 and put conclusions together in 2006 and potential impacts on that.

And at that point our conclusions were that we're moving

in the direction of larger strainers, but we didn't really have a fine tuned path forward solution at the time, and at this point I'd say end of the year, six months later, we're still continuing to make progress and moving in the right direction, and as you've just heard from the industry speakers.

Can I have Slide 2, please?

The agenda for today's meeting, the staff will provide a more detailed review than we did last March, and first I'll provide the brief regulatory history and try to answer some of Commissioner Lyons' questions and summarize how we got here, to where we are today.

Then Tom Martin, the Director of the Division of System Safety, which is the lead organization in NRR, will provide the status of the responses to Generic Letter 2004-02, a summary of what the staff views to be the key technical issues, the status of research and also the staff's conclusions as to where we feel we are with resolution of this issue.

And Dr. Brian Sheron from the Office of Research is here to answer the questions concerning research.

Slide 3 please.

CHAIRMAN KLEIN: So you're going to handle the sumpology questions?

MR. DYER: The sumpology.

(Laughter.)

MR. DYER: Yes. Just as a point though, Brian was here for the March 2007 presentation working for NRR at the time.

Regarding regulatory history, the concern was strainer clogging and dates back really to post Three Mile Island accident, and in

fact, in 1979, this was raised as a concern for both boiling water reactors and pressurized water reactors under unresolved Safety Issue A-43.

And after some extensive research, the issue was closed in 1985 with a recommendation to change the regulatory guidance, but not a mandate to revise the licensing basis for the existing plants.

So most of the plants remained licensed with the assumption of 50 percent blockage of their strainers regardless of their design and the materials in the containment.

In the early 1990s, the events at boiling water reactors, both internationally and within the U.S., raised concerns about fiber and fine particles from piping insulation and debris in the suppression pools creating a filter across the strainers and clogging them during the loss of coolant accident in the boiling water reactors.

This concern was resolved through the NRC issuance of several bulletins leading the industry to increase the size of their strainers and improve the maintenance practices inside the containment to limit debris.

Based on the information gained from the boiling water reactor experience in the early '90s, Generic Safety Issue 191 was opened to address the potential for PWR sump clogging during the loss of coolant accidents.

And to address one of Commissioner Lyons' earlier questions, and I was on the project staff. I wasn't working on the technical staff back in the early '90s. At that point our focus was one that when the boiling water reactor issues occurred, there was a sense of urgency in

dealing with the boiling water reactors immediately, and that's where we focused, and then after coming to a solution with the boiling water rectors, we turned our attention to the pressurized water reactors and tried to define the problem given the materials in the pressurized water reactors.

And after some research then is when the NRC staff concluded that the current licensing basis for pressurized water reactors did not adequately or completely model sump screen blockage and the related effects during a loss of coolant accident. And this was in the early 2000s at the time this research was complete.

At that point we decided to take a two-pronged approach for resolution. First, we issued NRC Bulletin 2003-01, which was issued to mitigate the effects of debris clogging in the PWR sumps through better maintenance and operating practices, some of which the industry representatives provided during their presentation.

The licensee actions in response to the Bulletin 2003-01 are complete, and the staff has reviewed them and found them to be acceptable.

Secondly, the staff issued Generic Letter 2004-02, which has been discussed, which really requires PWR licensees to reestablish their licensing basis to account for the new information developed during the research. The staff worked with NEI to develop the method for re-performing their licensing basis analysis. You heard Mr. Pietrangelo refer to that under NEI Document 04-07, which was endorsed by the staff, and the generic letter also established December 31st, 2007 as the expected completion date for the corrective actions, which would include any

necessary hardware changes needed to be made to the plants.

The operation until that date was considered acceptable because of the mitigating actions taken by the NRC Bulletin 2003-01 and the relatively low probability of the event occurring.

And subsequent to the issuance of the generic letter, the Office of Research identified a previously unaccounted for impact on some clogging by the nature of the chemical effects testing that was discussed earlier.

This research as stated earlier was done in response to a question raised by the ACRS, and it was a good question at the time that the staff really was lining up to do confirmatory testings to show that the chemical effects would not occur in the kind of time frames that were expected where the plant would be in the recirculation mode in recovery from an accident. We knew it would happen from some of the TMI results, but it was the timing that was the question. How soon would it happen?

And the results of the ICET test, in fact, showed that it happened much faster than we anticipated.

With that information now, the industry has undertaken a very aggressive research plan and program of testing in which to properly account for – develop the methods and impacts, and to properly account for the impacts of this chemical effects on their plants.

And so that, in summary, is how we got to where we are today, and at this point, let me turn the meeting over to Tom Martin to discuss the status and our path forward.

Tom.

MR. MARTIN: Thank you, Jim.

As you heard in the previous presentation, licensees have begun making major enhancements to improve their sump performance. Examples include much larger strainers with more efficient designs, with smaller strainer mesh openings, new debris interceptors, and change-out and removal of sump pH buffers to minimize chemical precipitate formation.

By the end of this year, we expect 28 units will have completed installation of substantially larger strainers. An additional 34 units will complete modifications in 2007, and seven plan to install enlarged strainers in early 2008.

Those seven plants have other mitigative measures in place and have discussed their plants with the staff. We will discuss extension requests a little later in this presentation.

We are planning to conduct 12 audits of the generic letter corrective actions, and four such audits will be conducted this year. The design of the sump of the first plant audited appears to be robust with ample safety margin. However, that plant has very little fibrous material inside containment.

The second audit just completed was of a plant with more challenging material inventories. Several open items need to be resolved before conclusions can be reached regarding adequacy of corrective actions at that plant.

Licensees are sponsoring test programs by strainer vendor teams to confirm acceptable head loss across the new strainers

under plant specific conditions. The five vendors have been performing hundreds of these head loss tests. Staff expects that licensees will insure that head loss test conditions, such as flow velocities and debris volume in characteristics will bound actual plant conditions.

Staff is also auditing the performance of these vendor tests in providing timely feedback to industry. They have already conducted several of these audits, documented the results, and made the results available to licensees.

COMMISSIONER MERRIFIELD: Mr. Chairman, if I may interrupt for a second, we just got handed some slides. Apparently these slides are different than the slides we have in the books that we were provided previously.

CHAIRMAN KLEIN: That was going to be my question.

COMMISSIONER MERRIFIELD: At least that's what I've been informed.

CHAIRMAN KLEIN: Are we on Slide 4?

COMMISSIONER MERRIFIELD: I'm trying to figure out what. We have slides in here. We have slides we were just handed by SECY, and we've been informed by SECY staff that the slides we've been handed are the ones you're presenting, but are different than the ones that were in our book. It may have been a modification in the slides.

MR. MARTIN: Not that I'm aware of.

COMMISSIONER MERRIFIELD: If there were a change, I would feel obligated to lecture our staff, as I have others, for failure to give this information in a timely way, but if that's not the case, I would hold

that --

CHAIRMAN KLEIN: I think they appear to be the same. I think the print is bigger on this one.

COMMISSIONER MERRIFIELD: Okay. All I know is I asked SECY if they were different.

MR. MARTIN: No, no.

COMMISSIONER MERRIFIELD: Okay.

MR. MARTIN: I'm on Slide 4 right now.

In addition, the staff and industry have been discussing the possibility of making further improvements to post LOCA water management by reducing the usage of containment sprays to extend the injection time of high quality water. This will increase debris settling, decrease flow velocities of the water coming to the sump, provide additional time for operators to react to the event.

Under certain small break LOCA conditions, it could even provide enough time for operators to line up residual heat removal cooling to avoid the need for recirculation.

Two plants have come forward so far to volunteer as pilots for this effort.

We are dealing with an evolving state of knowledge primarily in three areas: chemical effects, coatings, and downstream effects. We'll discuss each of these areas further. However, the area of chemical effects is the most challenging.

Now, my Slide 5, extension requests.

To define the criteria we communicated to the

Commission in SECY-06-0078, the staff has granted requests involving ten plants to extend the completion of certain generic letter corrective actions to the spring of 2008. These changes include such things as final installation of an enlarged sump screen, spray system start signal modifications, high pressure injection throttle valve gap resizing, and removal of certain types of insulating materials.

Licensees requesting extensions either have relatively large sump strainers in place or have agreed to make substantial modifications in 2006 to install much larger strainers.

Existing mitigative features of their plants were also identified to justify extensions, including such things as containment floors that slope away from the sumps, multiple sumps for redundancy, heavy reliance on the use of non-fibrous installation, and the leak before break principle.

Licensees are also maintaining Bulletin 2003-01 compensatory measures during extension periods, including such things as additional operator training on sump clogging, procedural modifications to delay switch-over to containment sump recirculation, and insuring that alternative water sources are available to refill the refueling water storage tank.

The staff's view is that the minimal incremental risk increases from certain incomplete corrective actions during early 2008 are counterbalanced by a much reduced likelihood of sump blockage resulting from the early installation of larger strainers and other mitigative measures.

COMMISSIONER MERRIFIELD: Mr. Chairman, the staff, I think, has done a good job of explaining the basis that they made for granting the extension, but you have not discussed, in my mind, what the rationale was for why the extensions were requested.

What was the problem that needed an extension? Was it because of a difficulty in getting vendors and the materials in sufficient time to meet the deadline?

MR. MARTIN: In some cases, it was lining up the vendors in a sufficient amount of time. In some cases, licensees got a late start on this issue, and frankly, their analysis and their timing left them unable to install the strainers without requiring an additional shutdown.

COMMISSIONER MERRIFIELD: Was that included in the vast bulk of material you sent up to the Commission in the briefing book?

MR. MARTIN: We have in the -- yes, I believe it's toward the end -- we have a matrix of extensions and the reasons for the latitude.

COMMISSIONER MERRIFIELD: Oh, yes. Thank you.

MR. MARTIN: I believe one of the columns in that extension matrix shows the reason for the extension.

COMMISSIONER MERRIFIELD: Thank you.

CHAIRMAN KLEIN: I assume most of these are installed during their normally scheduled outages?

MR. MARTIN: Yes, sir. In the case of the extensions that we ran it so far, the normally scheduled outages were the spring '08 outages. So we're looking at nominal extensions of two to five months.

We're on Slide 6, chemical effects.

Chemical effects are a technically complex and plant specific issue. Test results indicate some chemical precipitates can result in significant head loss across the debris bed. Issues with two commonly used buffer materials, sodium hydroxide and trisodium phosphate, have been identified through NRC and industry sponsored testing.

For example, NRC research identified the potential for phosphate from a pH buffer to combine with calcium, a common element in some types of insulating material, to create a flocculent that causes an increased differential pressure across the debris bed.

Testing to date has been based on conservative estimates of the quantities of materials present in the post LOCA environment. We expect that the results of these tests will lead the industry to try to make more realistic estimates of debris in chemical quantities.

NRC and industry are working to develop a sufficient understanding to conservatively bound uncertainties in this area. Licensees are sponsoring plant specific tests of head loss induced by chemical effects, and the industry has sponsored evaluation of possible alternative chemical pH buffers.

The staff is evaluating this ongoing work. Five NRC NUREG reports related to chemical effects, as well as an industry topical report on this subject, are in various stages of review.

NRC sponsored testing provided insight into the importance of containment environment parameters, such as pH, temperature, and the presence or absence of various pH buffers. The staff expects ongoing and future screen vendor chemical effects testing to

provide further insight into the magnitude of the plant specific problem.

CHAIRMAN KLEIN: For a clarifying question, so I assume the chemical effects as you indicated is due to causing the delta pressure, the DP, as opposed to corrosion causing pump seals to fail and things of that nature. Is that correct?

MR. MARTIN: Yes. That primary concern --

CHAIRMAN KLEIN: So a major chemical issue is just the pressure head loss, the differential.

MR. MARTIN: Yes, sir. That's the primary consideration at the suction site of the strainers as opposed to the downstream in-core effect. We're most concerned with the chemical effects on the debris bed at the strainer.

CHAIRMAN KLEIN: Okay. Thanks.

MR. MARTIN: You're welcome.

The solution for plants with significant chemical effects issues may involve multiple countermeasures, such as larger screens, removal of certain insulating materials, removal/replacement of problematic chemical species, and possibly reserving a clean sump area for use in the later stages of the recirculation phase of a LOCA.

I'm on Slide 7 now.

Coatings. The staff and the industry are not fully in agreement on the path forward for coatings inside containment. The industry has maintained that a visual examination is adequate to assess the condition of the coatings.

We remain skeptical in this area and have asked the

industry to demonstrate that a visual examination is adequate. We expect the licensees will either perform periodic physical testing that provides assurance that qualified coatings continue to meet qualification requirements or assume that the coatings fail in the event of a LOCA.

The industry has recently submitted two technical reports related to coatings for staff review on the subjects of zone of influence testing and testing of unqualified coatings. This testing was performed by industry to allow use of a smaller amount of coating debris than that predicted by the existing conservative guidance for coating debris generation.

NRC sponsored tests show that if coatings fail in the form of chips, they will not transport to the surface of enlarged strainers at the flow rates expected in the containment after a LOCA.

This lack of transport is due to the weight of the chip and the much lower flow velocities resulting from the increased strainer surface area. However, there are some scenarios where the coatings fail in the zone of influence as particulate that must be accounted for in the licensee's analyses.

The Office of Nuclear Regulatory Research has initiated discussions with the Electrical Power Research Institute regarding possible development of a joint coating condition assessment program. A decision on whether to proceed with this effort will be based on the results of other ongoing NRC and industry test programs.

COMMISSIONER MERRIFIELD: Sorry. Just a clarification. You're saying there are scenarios where coatings fail in the

zone of influence is particulate and must be counted for in the licensee's analysis.

By "particulate," do you mean it is in a smaller form than the chips?

MR. MARTIN: Basically ten micron sized particles, roughly.

COMMISSIONER MERRIFIELD: Ten microns.

MR. MARTIN: That would stay entrained in the solution and then be transported to the sump screen.

COMMISSIONER MERRIFIELD: Okay. Would that be of a size that would go onto the screen itself or would that go through the size openings that are being --

MR. MARTIN: It would go through they openings of the screen. However, if there is a debris bed, it could become entrained on the debris bed and contribute to the differential pressure across the suction strainer.

Okay. We're on Slide 8, downstream effects.

The new strainer designs are highly efficient and with holes typically less than a tenth of an inch in diameter. Despite this, some plants have found that they need to implement modifications to injection valves and orifices to increase clearances and remove susceptibility to clogging from downstream effects.

A PWR owners group topical report submitted to the NRC in June 2006 provides a template that can be used to perform downstream effects evaluations. It provides an in depth method for evaluation of

operation of the emergency core cooling system and containment spray system components that might be exposed to post LOCA fluid.

The industry has decided after interactions with NRC to develop a new topical report, to provide a more rigorous evaluation of the effects of debris injected into the reactor vessel and core.

The PWR owners group has taken the lead for development of a standard methodology for this evaluation. Vendor testing and a preliminary staff confirmatory analysis indicate that core cooling can be maintained with significant levels of core blockage. We expect that this will be confirmed by the industry work.

Slide 9.

The staff has sponsored research that focused on two major areas of chemical effects and transport of failed coatings. Significant results of this research in late 2005 and early 2006 indicated the potential for chemical effects, particularly involving sump pH buffer materials like trisodium phosphate and sodium hydroxide.

The potential impact of these effects were not previously appreciated. Our testing also confirmed assumptions that the impact of coatings failed in chip form is minimal since chips do not readily transport in the sump environment.

The NRC sponsored research effort is now complete, and with the exception of disseminating the final reports of the results. Three reports have been published and ten more reports will be completed by the end of the year.

The staff does not believe that the most efficient path

forward is to undertake additional research at this time. This issue is highly plant specific, and in many cases we don't know the full extent of the measures that plants will take to resolve the issue beyond enlarging the size of the strainer.

We believe it's in the best interest near term to continue evaluating plant specific strainer testing and interacting with industry as they develop the technical basis to support their generic letter submittals.

As we conduct our reviews of the generic and plant specific submittals, we'll better understand any risk significant gaps that remain in the knowledge base. Based on these reviews, we'll be able to determine whether additional focused research is warranted.

Staff has high confidence that ongoing modification activities on sumps and associated safety related systems will substantially reduce the risk significance of GSI 191. Therefore, any consideration of additional research activities will include the perspective of risk significance of the issue at that time.

Conclusions. Slide 10.

Licensees are moving forward aggressively to significantly increase the size of their sump strainers in parallel with the resolution of the remaining technical issues. The staff agrees with this approach and believes this is the most expeditious and effective way to significantly reduce the potential for unacceptable sump strainer clogging and minimize downstream effects.

Many licensees are making additional changes, such as removal, replacement of problematic materials. Of the areas that we

discussed today, chemical effects is the one where the state of knowledge continues to evolve the most and for which the greatest amount of uncertainty remains.

Despite uncertainty in some of the technical areas, the staff believes the well defined path forward to resolution exists. This involves both industry and NRC activities to reach closure on the areas of chemical effects, coatings, and downstream effects.

Based on staff review of industry topical reports and industry reviews of licensee submittals to address the generic letter, the staff will determine whether any additional focused research by NRC or industry is needed to support issue resolution. We expect licensees' final generic letter submittals in 2007 and early 2008. This should allow us to close the issue by mid-2008.

However, industry strainer testing is ongoing and it is possible that additional work beyond mid-2008 may be needed. By this time industry modifications to strainers and other components inside the containment will have substantially reduced the impact of this issue.

That completes the presentation, if there are any questions. Bill.

MR. KANE: That concludes the staff's presentation.

CHAIRMAN KLEIN: My guess, there will be a few questions.

(Laughter.)

CHAIRMAN KLEIN: Commissioner Merrifield.

COMMISSIONER MERRIFIELD: Mr. Chairman, I think

that's a fair analysis there.

The first question I have, I think, goes to what Commissioner Lyons telegraphed in terms of the questions relative to BWRs versus PWRs. And I heard the explanation, which basically sounded to me like, well, we focused on the BWRs first and when we got done, we started focusing on the PWRs.

This morning -- and I don't mean to be pejorative, but that's what it sounded like to me -- this morning we heard a briefing on our corrective action program and how we're conducting lessons learned in the agency and trying to use that as a template for figuring out how appropriately to go forward.

And so in the spirit of the corrective action program, I guess the question I would ask, understanding what the staff did: if we had it to do over again, would we conduct that process in series, as we did, or would we consider doing it in parallel so that the PWR issues were settled at an earlier standpoint than 2007-2008?

MR. DYER: We would have dealt with it on USI A-43 back in 1979, I think, jointly and in parallel at the time we did it. From my readings -- and, by the way, Brian and I when we went back through the history, we had the same question when we looked at the sequence of events on how we got to where we are.

At the time we missed the issue on A-43 because we weren't looking at the fine particulate in the thin bed effects. That was the emerging issue that occurred in the 1990s that was discovered at the boiling water reactors.

Why we didn't think of -- you know, we were looking at the transport in that, but we missed it. If we had it to do over again, we certainly would, Commissioner.

MR. MARTIN: If I might add also, in the early '90s we had real events at BWR plants, which made it an immediate BWR problem.

Also, the nature of the BWRs versus PWRs is that when you have an accident or an issue that involves requiring some cooling mechanism, you're immediately taking a suction from the suppression pool in a BWR as opposed to in a PWR you're immediately taking suction of considerably much larger pure water sources. And for a small break LOCA, I mean, that could go on for a very long period of time. For the large break LOCA, you get into a situation where, you know, like Tony mentioned, possibly as soon as 20 minutes, but actually for most events it would go, probably more like, it would go much larger than that.

COMMISSIONER MERRIFIELD: Well, I think that's an appropriate clarification, and I appreciate your making it. From a risk standpoint, we can obviously create an argument that we did it in a risk informed way, and we put what we thought was most significant first.

But I do think, and this is obviously, 20-20 hindsight, but as you say, Jim, I think looking back at it now, despite the fact we really needed to focus on the boilers because of the immediacy in the events that had occurred, that notwithstanding, certainly looking back at it we probably could have done these things a bit more in parallel.

But, what's done is done. I think the point that I would make with this is, as we say, we are a learned and learning organization,

and these types of things are worthwhile for us to capture in our knowledge management program so that we can avoid that happening again in the future.

All right. We've had a variety of discussions on the first panel about what industry is trying to do to get really to the bottom of chemical effects as it relates to both fibrous material, as well as the chemical buffer. In the presentation that you made, particularly as it relates to Slide 10, you all have come to the conclusion that we don't know at this point. You disagree with ACRS that we don't need as broad a research effort, although you certainly reserve it to say, well, at a point down in time there may be some more specific research that might be needed, possible additional work beyond mid-2008 may be needed.

Do you want to be a bit more expansive on that in terms of the differences you've got with ACRS and your characterization of what you know, what you're getting from the licensees, and how that gives you that level of confidence and perhaps even beyond that? Any inklings of what we might need to be doing in that 2008 time period, if you can use a crystal ball?

DR. DYER: Yes, sir. Let me let Brian take the lead on this, let Brian take the lead for Research.

DR. SHERON: Yes. The Office of Research has already done a vast amount of research. I was just totaling up some of the money, and the round numbers I got was about eight and a half million dollars worth of research on this.

And we covered a broad spectrum of the technical issues.

We looked at sump screen penetration. We looked at chemical effects, not only just, what kind of chemicals and what kind of precipitates they would form, but also the extent that they could clog up a screen.

We looked at head loss downstream effects to determine if there was issues there. We also looked at transport of coatings, which coatings would transport, which ones wouldn't.

We got enough information as an agency to understand what are the issues that need to be addressed by the industry. So, typically at this point, that's when you turn the issue over to the industry and you say, "Now, you need to provide us with the details to support whatever you're doing on your plant," which is what we were doing with the industry.

So at this point we haven't identified anything further that the Office of Research would be able to do that would shed any further light on this. You know, I think as Jim or Tom said, obviously as licensees come in and they propose their design fixes or their analyses, typically if they propose something or if they have research that raises questions, for example, about interpretation of data or whether the scale they used was appropriate where there were scale effects, at that point it may be appropriate for NRR to say, "We need some help. We need to do some additional focused tests to solve this particular part of the problem," in which case we're totally amenable to performing that.

COMMISSIONER MERRIFIELD: That's a very targeted form of research.

DR. SHERON: Yes, and I think it was also said -- I think

maybe Mr. Pietrangelo said it, too -- was that the uniqueness of the designs is such that I wouldn't know what to test and how I could argue that it was applicable to every plant.

COMMISSIONER MERRIFIELD: The bottom line is you stand by the statement that we have sufficient research at this point to make a regulatory decision?

DR. SHERON: Yes.

COMMISSIONER MERRIFIELD: Just a quick wrap-up. Notwithstanding the amount of time it has taken us to get to where we are today, sort of putting that aside, I take it from what I've heard today in the presentation that we, as the agency, do not believe that our licensees are being dilatory. Is that fair?

We don't believe that the licensees are dragging their feet on resolving this issue.

MR. DYER: No, sir. They are not dragging their feet.

COMMISSIONER MERRIFIELD: They're not dragging their feet, and have they put in place a plan to resolve these outstanding issues, like chemical effects, that you believe will result in our getting the information we need to make a decision?

MR. DYER: Yes, sir.

COMMISSIONER MERRIFIELD: Thank you.

CHAIRMAN KLEIN: Commissioner Jaczko.

COMMISSIONER JACZKO: A couple of things I want to follow up on. One, Tom, maybe you could just go into a little bit more detail about the concern you raised about coatings and where we stand

with some of those issues.

MR. MARTIN: We're reviewing some additional material we're getting from industry on the magnitude of the coating problem and whether or not or the extent to which they will stay on the wall following an event, an we're willing to entertain relaxation of some of the methodology that they consider to be conservative if they come forward with appropriate justification, whether it be research on their own part or some other literature that they can provide that will reduce the volume of that coating material.

We established a deterministic process early on with some assumptions. The assumptions were conservative. We recognized that. In order to remove those conservatisms, we're willing to consider removing those conservatisms if the appropriate justification is brought forward.

And the issue now that I would say is probably the most significant between us and industry is the extent to which unqualified coatings will remain on the wall or whether you could test and verify through visual means whether the coatings will stay on the wall without doing some kind of a mechanical test.

COMMISSIONER JACZKO: Are there any plans right now that you're aware of to do that kind of mechanical testing?

MR. MARTIN: Yes, I think the industry has some such plans in progress that we intend to review.

COMMISSIONER JACZKO: Thanks.

One of the issues that came up, I think, and I've been

looking at this issue in the previous panel, is the idea of looking at some things beyond just increasing sump size, and we had some people talk about changing the flow from I guess it was the reactor water. I'm not sure exactly the source, but I think that was the right source, as well as an issue that has since been dropped, but the idea of active strainer and a lot of different things.

And just going back and looking at some of the things the ACRS said, you know, they certainly suggest that there may need to be some other things that we'll need to look at.

Where is the staff right now? I know active strainers is really an issue that has been taken off the table and nobody is pursuing active strainers, but has the staff given any thought to eventually having to go to some of those other kind of more active solutions to this problem in addition to what we have with the passive solution right now, the larger surface area?

MR. DYER: I guess, Commissioner, from my perspective, I think the staff's position is as we create the licensing basis, we have a very conservative methodology right now, and as Tom said, if the industry wants to reduce some of the conservatism in that, the proposal would be some of those more active strainers. Reduce the amount of fibrous insulation that's in the containment and available for transport.

I think take a look at what are the different chemical buffers, if you would. We have the two pilot plants that are coming in on water management.

Just to clarify, the Bulletin 93-01 gave operating practices

that would say if you have a immediate initiation of your containment spray system and you're spraying down this material and you don't need it, turn them off and conserve your water.

What the water management initiative is is going back and reanalyzing to see if you can defeat the automatic initiation and, in fact, take manual control of the containment sprays and only use them if you need them, thereby even conserving more water.

And so those initiatives in that, I think, to build margin and go forward with it, we are looking at an integrated approach to it.

COMMISSIONER JACZKO: But I have to say I'm actually a little bit surprised on the issue of fibrous insulation. I've had a chance to visit plants, and periodically I'll hear, I think, as I said earlier, anecdotal information that as people are replacing components or doing work and during outages they are removing some of this insulation material. I'm somewhat surprised that we haven't gone through the process and made that more of a systematic program that we replace a lot of this material where we can.

Because, I think, as I said, the chemical problem, although not a chemist, chemistry, I think, to some degree is fairly simple. You usually need a couple of different chemicals to get some kind of reaction.

So if you can take away one of those elements, and here we really have two elements involved; we have the buffer and then often the insulation material, and that's where the chemical problems are coming from. If we can eliminate one of those issues, we can perhaps move forward on eliminating this problem from a chemistry standpoint.

So I am somewhat surprised that this hasn't been something that has been looked at more systematically, that is, as these analyses go on, that we're replacing a lot of this material and moving where we can to other types of materials.

So that may be something perhaps to continue to consider.

CHAIRMAN KLEIN: Commissioner Lyons.

COMMISSIONER LYONS: I appreciated Commissioner Merrifield's following up on my question on the history, and I very much appreciated, Jim and also Tom, your comments on sort of how we got where we are. And, Tom, your comments helped me understand why there is a reason to focus first on BWRs and then why the PWRs came somewhat later. So I really appreciated that.

I have to admit that I've been rather torn on this question of the difference between the staff perspective and the ACRS perspective on additional research, and I very much appreciated Brian's comments on that.

I also have to admit that at least at my limited level of understanding of this, I wouldn't know what research to suggest at this point, given the number of different configurations that we may be faced with.

Now, I missed the ACRS meeting last week. I was on foreign travel. I'm curious. Did ACRS specify what they thought the additional research should be? Because I'm saying and I think you're saying that we're not really sure what that research should focus on.

DR. SHERON: At the meeting I don't believe they identified any specific areas. At least I don't remember any, but I know that Dr. Wallis has been very concerned about the head loss correlation, the pressure drop across the screen when you build up this material.

We've done some work in that area in terms of developing a theoretical correlation as well as getting experimental data, but it doesn't cover you might say all combinations of debris and so forth, and the like. That's where I think he feels -- at least my understanding -- he feels perhaps we should be doing more work as to better understand that head loss across the screens.

The difficulty, I think, in my mind goes back to the uniqueness. In other words, each plant has its own unique mix of chemicals and different kinds of insulation and other debris, and to come up with a correlation that might universally fit all of those plants I think would be very difficult.

You know, again, you have to look at it from the standpoint of, should each plant when they come in with their sump design justify their design for their particular plant and their particular chemical mix that's in their containment because a lot of plants are doing a number -- as we said, they're not only making the screens larger, they're removing insulation, they're considering alternate buffers, removing aluminum. So things are changing in terms of what that chemical mix and what those loadings would actually be.

So it's hard to even say what you would test.

CHAIRMAN KLEIN: Just a clarifying comment. What I

heard ACRS say, Graham Wallis wanted a lot more tests to be conducted so that they could have a lot more predictive models so they could tell how much insulation would come in, what the chemical interaction would be, and what the pressure drop loss would be.

Just from my observation, that would be very difficult to come up with those kinds of analytical models to develop that, and so, I mean, what I heard him say was just a lot more tests to come up with these predictive models. It is a lot more of an art than a science in this particular case.

COMMISSIONER LYONS: Well, and even though I did miss the meeting, that certainly reflects my limited understanding of this. I referred earlier to how I was struck by the dependence on initial conditions, including things that surprised -- well, maybe they shouldn't surprise me -- like the temperature at which they started to observe the precipitation. There seemed to be an incredible number of variables which could vary with scenarios and certainly with chemistries.

And I guess along that line because I have been struck by the difficulty and the complexity of the chemical effects, it's probably a question for Brian, but I noticed that there is -- one of the NUREGs that's coming out is a peer review of the chemical effects research program. Now, it's not coming out until this year, December. So it may be early to ask, but I was just curious. Are any indications of what that's going to say available yet?

It struck me that that will be an extremely interesting study. I hope that there's been an effort to get people who haven't been directly

involved in the research to critique it.

DR. SHERON: Yes, I think Erv Geiger from the staff could answer that.

MR. GEIGER: Erv Geiger, Research staff.

The report is currently in the review cycle. So we do have some ideas. There were five reviewers, and there were some recommendations in there on evaluating the radiological effects that may occur due to the radioactivity being released during, let's say, fuel failure. And there were some other issues about the carbon dioxide solution becoming a more acidic environment and that sort of thing, which I think that was the major areas that were pointed out that we may want to do some further evaluation on.

Of course, we have considered those, and at this point we had decided that those or others that had minor effect or lesser effects; that we would wait to evaluate when we knew what the actual implementations would be by the utilities.

Like I said, the problem is so complex. There are just so many variables that even with temperature, it's a 30-day mission cycle. So in those 30 days so many things change so much that at any one point you might want to pin down a certain phenomenon, it would be open to challenge. So it would be very difficult to come up with assumptions that would not be challenged. So, therefore, we decided to wait until we get some specific responses that we could then look at.

COMMISSIONER LYONS: I appreciate that comment. I'll certainly, and I'm sure all of us, will be interested in seeing that report

as it is published.

I guess I'd just close, since I'm over my time anyway, with the comment that I made before that I hope that the staff, as well as the industry, to the extent there are changes made in chemistry or insulation or anything else, there's a very, very concerted effort to look at it in a holistic way so that we don't solve one problem and complicate another.

DR. SHERON: One area we are kind of monitoring is if the industry comes in with alternative buffer material, and what that may mean from the standpoint of how it interacts in the containment, how well it works to prevent the iodine from re-volatilizing and so forth.

That could be an area for further research, but until we see what they propose, it's a little premature to do anything.

COMMISSIONER LYONS: Thanks.

CHAIRMAN KLEIN: In terms of the insulation that comes off that bleeds down to potential sump clogging, where does that come from? Is it from pipes?

MR. DYER: Yes, sir.

MR. MARTIN: Yes, pipes and valves, and then there's the reflective, metallic insulation that many plants have. That's a good insulator, but in some cases it's not as efficient as the calcium silicate or some of the fibrous insulation.

So it's very challenging. We really couldn't specify that they would have to remove this material because there might not be a suitable replacement for certain applications.

Some plants do become limited in terms of the

temperature inside containment. We've had plants that have shut down and reduced power because of issues of high temperatures inside their containment, and as we start doing things with the insulation and going in the direction of perhaps insulation that might be better from a sump standpoint, but not as efficient, then we conceivably could limit the ability of the plants to operate.

CHAIRMAN KLEIN: Well, if it primarily comes from pipes, I've been in a lot of plants where they just do a metal wrap, and so obviously that's such a simple solution it must be wrong. I mean, why didn't they go through and just put metal wraps around the pipe so that the insulation doesn't get knocked off?

MR. MARTIN: In some cases they're doing that, yes, sir.

MR. DYER: They are, but I think Tom's point is those metal wraps may not have the insulation capabilities of the fibrous material. So the consequence would be an elevated temperature in the containment.

CHAIRMAN KLEIN: Put the metal wrap around the insulation that's already there.

MR. MARTIN: There are some cases where the licensees are doing that, and that is one opportunity for them to potentially reduce their debris volume.

CHAIRMAN KLEIN: Well, for the amount of time and effort you spent analyzing sumps and put in these new filters, you could have wrapped every pipe in these containments for a lot less cost and lot more clarity. I must be missing something.

MR. MARTIN: I do believe, sir, however, in the zone of influence it would be unlikely that just putting a metal wrap would be adequate. It would still be likely that if they were in the zone of influence, the blow-down under the conditions that you expect this blow-down to exist, it's still likely that that would blow off.

So in many places, it could, in the places outside the zone of influence, it may be of benefit.

CHAIRMAN KLEIN: Could you tell me is this the zone of influence where we have the double ended pipe break?

MR. MARTIN: Yes, sir, the zone of influence that would be subject to the impingement by the blow-down.

CHAIRMAN KLEIN: But I would think that would be a small area. I mean in terms of the area that you would knock insulation off, particularly if it has a metal wrap.

COMMISSIONER MERRIFIELD: Mr. Chairman, staff is eager to answer your questions here.

CHAIRMAN KLEIN: Okay.

MR. GEIGER: Erv Geiger again from Research.

I spent about 30 years in the industry in the AE firm, and I have been involved a great deal in insulation and doing sump analysis and re-analysis, and there's a conservative assumption.

First of all, most of the insulation, even if it's fiberglass insulation, it would be jacketed with stainless steel jacketing. Very rare areas where they don't have jacketing.

But there's a conservative assumption that within the zone

of influence, which is, you know, whatever, the pipe diameter times so much it all gets destroyed unless there's specific tests to show that the insulation jacket can withstand that pressure.

So, therefore, it is assumed that all of that insulation is then basically pulverized into small fibers, broken up, and then it transports. So it's a very conservative assumption, but without actual industry test data, that's the current status of that.

CHAIRMAN KLEIN: Obviously, looking at the size of these sumps that you're putting in, these filters, that's a lot of surface area. So that zone of influence must be huge to knock off enough insulation that it would cover that surface area.

MR. GEIGER: Well, right now, I think what they have is they have the area of the pipe break. So an RCS pipe break is 32 inches inside diameter. So you take 32 inches times ten pipe diameters or whatever it is, and then they take a -- because when you have this break, this pipe could whip and, therefore, this jet could theoretically hit the entire area that's in the line of sight of the pipe, and that's how you generate all of this debris. Because a steam generator has all of this insulation on it, plus the RCS pipes, and depending on your plants, some of these steam generators are pretty big. You know, if you have four loops they're smaller, so that you end up with a lot of insulation postulated to come off.

In reality, it probably would never, and there's also debris platforms which will catch debris and so on. So it's a conservative assumption, but that's where we are right now.

CHAIRMAN KLEIN: It sounds like a rather conservative

assumption, which is fine. I mean, it's certainly good to be conservative, but I guess maybe in your spare time, Jim, if you could come up, I'd like to see this zone of influence a little bit better, particularly if the insulation has metal cladding.

It seems to me that you already have a barrier on there, which I think now answers one of my other questions that I had, was as the plants age, does this problem get worse, but it probably doesn't if they're wrapped in a metal. So it's not likely that aging would have any impact on the insulation.

MR. MARTIN: No, sir. I don't -- no. No, sir. I'm getting confirmation from our staff expert.

DR. SHERON: I think the industry did do some testing, and I think you had heard -- I think Mr. Pietrangelo may have said that the zone of influence in some cases was able to be reduced down to around five or six pipe diameters, I think. So there is some evidence. I mean, it's a matter of doing research and getting information to justify something less.

CHAIRMAN KLEIN: Thanks.

Anymore questions?

COMMISSIONER MERRIFIELD: I don't have any questions. A comment. My closing comment would be this, Mr. Chairman. You know, we do have variations in degrees of utility of briefings that we have, and I would have to say I think this was a very useful briefing. Certainly both panels put a lot of information on the table to give us some better sense of where we're going.

This has been an issue that has been challenging us for a number of years. I think at various points in the past I have had concerns about whether there was, in fact, a light at the end of the tunnel or whether we would be continuing to spin around and do more research and more research. Some targeted research may be necessary, but in the main, it strikes me today that the licensees have outlined a plan to meet the requirements as we have laid out, and our staff has outlined a plan that would certainly bring us to a point where we can be comforted that that's going to come to resolution.

So I think it sounds to me like we're headed in the right direction, and I appreciate the work of the staff and our licensees to make that happen.

CHAIRMAN KLEIN: Commissioner Jaczko?

COMMISSIONER JACZKO: No, I obviously agree. I think it was a very good briefing. I think we had some interesting issues raised, and I think, as I said, this is a complicated problem, and it's probably going to require a complicated solution, but I think certainly we are definitely, I think, moving in the right direction with larger sump areas, and I think from there we'll have to see as we get more information about how to deal with some of the other problems with chemical effects and downstream effects.

CHAIRMAN KLEIN: Commissioner Lyons?

COMMISSIONER LYONS: I just appreciate the briefing, both from industry and from staff. I understand the problem better. I understand the uncertainties better, and I appreciate the direction we're going, albeit it may still be a rocky road ahead.

But I hope there is a clear path through this.

CHAIRMAN KLEIN: Well, thank you very much.

It has been, I think, a very good briefing, both panels, and I think it has laid out the issues and it looks like we're coming to closure on them.

And I look forward, Jim, to you coming in and giving me my lecture on insulation.

MR. DYER: Yes, sir.

(Laughter.)

CHAIRMAN KLEIN: Thank you.

The meeting is adjourned.