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NUCLEAR REGULATORY COMMISSION

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PUBLIC WORKSHOP

ON

TECHNICAL AND POLICY CONSIDERATIONS

FOR

NUCLEAR POWER PLANT LICENSE RENEWAL

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Session 4

Screening Methodology for System

Structures and Components Important

to Safety

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Sheraton Resort Hotel

Conference Rooms A, B and C

11810 Sunrise Valley Drive

Reston, Virginia

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Monday, November 13, 1989

1:15 o'clock p.m.

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SESSION LEADERS

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P R O C E E D I N G S

[1:15 p.m.]

MR. THADANI: I guess it's time to begin this session. Good afternoon, ladies and gentlemen. I'm Ashok Thadani, Director of Division of Systems Technology in the Office of Nuclear Reactor Regulation.

Co-chairing with me this session is Mark Cunningham, who is Chief of Probabilistic Risk Analysis Branch, Office of Research. The subject of this session is screening methodology for systems, structures and components important to safety.

Let me just say a couple of words and then we'll get on to you folks because we're here to listen to you mostly. As you heard this morning, the purpose of this workshop is to receive comments from you on a number of specific technical and policy questions prior to issuing a proposed rule and the regulatory guides for license renewal.

As you heard this morning, the approach being considered is fairly straightforward. First, identify a set of systems structures and components that have an impact on plant safety; develop a process to reduce the number of systems components that one looks at in terms of their significance to the issue at hand, which is license renewal; that is, to determine specific sets of degradation mechanisms and how they might impact operability of these components.

Once we have identified these components, we also need to take a look to see what programs are in place that might, in fact, focus attention on these degradation mechanisms; and, if there are any improvements to be made to those processes or programs to identify those improvements.

The purpose of this session really is to -- it's sort of like a hopper. Something goes in and let's see what comes out. It's the process within the hopper that matters. There are a number of ways one can go at it. One can utilize a purely deterministic approach to look at components and systems and decide upon what things to pursue and to assess in terms of potential for degradation. One can utilize probabilistic approach or one can utilize a hybrid of the two schemes, so to speak.

[Slide.]

MR. THADANI: We sent out 15 questions to you. It's not that we have to address all 15 questions, but really to try to stimulate your thinking to say the types of problems we see coming up and trying to arrive at an acceptable methodology for screening.

We need to be sure that, in fact, if the scope of the systems and so on that are identified in the language in the rule, is that too great or not big enough? I doubt that's the case. If we utilize probabilistic risk assessment techniques, what else do we need to pay attention to? Do we need to have new models, aging models perhaps? What sort of database one would utilize if one were to use probabilistic risk assessment?

The types of questions that we've sent out give you a sense of what we are thinking, at least, and the potential detail one may have to go to depending on what technique one utilizes.

So before saying much more -- and let me ask the first speaker -- I'm told that there are four speakers here. Four groups will be speaking in this session. All the sessions of this workshop are, in fact, being recorded and I'm told a transcript will be available from Ann Riley & Associates, 1612 K Street, Northwest, Suite 300, Washington, D.C, approximately one week after the meeting.

So now let's go on. The first group to speak is NUMARC, and I think Terry Pickens is going to speak for NUMARC. Terry?

[Slide.]

MR. PICKENS: Thank you. Good afternoon. I don't know how my name keeps coming up first through all of these sessions. I'm going to have to talk to the moderator and see if I can do something to change that.

My name is Terry Pickens from Northern States Power, and I guess I'm speaking as a member of the NUMARC working group today to talk a little bit about the screening methodology for the systems, structures and components important to safety.

[Slide.]

MR. PICKENS: In reviewing the document that was sent out, out of the philosophy section, we pulled out the following points which seemed to address the systems, structure and component evaluation. And that was that the NRC philosophy was that the scope of systems, structures and components to be addressed are similar to that of the environmental qualification of electrical equipment; the definition provided of important to safety.

From there, licensees are required to identify where, in the existing plant programs, degradation mechanisms are being monitored to provide reasonable assurance that the replacement and refurbishment schedules for degrading equipment are being developed or service lifetimes for equipment are established.

I think probably the most key statement is that those structures, systems and components that are effectively covered by existing ongoing NRC requirements and/or licensee programs, or are not subject to aging mechanisms need not be addressed in the application and need not be within the scope of the hearing process.

[Slide.]

MR. PICKENS: Going back, then, to the conceptual outline section under XX.9, it then laid out the process that we should go through in identifying these structures, systems and components in the information that needed to be provided. Our interpretation of those requirements led us -- these are the five bullets which state what was being looked for.

Identify all the structure, systems and components important to safety, ITS. Identify design requirements, functions and environmental conditions for operation. Now, our interpretation, as I stated in this morning's session, is that for all of those structures, systems and components identified up in No. 1, that all of the information following this would need to be provided.

So that you would then go on to identify design requirements, function, environmental conditions, the applicable degradation mechanisms, describe the measures taken to manage those degradation mechanisms, and, finally, describe and provide the technical basis for monitoring the effects of all relevant age-related degradation for all of the structures, systems and components that we identified as important to safety.

[Slide.]

MR. PICKENS: As we see it, this would result in the application coming up with some type of table or whatever, but for every system and then every component in that system, identifying the design requirements, functional and environmental conditions, measure programs no matter where it falls in terms of your own interpretation of the significance of that degradation or of the safety function or what that component has to perform.

[Slide.]

MR. PICKENS: As I stated, the requirements of the conceptual outline appear inconsistent with the philosophical approach. It seems to go to a much higher level of detail and type of technical data for all the structures, systems and components and that it's not necessary -- that you have to go to that level of detail and type of technical data for all the structures, systems and components, even where it's not necessary to determine the ability of the plant to continue to operate safely. Those components aren't involved in that.

From that, I guess I would say that I would like to see us strive to focus the application of resources for evaluating these structures, systems and components to those whose safety function can be affected by age-related degradation.

And we have submitted to the NRC, NUMARC, an approach, industry approach for a methodology to provide that focusing. What I would like to do now is run through that approach and kind of lay it next to the requirements and see what type of information we can avoid having to submit by focusing this evaluation.

[Slide.]

MR. PICKENS: At Step 1A -- and the numbers that I'm referring to in the steps deal with those numbers as they're identified in the methodology document that's been submitted to the NRC.

At the system and structure level evaluation, and the first step of that methodology is a system and structure level evaluation, it identifies those systems and structures relied upon to operate the plant safely. At this point, the NRC approach identifies structures, systems and components important to safety.

After taking a look at this, it appears that the general philosophy of what populations of systems and structures that we want to look at is consistent between the two. We're both trying to get to, within the noise level, the same set of systems and structures that we should go forward with from here. And I don't know that we need to spend a lot of time here refining the exact definition that we want to use in the regulation for that.

[Slide.]

MR. PICKENS: Moving on, then, to Step 1B. From those systems that we've identified, we then go on to look at those systems and try and determine those systems and structures that can significantly effect the radiological health and safety risk to the public through a series of criteria that we've proposed.

This requires the determination of a system safety function on a deterministic basis or taking a look at the systems on a probabilistic basis for safety importance. In our methodology that's identified, we believe that the deterministic criteria, in and of themselves, are adequate and a plant doesn't have to have a PRA to apply the methodology.

The probabilistic criteria are optional at the discretion of the utility. And it's our intent that if you don't use the PRA, that the deterministic would meet all of the requirements that you would have to implement.

To be dispositioned from further evaluation, the industry approach would document the system function and the conclusion as to why it does not effect the radiological health and safety risk to the public.

Under the NRC approach, the way we have interpreted it, it would require all the information called out in 9C, even for those systems which don't effect the radiological health and safety risk to the public. That's an area where we view that's information in excess of what we need to provide to make a finding of adequate safety during the renewal period.

[Slide.]

MR. PICKENS: Going on to Step 2a as we go down to Step 2, for all those systems now that we have identified out of Step 1 we are going to go down to a component level evaluation.

Under Step 2a what we are trying to do is identify those components which are necessary for a system to perform its safety function.

This requires the determination of components' contributions to the system's safety function.

What we're trying to do at this point is look at those components which are not intricately involved in performing the safety function of the system. For example might be a minimum flow line or something like that that's normally isolated from the system, those valves, the instrumentation of things that are beyond those isolation boundaries, they do not contribute in any way to the system's safety function being performed in the event of an accident. For those type of components we'd like to keep those from saying that we have to go to the level of detail and analysis that we do for those that contribute to the safety function.

To be dispositioned from further evaluation the industry approach would document the components not necessary for a system to perform its safety function and that its failure would not preclude the system's safety function from being performed.

The second statement there is of importance where you have an interface between those systems which are normally isolated perhaps or whatever that those components still have to maintain let's say a pressure boundary although they don't have to perform any actual operator actions so what you'd be concerned with on those types of interfaces is something like the pressure boundary.

The NRC approach again would require all the information to be called out in 9C to be provided even though those components are not necessary for a system to perform its safety function or preclude the system from performing that safety function.

[Slide.]

MR. PICKENS: At Step 2b then, the components which have made it down this far are subject to an established -- identifies those components which are subject to an established effective replacement, refurbishment or inspection program.

This requires the determination of the contribution that a component makes to the system's safety function and then a review of the effectiveness of the established plant programs in managing the known age-related degradation mechanisms which might preclude that component from performing that function.

At this step we are taking the effective programs, looking at the specific functions that a component meets and making the determination if we are effectively managing the aging that might challenge those components.

If we find that those programs are effective we at that point don't want to -- don't think that we need to get down to the level of relooking at the design basis, taking a look at the age-related degradation mechanisms, analyzing them, looking at how -- a number of the aspects of that.

To be dispositioned from further evaluation, the industry approach would document that component's safety function, the degradation mechanisms which would preclude that component from performing that safety function and the programs which ensure that that function is maintained.

The NRC approach would require all of the information to be provided for those components which are subject, even if they are subject to an established program and are effective in managing age-related degradation.

[Slide.]

MR. PICKENS: Under Step 2 we are then going to identify those components which are subject to significant age-related degradation.

This requires the determination that using established documented source documents that a documented source has provided a thorough understanding of the component's behavior in the expected environment and provides the basis to conclude that the component will not be subject to age related degradation in the renewal period or that if the component fails due to age-related degradation, that the increase to the risk is not significant, so we provide under this step both the deterministic and the probabilistic criteria to be applied.

To be dispositioned from further evaluation the approach would reference the documents which provide the basis for the conclusion that the component is not subject to significant age-related degradation or we would provide the risk assessment results for review.

The NRC approach would require all information called out in 9(c) to be provided, again even for those which are not subject by our determination to significant age-related degradation or if they were and went to failure would not result in a significant increase to risk.

[Slide.]

MR. PICKENS: At Step 2d finally we have identified the components which are subject to potentially significant age-related degradation which if allowed to occur unmanaged could affect safety. Under this step we have identified a number of options in which you can address potentially significant age-related degradation and this step would be used to evaluate those.

Depending on the option chosen, varying degrees of the information required under 9(c) would be necessary. It might be as simple as identifying an improvement or adding a component into an already existing, effective program. That type of component would not require all of the information that is required in 9(c). However, if we choose to go into a complete technical evaluation of the age-related degradation, the design conditions and trying to disposition it without doing anything it might indeed be appropriate to provide all of the information that is called out under 9(c).

So the NRC approach, where it would require all the information in 9(c) be provided. There are some components depending on how you choose to manage the age-related degradation where you would have to submit all of the information in some cases you would not.

[Slide.]

MR. PICKENS: I guess at this point that is all of the discussion that I am going to go through on the proposal that we have put forward, we the industry, for a methodology for screening down but I think that it is significant that as we go through it we have identified a lot of information that might be required under 9(c) which is not necessary to be provided to make an adequate determination of that component's ability to function or its need to function throughout the period.

A specific comment on the list of degradation mechanisms would be that the degradation mechanisms if listed in the rule should probably be approved by equipment type so that we don't have to address degradation mechanisms which aren't really pertinent to an electrical or to a mechanical type system.

In addition, we would like to request that additional clarification be provided regarding the last degradation mechanism listed, which is degradation due to operational environments and what the Staff is referring to there.

[Slide.]

MR. PICKENS: In summary, the industry -- we believe that the industry approach provides a method that is consistent with the stated NRC philosophy.

We believe that the requirements to provide all of the information under 9(c) for all system structures and components important to safety is inconsistent with that philosophy and would require a large amount of unnecessary information to be provided.

The industry approach focuses the use of resources and provides a sound technical basis for the level of evaluation and dispositioning of components at each level of the evaluation.

The lead plants right now are currently applying the methodology and demonstrating its value and we have had discussions with members of the NRC Staff about reports that we will submit for them to review to see how the methodology has played out. We would like the NRC as it goes through the rulemaking to consider the applicability of this methodology and how it can be used in the regulations.

That concludes my comments. Thank you.

MR. THADANI: A short question. If you utilized probabilistic techniques in trying to limit the number of components that one evaluates, do you then see a need for perhaps a different type of database and if so, do you think we can develop such a database in some fixed time frame?

What sort of sense do you have on that?

MR. PICKENS: I am not sure I understand what you mean by putting together a database, different type of database.

MR. THADANI: Well, I guess where I am coming from is if there is aging taking place, is that impacting failure rate in any way? Do we have enough information to be able to say one way or another that potential failure rate may be significant past a certain number of years, and would sort of the plant-specific database or average industry database then be appropriate in PRAs?

MR. PICKENS: I will look for help if I answer the question wrong but at this point the way we have structured the criteria for the probabilistic portion of the screening methodology does not assume a given failure rate other than a failure rate of one, and then looking at the risk impact at that point. For that reason I think the answer to your question is no, we would not need to establish a separate database and then monitor fail rates to see if that is appropriate in those kind of things because we are assuming failure and then looking at the impact on risk and only on that basis making a determination as to whether or not it's significant and needs to be addressed.

MR. THADANI: Thank you.

Yankee Atomic, and I guess William Szymczak. Thank you.

[Slide.]

MR. SZYMCZAK: Good afternoon. My name is Bill Szymczak. I work for the Yankee Atomic Electric Company and, for the past year or so, I have been involved in the Yankee Nuclear Power Station lead plant project and my principal responsibility has been screening in relation to the lead plant program.

[Slide.]

MR. SZYMCZAK: I would first like to begin with an overview of what we perceive the screening process to be, and then proceed to comments on the draft rule, ending with suggestions for the final rule.

[Slide.]

MR. SZYMCZAK: Where does this screening process fit in? Well, let's start at the very beginning. That is what's the objective of the license renewal program itself. We feel the objective is to demonstrate that the current level of safety will be maintained through the renewal period. It's very much in concert with NRC philosophy.

[Slide.]

MR. SZYMCZAK: How do we achieve this objective for the license renewal program? Well, it consists of five tasks, as we envision it; screening, evaluations, programmatic assessments, implementation, and documentation. Screening is that first essential step that we have to take that gets us into those other programs.

[Slide.]

MR. SZYMCZAK: Now that we've identified where the screening process fits in with the other tasks that have to be done for license renewal, what is it that we're trying to do? In a nutshell, we are trying to show a screening process that should efficiently review plant equipment to identify those systems, structures and components important to safety that are subject to unresolved aging degradation issues.

This is the critical part of screening, is to get down to that subset of components.

[Slide.]

MR. SZYMCZAK: To achieve this screening objective, we feel that the screening process must have some essential features, and those features are it must be comprehensive; it's got to consider the entire plant, to start with. Moreover, it has to be clear and consistent. It has to be efficient, flexible and only require that amount of information necessary for making sound technical screening decisions.

[Slide.]

MR. SZYMCZAK: The screening process that has these features is one that progressively focuses our review to that subset of equipment that warrants further attention. Now, such a screening process would first identify those systems, structures and components important to safety. Then, of those, identify which ones are covered by an existing program, and/or identify which structures, systems and components are not subject to significant age-related degradation.

These components are then set aside and do not require further evaluation for license renewal. But the remaining structures, systems and components important to safety have unresolved aging degradation issues which must be addressed, and these require further evaluation.

[Slide.]

MR. SZYMCZAK: Let me amplify our thoughts concerning the use of existing programs. It isn't simply a simple matter of a component being in an existing program that is sufficient basis to screen it out. Strict criteria must be met in order to take credit for such programs. In concern with the lead plant, the NUMARC plant review methodology, the existing program must be documented, approved and implemented routinely in accordance with plant procedures.

It must, moreover, ensure that all the components significant to safety, functions or aging degradation mechanisms are addressed. And it must establish acceptance criteria and requirements in the event that the acceptance criteria are not met, that followup action be taken.

I have listed examples of some programs that we feel fit in that category.

[Slide.]

MR. SZYMCZAK: Regarding age-related degradation. We feel that you have to do your homework. At Yankee Atomic, we are using existing technical information on age-related degradation together with component, material and environmental information to determine if a component is subject to significant age-related degradation.

And we'd like to point out that, as you all well know, degradation mechanisms and screening criteria vary with the component type. Fluid systems, electrical, INC and structural all demand their own set of degradation mechanisms and criteria for exclusion under whether or not age-related degradation exists.

[Slide.]

MR. SZYMCZAK: Now that I've given an outline of where we perceive screening to be, I'd like to shift gears and go into some specific comments on the draft rule.

First and foremost, we feel that the philosophy expressed in the letter transmitting the rule to us is good. However, we feel the rule as written does not express NRC philosophy. Specifically, on Page 11, it states "those systems, structures and components that are effectively covered by existing ongoing NRC requirements and/or licensee programs, or are not subject to aging mechanisms, need not be addressed within the rule in the application."

[Slide.]

MR. SZYMCZAK: Let's get to some specifics. First off, the definition of important to safety. We feel that the definition is acceptable providing the requirement in Section 3(c)(3) be deleted. This is the requirement that specifically calls for certain post-accident monitoring equipment.

We feel that 3(c)(1) and 3(c)(2) are sufficient criteria to identify the scope of equipment to be considered. There should be no need to single out any one group of components in the definition. Either a component makes it by the criteria in the definition or it doesn't. There should be no need to single out specific equipment.

Screening also appears to be limited to only Step 9(c)(1), the identification of systems, structures important to safety. We take a broader view of what screening is and that it's not just those components important to safety, but it's those components important to safety which have unresolved aging degradation issues.

[Slide.]

MR. SZYMCZAK: Furthermore, as Terry pointed out, we feel that the scope behind Section 9(c) is unnecessary. Section 9(c) demands a lot of information. Specifically, as stated in the rule, it requires for each system, structure and component identified important to safety, the identification of design requirements, functions and environmental conditions, identification of degradation mechanisms, and furthermore, a program to evaluate -- identify, evaluate and trend effects of relevant degradation mechanisms for all those components important to safety.

[Slide.]

MR. SZYMCZAK: This scope is unnecessary for the following reasons. It is well recognized that degradation concerns do not exist for many components for the following reasons; design considerations, the non-environmental conditions, inspection and maintenance that's performed, or refurbishment and replacement that goes on.

It is very important that the screening process consider these factors so that the resources can be focused on those components warranting attention.

[Slide.]

MR. SZYMCZAK: Furthermore, we feel that the draft rule does not reflect a multi-level review process by not clearly distinguishing screening from evaluations. We feel screening should be the section in 9(c)(1) which calls for the identification of systems, structures and components important to safety, that that should be amplified to reflect the first level screening, which Terry talked about.

Furthermore, in line with this, the credit for existing programs is not specifically called out, nor is credit for components not subject to aging degradation specifically called out.

Furthermore, the rule does not allow for flexibility in demonstrating age-related degradation has been addressed. You've got a process that's bing, bing, bing, one, two, three, four, that you have to go through each step to get from one to the other. We really feel that flexibility is needed to mix and match as appropriate.

Furthermore, degradation mechanisms uniquely identified in 9(c)(3) do not apply to all components or all component types. Our feeling on specifically calling out degradation mechanisms in the rule is that they should not be called out. The rule should be left general. The application should address the degradation mechanisms and it will up to the licensee to demonstrate that he has.

[Slide.]

MR. SZYMCZAK: Furthermore, we'd like to point out that trending as required by Section 9(c)(5) for all components important to safety is not necessary.

[Slide.]

MR. SZYMCZAK: There are other options, other than trending, that you can take to show that you're managing age-related degradation. Programs which effectively manage aging by replacement prior to degradation or which provides for periodic refurbishment, replacement of components, or programs which show that by analysis aging is not a concern if equipment is operated within given limits.

This is specifically calling out for the EQ program where the EQ program envelopes operation of a component for a specified time under specified conditions.

Another option, other than trending, is analysis that shows the aging degradation is accommodated by design. Trending should only be looked at as one option to look towards as managing age-related degradation.

[Slide.]

MR. SZYMCZAK: Let me summarize. We feel that the final rule should be consistent with expressed NRC philosophy in the industry developed plant evaluation methodology. The screening process should efficiently determine those components important to plant safety that have unresolved age-related degradation issues. Integral to that screening process, we need to have credited existing effective programs and credited components that are not subject to age-related degradation.

The screening process, moreover, should provide flexibility. Currently, the screening process that's been published is very component oriented. There are generic component approaches and issue specific approaches that can be taken to show that age degradation is being managed. Furthermore, the screening order should not be constrained.

Next slide.

[Slide.]

MR. SZYMCZAK: Regarding evaluations, those systems, structure and components important to safety with unresolved age-related degradation issues require further evaluations. However, the evaluation requirements should be generally defined within the rule, and the rule should acknowledge that the evaluation scope is going to be highly component specific.

In line with that, it should permit flexibility in resolving issues. When it comes down to evaluations, there are many options which you can pursue to determine whether or not -- to determine what your course of action is going to be. Those are analysis, procedural enhancements, inspections, refurbishment, or replacement. Those are all viable options once you get down to this level in evaluations, and it'll be very component specific.

In conclusion, let me say that we are looking towards a final rule which has a screening process that efficiently focuses our plant review. Because resources are limited, a screening process that allows us to focus on the equipment with unresolved age and degradation issues in the most efficient manner is of paramount importance to the success of our license renewal program.

That's the conclusion of my presentation. Thank you. Any questions?

MR. THADANI: No, thank you.

Next, Union of Concerned Scientists, Bob Pallard. Bob?

[No response.]

MR. THADANI: I guess -- is Bob here? Now, why don't we go on to the next group, and then we'll see if he's arrived later on. SAI and Bill Vesley.

MR. VESLEY: This is an adaptation of a paper which I presented at the water reactor safety meeting. It deals specifically on the issues of screening of safety systems, components and structures, particularly on the credit given to establish maintenance programs and the use of PRAs.

Could I have the next slide?

[Slide.]

MR. VESLEY: We have been doing a good amount of work for the NRC for the past years in analyzing failure and maintenance data for aging of facts and incorporating aging into PRAs. We have developed procedures to analyze failure and maintenance data. We have analyzed over 120 components and have found significant aging trends in components.

Examples are, for example, the plant-specific diesel data, and the NPRDS data, which we did validate going back to plant-specific data and had to supplement that NPRDS data. We will show these aging effects, which have occurred even though there were, quote, "existing maintenance programs" existing on these components. So the assumption that just because maintenance programs exist doesn't necessary mean that aging is being controlled.

Could I have the next slide?

[Slide.]

MR. VESLEY: In this particular case, this was a diesel analysis. The diesels were fairly young, less than ten years, age-specific diesels. It indicated that -- this analysis indicated that all four diesels were aging. Specifically, the control systems were aging and the governors were aging, even though this plant supposedly had a maintenance program.

The problem with the diesel is the aging effects, the multiple aging effects, and that's one of my problems with the NUMARC approach, is I don't believe the NUMARC approach handles multiple aging effects, which we are observing in data.

In the circuit breakers that we analyzed for a plant-specific data, which was supplemented by plant-specific data because of the problems with NPRDS, we did see circuit breakers aging, and the problem here was the multiple aging of all circuit breakers in the emergency power system, essential service water system, and particular manufacture models did show these aging effects. In the reactor protection system, there was no aging observed.

Controllers -- again, all of the controllers in the residual heat removal system, low pressure injection system, and particular manufacture models did show more aging than others.

Can I have the next?

[Slide.]

MR. VESLEY: These are just some of the details of the aging, which, in this case, was the Weibull models. It's interesting to point out at the bottom that this -- this is on the diesels -- is that the diesels, if you look at the beta, is aging at a 1.7 power with age, so it is non-linear.

These are the kind of data that you can get. This is an example of the -- this is an example -- this is downtime rate. We're looking also at catastrophic failures. It does show -- this is just a plot of the empirical failure rate against age and the Weibull fit. This is significant to greater than 95 percent competence, so, again -- and this was just an example of one diesel. The concern is all four diesels.

[Slide.]

MR. VESLEY: The circuit breakers were even showing more of an extreme effect. If you look at the beta, I'm seeing a T to the 5.6 power, so highly non-linear aging.

Could I have the next slide.

[Slide.]

MR. VESLEY: The circuit breakers in all these are showing these kind of an effect, where there is no aging for perhaps 3,000 days, which is approximately ten years, and then the circuit breaker takes off very significantly, increasing by several orders of magnitude, not yet becoming so frequent as to impact the unavailability or the risk, but significantly increasing. All the circuit breakers were exhibiting this kind of behavior, quote, "even though the plant had an established maintenance program."

[Slide.]

MR. VESLEY: So I certainly agree that one should take credit for it, but one has to be careful in defining what criteria one uses in establishing how to take credit, particularly when some of these maintenance programs have not been really particularly evaluated for their aging controls or their risk and safety effects.

The conclusions in this data analysis, the application indicated significant aging trends in specific failure modes and causes. We have looked at other components. In approximately 30 percent of the components, we have seen aging effects. They are in the paper, in the water reactor safety paper, and as well as reports we have sent to NRC.

One has to evaluate data and develop approaches to monitor, even on those components that are replaceable and that one generally may not assume is having significant aging trends occurring.

[Slide.]

MR. VESLEY: This is now on the risk evaluations of aging, and it goes back to Ashok's question of, "Do you need different approaches for PRAs?" Now, I think my approach would be yes.

Even when you fail a component, the impact of the component depends on the other failure rates assigned to the component, and in the NUMARC approach, they're still assigning steady state failure rates, assuming those others are not aging. So the impact is a steady state, non-aging impact, and it's a one-at-a-time impact. That's my concern.

The common causes that are treated in the NUMARC approach are this traditional PRA common cause. Aging itself is a common cause. Different mechanisms where corrosion caused multiple failure rates to increase. I do not have to have a common triggering mechanism. Aging itself. And that multiple failure increase can cause significant core melt impacts, and can have contributors which the NUMARC approach would not find.

We, in our analysis, have used the two recent NUREG PRAs to evaluate the core melt frequency effects of aging and to prioritize contributors. We have also looked at how to quantify various aging maintenance programs for their risk effectiveness.

One thing nice about the PRAs -- it does show that even if you include the aging contributors and multiple contributors, the multiple effects, one can effectively prioritize. The PRAs are very powerful for this, showing that even in the ineffective maintenance programs that we did assume, which were not characteristic of the plants, which were just for parametric, that only a small number of components contributed. These were different from the standard PRA contributors and those that would be found by the NUMARC approach.

Could I have the next slide, please.

[Slide.]

MR. VESLEY: To quantify the maintenance program's effectiveness, you really need two quantities, which is the overhaul interval, which is the interval at which subassembly and major piece parts are replaced. This can be done at failure or corrective maintenance and the surveillance interval at which operational tests or conditional monitoring is performed. If one uses tech specs as intervals, then one has to get the effective interval, which is the actual interval divided by the efficiency of the tech spec in detecting aging contributions, which the PRA doesn't get into because of the non-treatment of aging.

Could I have the next slide?

[Slide]

MR. VESLEY: There are databases that have been established -- they have large uncertainties in treating aging effects -- TIRAGLEX, which is a database developed in NPAR and has subjective estimates. There are updates. We use Mod 1, which includes specific data to check TIRAGLEX for the two plants we analyzed. Mod 2 was a sensitivity study in which we assigned 20-year failure-rate doubling times. The failure in Mod 3 was a doubling time of 5 years.

These are relatively small aging effects. It says the failure rate only doubles by a factor of 2 over the steady state. This says it doubles after 5 years; this says 20 years. Even with these relatively small aging effects, which would be very hard to distinguish in current data-collection systems, we saw very large core-melt frequency impacts for certain maintenance programs.

[Slide]

MR. VESLEY: The plus side was the relatively small contributors. This is an example of the results that we've looked at. At the bottom are the characterizations of the maintenance program. This is overhaul at 18 months, aging surveillance at 1 month; every 72 months, aging surveillance at 1 month. This was overhaul at only 18 months. Aging surveillances and tech specs are not considered to be effective. Overhauls every 72 months, and 6 months on aging surveillance, overhauls only on 72 months, with tech specs not given credit. This was assumed -- all of these intervals were assumed to be done on all of the active components.

What one sees here is that -- and these different data are for the different aging rates, the different aging-rate databases. This happened to be for the PWR for 1150.

It's interesting that, depending on the maintenance program, this is just an active component. This is the delta-C. The delta-C is a core-melt frequency increase due to aging. This is the baseline that 1150 calculated, which was the dotted line, which was 2 times 10 to the minus 5 for this PRA.

You can see, if you have effective maintenance programs, that you can keep the core-melt frequency increase to below 2 times 10 to the minus 5, even for the more severe aging. For ineffective programs, which are probably not reflective of current maintenance programs but were used here for sensitivity studies, I can get core-melt frequency increases, average core-melt frequency increases of up to 10 to the minus 2, which just shows the sensitivity of core-melt frequency to the maintenance program.

This delta-C was calculated as the average core-melt frequency increase between overhauls. So, this was an average core-melt frequency after approximately 7 years, which was our maximum -- after 6 years, which was our maximum overhaul period. This should only be viewed in a relative sense, but it does show that "even with given maintenance programs", I can have very dramatic effects on core-melt frequency increase.

[Slide]

MR. VESLEY: The BWR shows the same kind of an effect. The BWR results are an order of magnitude lower. It says if you have very effective maintenance programs, I can keep my core-melt frequency below the baseline and have aging negligible. If I have very ineffective, which are not likely to current practice, but it shows, for sensitivity, I can get a very large core-melt frequency increase.

PRAs, in my viewpoint, can be used to evaluate, at least on a relative scale, the effectiveness of maintenance programs.

[Slide]

MR. VESLEY: One can include the uncertainties on it. We included the uncertainties on the data. It shows that they are more sensitive to the aging program than they are to the data. Very ineffective programs will give you -- this is we're plotting the probability of core-melt frequencies greater than given values against the given core-melt frequency increase.

The lower curve, on your lefthand side, is for an effective maintenance program, and it can keep the core-frequency below 10 to the minus 5, the baseline for ineffective maintenance programs, "ineffective" here being even though maintenance is done, it's not done enough on the critical components. You can get very high.

We found very large sensitivities, as a matter of fact, for core-melt frequencies to maintenance programs at different assumptions on the maintenance programs.

This shows the BWR. It's interesting. The BWR design drops everything an order of magnitude, so it's design is more robust aging effect, keeping aging effects down by an order of magnitude for the same maintenance program and same aging. These are just different. The best maintenance is where the maintenance program is characterized as having overhauls every 12 to 120 months, and every aging surveillance is 1 to 12 months. The others are different aging controls, different maintenance controls.

[Slide]

MR. VESLEY: One of the most important features of these evaluations, I think, is not particularly the numbers but the prioritization it gives you. It shows the PRAs are very effective, in fact one of the most powerful in showing what's contributing. Even in the ineffective maintenance programs, relatively few components contribute, and it says if you focus your maintenance on those 20 or 25 components that, indeed, I can control my core-melt frequency and allow looser maintenance on the rest of the components.

We found, for the PWR, for example, that the dominant contributors were diesels, specific check valves, and motor-operated valves in the ECCS, and motor-driven pumps and turbine-driven pumps in the aux feed systems. Some of these would not have been found by the traditional PRA importance of evaluations.

For Plant B, the dominant contributors were diesels, specific motor-driven pumps in *he service water system, and turbine-driven pumps in the RCI.

[Slide]

MR. VESLEY: These are the single aging effects. This is interesting. PRAs can provide this kind of detail. The component name is a specific component in the PRA. It identifies a specific system, the component, the failure mode. These are the top 25 single contributors. You can see it gives -- the top 25 go from 6 times 10 to the minus 5 for the delta C, which is the core-melt frequency increase due to aging, down to about 7.8 times 10 to the minus 7, approximatel; 2 orders of magnitude. If you control these 25 contributors -- and this was the worst maintenance program. This was the most lax than the others, where I gave no credit to tech specs and relatively little replacement.

Even what this says -- this is interesting, that these same contributors came up, regardless of the database that was used. They might have had some relative ordering, but it was these same contributors. If you control these 25 contributors, I can control the core-melt to be less than the baseline.

[Slide]

MR. VESLEY: These are the multiple aging effects which NUMARC does not -- this is multiple aging of components, not common cause. It's multiple aging, components simultaneously increasing of failure rate due to different aging mechanisms, but aging mechanisms. One could be erosion. One could be wear. It's not a common cause in a traditional PRA sense. It's an aging, multiple increases of multiple increases in failure rate.

With two diesels failing or there is interactions between MOVs, I have larger core-melt frequency impacts for multiple aging of components than the single impacts. So, the argument that my screening approach, by bounding, by failing one at a time, by actually -- by assuming the component fails, does not cover these multiple effects, where two of them are multiply aging due to different mechanisms.

The conservatism in covering one at a time, by assuming failure, is not enough to cover the multiple aging effects, but it's interesting that these same -- that these multiple effects, again looking at the top 25, I can control it to within approximately an order and a half to 2 orders of magnitude. We looked at all the detailed PRA contributors. This was the most lax case of maintenance, the highest aging, and you still ended up with saying, if I can focus on the top 25 contributors for this and one has, for the same on a PWR as the "Bs", I can control the aging.

So, the PWRs have a very effective way of screening.

I don't know how you can screen without the PRAs, but you've got to be careful in handling the aging and the multiple aging effects to do it correctly.

[Slide]

MR. VESLEY: In conclusions, then, one can evaluate maintenance programs and surveillance programs for their risk effectiveness. We looked at core-melt frequency. You can also look at the risk effectivness on consequences. You need to do that, for example, in screening, if you want to look at containment systems.

If you look just as core-melt frequency, none of the containment systems have shown up as important. When we've looked at risk, as calculated in 1150, we got some different contributors that were left in the hopper because of the contributions to high-risk sequences, as opposed to core melt. So, when you are just screening on core melt, you will not pick up some important contributors that are important to high-risk sequences.

Contributors to aging can be effectively prioritized. We found these contributors were not that sensitive to aging rates, were not that sensitive to maintenance program if you picked up the 2 orders of magnitude, and one could have criteria to control below the baseline, and that one could include the multiple aging effects, and we found that multiple aging effects, by looking at multiple aging of components, did give you some additional components that were not picked up in the single aging effects.

There was not a large number. You could still manage. I think the total number of components in each -- in the P and the B was less than 30 -- less than 40 for the P, less than 30 for the B.

Aging-rate data certainly does need to be improved. There are aging-rate databases out there. If one uses to prioritize and to do relative sensitivity, we found that, in our studies, the results are not that sensitive to aging-rate data, if you're trying to do relative kinds of evaluations. There are databases one can use for even evaluating maintenance-effectiveness program.

My position is if you've got an aging rate that only doubles the failure rate every 20 years and if your maintenance program does not control that core-melt frequency to be acceptable, then that's not an acceptable maintenance program.

If I can't control minimal aging and I can define it to the point where it only increases the failure rate by a factor of 2 within 20 years, if it cannot control that kind of aging, then it's not an effective aging and it's not an effective maintenance program, regardless of what you say. So, one can establish minimal kinds of aging-rate databases to be able to check and evaluate the maintenance programs to determine its effectiveness as one additional and important evaluation.

Again, the prioritization is very critical, and I think that is the key issue. So, in conclusion, I really do advocate the PRAs a stronger use in this screening methodology, provided they are used correctly.

Thank you.

MR. CHAPMAN: May I comment, based on that presentation?

MR. THADANI: Please go ahead. But identify yourself first.

MR. CHAPMAN: I am Jim Chapman from Yankee Atomic Electric Company, Manager of Safety Assessment. And Bill, it has been a long time since I have seen you. And of course, I am involved in PRA. And we are big believers in PRA. But not in this use, at all.

We think that the PRA use in screening is clearly optional, and there is not a need for an increased aging data base.

I want to make a couple of points, however.

Yankee Rowe has been operating for about 30 years, and I guess the reason we haven't seen what you have talked about, Bill, is because we passed ten years 20 years ago. We just have not seen it. And we just did an update, just this last year, to look at trends of key equipment, not just standby equipment and not just failure rates. We've looked at maintenance unavailability and things like that. We have not seen this. We looked at it very carefully.

MR. VESLEY: I would like to interject. That aging rate data that we used in our studies would not be detectable under current data collection. That increases the failure rate by a factor of 2 in 20 years. You would not see such. The concern is that aging can be ongoing, which you would not detect. Those trends that we saw in diesels and in breakers were much higher. They are orders of magnitude higher than the aging rates that we used in the PRA. So there is a concern, if I don't see it, is it still going on.

MR. CHAPMAN: We have over 2,000 demands on our diesels and we haven't seen this trend. So they have been there quite a while and there are a fair number of them.

The other point I wanted to make is that if one were to see this phenomenon, this change in failure rates, that is part of the monitoring program, and part of what is built into the NUMARC screening and evaluation process. We think that is very important.

MR. VESLEY: Yes. I believe the concern is you must monitor multiple equipment, because --

MR. CHAPMAN: We are clearly doing that. I wanted ot make a point relative to that. Our core damage frequency, calculated core damage frequency has decreased with time, not increased with time, which is again at odds to what you are presenting, because of the proactive and living nature of all plant-control programs. And that is the point that many of the speakers have tried to make relative to effective maintenance. Clearly, one needs to understand degradation mechanisms. And that is what the approach is intended to do. And based on what I've seen, in the independent reviews I've done and what is going on in our place, they are doing that.

MR. VESLEY: That's right. This is just aging. If you include now on top of that backfitting, changes in components that have been made, then I can see other effects. This is where aging was going on. We are focusing on aging time-dependent degradation, the fact that, how much can time-dependent degradation impact the risk and can it be incorporated in the PRA. Changes in design, changes in maintenance policy, can all have a positive effect that can counteract the aging.

And that is effectively included, to examine those tradeoffs.

MR. CHAPMAN: I have a simple fact. The performance of our plant, and I suspect of the other lead plant, has improved over the last 30 years, both in terms of its online performance and its "standby," quote unquote, safety equipment performance.

So if there is aging going on, we must be managing it very well. So I don't think these models are appropriate. I think they are a nice exercise. And I don't think we need to devote many resources, if any, trying to develop sophisticated models.

MR. VESLEY: How do you screen for aging without including aging?

If you ignore it and say I will screen by just failing one at a time and ignore the aging, what this does is, say, this is for screening. There is one thing. It is how much aging do I have and how do I evaluate that in aged models? How do I screen for aging? Where is aging? Where do I have to focus my aging programs?

I think these techniques are very valuable for that.

MR. CHAPMAN: Again, I am a big believer in PRA. But I first of all, I believe the NUMARC methodology does account for multiple failures. I feel that the traditional, deterministic screening approach that we are using is in consonance with PRA. It is critical safety function based. And it is our intent to look at degradation mechanisms. So I think that it does account for it. I don't think there is any question that it accounts for it.

I had a question for you, though.

MR. VESLEY: That's good. I think they are combined. I am very strong in the hybrid approach. I don't think the PRA itself, and it never has, is a very -- If you don't see aging, or if you really believe in it, that's fine. But I am just saying, as a way to screen out, even in these contributors, even these valuations that identified a relatively small number of contributors, that one had to focus his aging control programs.

If you don't use a PRA for screening, you've got a problem in how to narrow your deterministic analysis.

MR. CHAPMAN: Maybe we are doing too much work, then. Because we seem to be pretty efficient in effect.

I had a question for you.

MR. VESLEY: Yes, Jim.

MR. CHAPMAN: What is the definition of aging?

MR. VESLEY: Aging is increased, time-dependent increase in the failure rate.

MR. CHAPMAN: Again, then, if people are seeing that, they should be monitoring and controlling, and it is built into the process.

MR. VESLEY: By the time you see it --

MR. CHAPMAN: We have 30 years of experience.

MR. VESLEY: Right.

MR. CHAPMAN: So we are past your ten-year history.

MR. VESLEY: If you looked at the 95 percent confidence, I would not expect to see this within the plant life. We picked that 20 years because you would not expect to see it within 40 years, within a high confidence. All this says is that I can have aging going on and not identify it in data collection programs.

MR. CHAPMAN: I am going to let you in on a secret. We have a pump at our plant that was built in 1917. We haven't had a failure in that pump in the last 24 years.

MR. VESLEY: Sure. And in fact that doesn't say aging is not going on in it. It just says aging has not gotten to the point where it has caused that pump to be unavailable.

You know, in this case, even this doubling of the failure rates still has a low failure rate. The concern you have in aging is multiple equipment all having small increases in the failure rate. What is their multiple impact? One component failing or one component having high aging is not a problem. The plant has enough backups, enough diversity. The concern is multiple aging and multiple equipment at low levels that can cause significant risk impacts. I'm not worried about the single component. If we put these high aging rates, by the time, if the component is failing, at that high level of the plant, of course it will identify it and will have fixed it, although in those two cases, in the diesel and the breaker, they did not.

So it is the multiple aging effects that are the most deleterious.

MR. CHAPMAN: I think you visited the wrong plants. But that is another issue.

[Laughter.]

MR. VESLEY: Good.

MR. CHAPMAN: It's good to see you again.

MR. VESLEY: Good to see you, too.

[Laughter.]

MR. VESLEY: You know, I saw Guy, and he said, these meetings have to be stirred up. And I said I was certainly trying to do my part in this.

[Laughter.]

MR. THADANI: Did you want to comment on Bill's presentation, then? We can use that viewgraph machine.

MR. SLITER: Hi, Mr. Vesley. I am George Sliter, from the Electric Power Research Institute, providing support, technical support to NUMARC for life extension.

I would like to back up some of the points made by Mr. Chapman, by showing you what you already know, but I think it is important to bring it out here and have you comment on it.

It is the idea of the utility's perspective of what an aging failure rate curve looks like with respect to time.

The information and data that I will show you comes out of the NRC NPAR report from a Brookhaven NPAR report.

[Slide.]

MR. SLITER: And the first viewgraph I have here is the report. It is the operating experience, an aging seismic assessment of battery chargers and inverters, by Brookhaven.

And it looked into typical shapes of failure rate curves, as you know.

[Slide.]

MR. SLITER: And so the data that they displayed is shown schematically in this figure, but it is supported by the data they have.

First of all, I want to point out that we all admit that the data base is rather scant at this time, and it is difficult. But often, we attempt to put curves through failure rate data that may not be appropriate.

This figure shows the typical bathtub curve. And it shows the typical bathtub-shaped curve with initial failure curve for infant mortality than going down to the random failure level, and then beginning to increase. And you showed us many data curves that showed the quote "aging effects" portion of the curve. And we all can put straight-line extrapolations through that increasing aging portion.

But in order to emphasize what is really going on in the real world, I will simply read for the record the report words: "Some of the actions taken by utilities who have experienced inverter and battery charger failures which affected plant safety and availability were to increase preventive maintenance, scope, and intervals, replace troublesome equipment, and improve system designs. Improvements in materials and procedures also helped reduce the failure rate and could explain the shape of the curve in this figure obtained when plotting inverter and charter failures against plant age."

And it is those actions and procedures that Mr. Chapman was talking about.

If components exhibit greater than expected failure rates, which are nonetheless, as you pointed out in your talk, acceptable in view of the redundant nature of safety-related systems, the utility would simply shorten the replacement interval of these sub-components.

This action. usually taken early in the plant's life, would have the effect of improving reliability over the remaining expected long life of the assembly.

And Mr. Chapman also talked about the improved reliability.

The important point here is that plant procedures are in place to determine if and when component reliability is approaching unacceptable levels, so that timely measures can be taken to adjust maintenance programs. Aging models, such as the one you are talking about today, are good for doing "what-if" sensitivity studies and for telling us what are acceptable accident failure rates in various components.

But extrapolation of your aging models to long times, assuming that changes in programs are not effective, I'm afraid are inappropriate, especially with today's limited data base and the state of the art of the whole procedure that you are explaining to us today.

MR. VESLEY: That's true. I agree with you, George.

One, these were done at maximum seven years, so that we are not extrapolating out to 20. Two, the plant, even on the breakers, have replaced the breakers. So they have now, it has come down. So indeed, I start with a new failure rate.

It doesn't say aging isn't going on. I may have controlled it to be at a lower level so that my resulting unavailability, reliability has been controlled. What this is saying, and this is right, what this has identified is, we have looked at this and identified what components you need to have. In one of these programs there was an existing maintenance program going on in the plant. And to look at that, one, how is it controlling it; and if it is not controlling it, what needs additional attention? And what this identified is that on the majority of components, it was doing well on this. There was a small number of components, if it would keep what it was doing, would have a large impact if things weren't changed.

Now, if they come in and say I will change, I will increase my intervals, that can be put in. In fact, they were done on these components, the 25 components, and if I do reduce the intervals, I can control it. And I think the PRAs allow you to do this, to say how good are my programs, where do I need to change, if I do make these changes, what are the impacts?

I have the problem of making the assumption that I am controlling things without doing these evaluations.

MR. SLITER: There is one thing I don't understand. You keep saying if the program is changed, then we have, you might say, an improved slope, a lower slope. You, of course, y our model can accept the lower slope. I just don't understand how you can put the lower slope in and then extrapolate out to any degree, because as soon as you predict things become unacceptable, things are extrapolated.

MR. VESLEY: It's not a change. It's not. We only carried it out to the next, we let aging occur between overhauls, between the replacement of the piece part or subassembly. But then we started over. We assumed the plant put in good as new without any burn-in. So what we only did was to not assume that aging was not controlled, we assumed that aging occurred between replacements, between times at which that aging was addressed.

So I did not assume, if I would have assumed no aging, or no maintenance, these curves would have gone out to even higher values. I assumed that aging only occurred between replacements or overhauls.

MR. SLITER: That means you have an increasing slope between overhauls. That implies that we have some kind of a data base in which we can actually go in and put a reasonable representation of the slope in such a short time period. The present data base, and I have seen it over and over in attempts in various NPAR reports, to put a slope through. One can put an upper bound slope through, through those curves, but it is unrealistic to use that upper bound in the way you are suggesting, and it is very difficult to put a real-life fit through it without a very large uncertainty today. So I still don't understand.

MR. VESLEY: The data base problem is an important problem. It is an issue of, there is another point to say all right, if this aging is small, like it doubles the failure rate, and every 20 years, only, and if I have this small aging rate, should my maintenance program be able to control that? And if I put that in and if it doesn't, then there is an argument that that is not adequate.

So I think one can construct data bases to test the maintenance program to see how well it controls these. These are not upper boundaries, they are lower bound aging, that would not be detected. If we put in the circuit breaker diesel, which they have now changed, the plant has, that would be upper bound.

But I'm saying, how does one establish a data base and how does one use it? If you are using for evaluating maintenance programs or trying to focus on the dominant contributors, I don't need to have that detailed plant-specific data if I am trying to get an absolute number to compare.

MR. THADANI: Bill, I have a couple of questions.

MR. VESLEY: I thought you would have.

MR. THADANI: The first one is; I guess you focused your discussion on, I think, active components.

MR. VESLEY: Yes.

MR. THADANI: Passive components are generally not -- their failure rate is, in fact, much lower than that of active components, if I may make that generalization.

MR. VESLEY: Yes, they are.

MR. THADANI: How do you see the effects of aging on passive components and the resultant on probabilistic assessments, or have you looked into that?

MR. VESLEY: We are starting to look into that. Passive components are a different beast. They have lower failure rates; they're not as testable or replaceable as active, so you have longer intervals between replacements or you may have no interval between replacements.

You've got to go on and it's not replaceable. To that extent that the PRA's are deficient in this area. The Lasalle PRA, which we will be evaluating, does include, to some extent, passives in terms of connectors and pipe segments.

How they contribute, how they interact with actives, has not been done. That's an open issue, but the PRAs do provide a very valuable approach, I think, for prioritizing even actives and as a check on your maintenance program and to identify where, perhaps -- what the PRAs say is that a graded maintenance program or a prioritized maintenance program is most effective.

There are a handful of components that one really has to focus his maintenance of his monitoring on, and the rest of the components can have fairly low levels of maintenance. Maintenance is still required, but if it's not as effective or it's not as frequent, they don't contribute.

Focus your maintenance on 20 or 25 components; I can control core melt frequency to be below the baseline. That's a very strong argument that aging, regardless -- and I can put in these aging rates and look and what happens is that the same contributors come up for these different aging rate databases.

So, PRAs, I think, right now can provide a very valuable tool for prioritizing active components. On the passive components, that's still in the experimental stage, in the development stage. It's not clear how the probabilistic models and passive models would be incorporated and the degree to which they could be used in the PRA.d

Again, this is why the hybrid approach. The PRA -- don't throw away the PRA. The PRA, even when you put these aging rates in, and the ineffective maintenance says there's relatively few components contributing, focus on those components. It's a very strong -- the PRA can be a very strong tool for showing where to focus your maintenance.

Even if I have this aging going on, that it's only these components contributing and I only have to focus on ten percent or less of my components. I think the PRA is some of -- it's the strongest tool you have for prioritizing and screening components, even if you include these multiple effects and aging effects which Jim and George and some people feel are upper bounds. I don't.

I think they are real and they're very difficult to detect, though. Even if you do include these, it comes out with relatively small contributors. I say focus on those. The danger in this rule is that you're going to spread yourself and have all of this information and spread your focus.

The screening methodology, if used -- and I think that in this multiple approach, it's a very powerful tool in the actives. In the passives, it still needs development.

MR. THADANI: Thank you. One more question for you and I think the previous speakers might want also to address it, if they so choose. That is; when you're screening components and if you're utilizing, let's say, probabilistic techniques and you're using things like core damage frequency and so on, do you think one ought to use that core damage frequency in screening, or should one look at the hardware only without recovery actions because the priorities might, in fact, change, if you looked at results without those recovery actions built in. What is your view on that?

MR. VESLEY: We looked -- in NUREG, we looked at with and without recovery. We added approximately 15 components, if you don't add recovery. Our criteria was to control -- our criteria that we used was to control the core melt frequency increase to be below the baseline, with the assumption that if the baseline was acceptable, because a plant is licensed, then I ought to control the core melt frequency increase due to aging effects to be below that baseline.

So, yes, it can have a very large effect -- an important effect, not large. It does bring in additional components. We found in the two cases that they were not a large number. What's more important is that we found in the screening, that when you look at consequences or high accident consequence consequences and those specific event sequences that contribute to high consequences, you bring in another set of components, the containment components that you would not see when you screened just on core melt frequency.

So you ask yourself the question of; if I want to cover the containment components using a PRA, I've got to go to a containment system such as spray systems. I really have to go to a consequence or at least and accident sequence prioritization or a screening, instead of just a core melt frequency.

MR. THADANI: Thank you, Bill. Do you have a question for Bill?

[No response.]

MR. GARDNER: I am J.B. Gardner, a consultant. I hear about the hopper into which we're to screen these materials, and I'm thinking there are two openings -- a yes and no, important to safety. But then I hear there's screening for priorities and I wonder what's to be done with the lower priority things where we're not focusing and what happens to all the items that we say that are important to safety, but they're not on your priority list?

Do you have a recommendation for the dispensation of those?

MR. VESLEY: We looked at that in terms of these two specific plants, and did identify the minimal maintenance that was required on those components which are still required on those unimportant components, but one had to have the minimal maintenance requirements in terms of replacement and surveillance that would allow them to be minimal and not important.

So, by putting those unimportant components in a hopper, one still has requirements. They're not as strong, and current programs, in general, may be adequate, adequate for those. In fact, they may be too much, too much focus, so one can also identify the requirements for those unimportant. One still has to maintain and check those components -- not at the focus, the frequency or the efficiency of the important components, so that's an important point.

I think that one doesn't just put those in the hopper and say, I don't have to worry about them. I don't have to do any maintenance on them, because if you don't do any maintenance, one finds that those rapidly can become -- not rapidly, but after time, can become contributors. So, one can identify -- what we found is that for the unimportant components, what we called the -- we looked at the top 99 percent contributors.

The bottom one percent, and generally the maintenance programs at plant, we looked at to a degree, were adequate in covering those programs and components, and probably are doing too much maintenance. One of the things that we have not included here and we have to be careful of, are the current programs, NRC and industry programs that are in place or that are being proposed that could have some large impacts also on these aging controls.

The evaluations that we are doing now are focusing on as-is maintenance; what the plants are doing now and what they are carrying out as opposed to what is being proposed or what could they do.

MR. GARDNER: My question really was oriented more, not to maintenance and their relative importance, but the license renewal application and where it fits into that picture.

MR. VESLEY: I do think that's where the deterministic comes into it. I do believe the PRAs can provide that prioritization -- what's important to risk; what is not; what's the minimal maintenance or the minimal failure rate -- any other additional issue in terms of the renewal or other issues associated with the components have to be addressed by deterministic approaches.

I really feel that's why the hybrid approach is most powerful. I think you need -- the PRAs can identify where to focus and where not to focus from a risk standpoint. What additional considerations you need for license renewal or for other issues, have to be dealt with separately.

MR. THADANI: Any other comments?

[No response.]

MR. THADANI: Thank you, Bill. Let's see. Let's try again. Is Bob Pollard here from the Union of Concerned Scientists?

[No response.]

MR. THADANI: I guess not. Okay, those, I guess, four organizations are the ones that requested time. If anyone else wishes to comment, we have -- well, this is time for a break. You might want to think about it. We'll come back at 3:00.

[Brief recess.]

MR. THADANI: Let's get started again. Let me try for the last time and this is indeed the last call. Is Bob Pollard here from the Union of Concerned Scientists?

[No response.]

MR. THADANI: Okay. In that case, let's go back. I understand Andy Wolford of INEL has a question for Terry Pickens.

Andy, are you here?

MR. WOLFORD: Yes, I'd like to address this to Mr. Terry Pickens. It seems to me that a central question must be considered throughout the screening methodology. Would the use of the PRA method and criteria alone give the same result as the use of the deterministic method alone? Further complications seem to be introduced by considering a hybrid approach, that is, working through the methodology in some cases, meeting subset criteria by probabilistic arguments and in other cases by deterministic methods on the same equipment to be evaluated.

This attribute of the methodology that is arriving at the same result by both approaches, seems to be key to its validity.

MR. PICKENS: The methodology as we've currently structured it utilizes the deterministic criteria with PRA as an option. We have not attempted to structure it such that you could go through and utilize the probabilistic criteria in and of itself to achieve the same results.

I don't know if that addresses your question.

MR. WOLFORD: The concern is using a mixture of probabilistic and deterministic criteria to satisfy certain substeps of the methodology may in fact arrive at different answers and from reading the document and listening to your presentation, I'm not sure that the controls are built in to maintain consistency.

MR. PICKENS: What we were attempting to do with the probabilistic criteria was to further focus resources and indeed use it as a tool to look -- a second look as to whether or not something had significance to safety and we're using it as a measure of that significance so that we could focus resources back on those components that stayed in and essentially weren't dispositioned at those component steps.

MR. WOLFORD: Perhaps the use of the methodology doesn't really reflect the way it's documented at the present time with essentially the logical steps.

MR. CARLSON: Hi. I'm Dave Carlson. I've got a couple of comments on the question.

I think the question as to whether they give the same result is not the central point. The criteria that we put together were criteria to evaluate equipment in a step-by-step process and to ask ourselves and to provide evidence to the NRC that we can acceptably disposition components along the way through the process. There are different ways, different views, on how to disposition those components. The deterministic criteria capture some aspects of that. The probabilistic criteria capture other aspects of that and a combination of these we believe provides a basis for the evaluation of plant equipment.

There was not an intent to have us have a method by which you deterministically screen the whole plant and probabilistically screen the whole plant and see if you come up with exactly the same result. The question is that at each step along the way, do you have a basis for dispositioning equipment that we're comfortable with as the industry and that the NRC will accept.

MR. WOLFORD: Dave, when you use the term "dispositioning," the way I'm familiar with your methodology, it means essentially, omitting from further consideration until you get down to the very lowest level of applying the method. So I'm concerned that perhaps some of the equipment that would be eliminated -- unless you could eliminate it both with probabilistic and deterministic approaches -- you definitely wouldn't arrive at the same set of equipment to do further detailed analysis on or to submit as your license renewal set of equipment.

MR. CARLSON: The process that's been put together --

by dispositioning what I mean and what we mean is that an evaluation is done and if the determination is made that age-related degradation is not significant or is adequately managed, the basis for that conclusion will be documented and no further review will be conducted.

MR. WOLFORD: I have a second very minor point about criteria and it specifically addresses the sequenced-based criteria -- 1B, 2A. I think one of the things that was confusing about that was that different PRAs will include different things in a sequence and unless a sequence is defined strictly, putting a numerical criterion on it is meaningless.

So I would just recommend either that you define what a sequence is in order to use a criterion appearing in a sequence of 10 to the minus 4 or eliminate the criteria altogether.

Thank you.

MR. THADANI: Let me follow up on that point.

Is the point you're making that unless you define sequences up front, you can have thousands of sequences and what might appear to be a fairly low cutoff frequency may in fact not be so low. It would sort of depend on how you define sequence. Is that really the point you're trying to make?

MR. WOLFORD: Precisely.

MR. THADANI: Thank you.

Are there any other comments? Presentations?

[No response.]

MR. THADANI: I have a couple of questions and if NUMARC and Yankee people or anyone else might want to address these questions. First is, sitting at this end is a disadvantage, let me tell you, because you can't see what's being presented and I sort of got the sense and perhaps incorrectly that pulse accident monitoring systems should not be included -- should be taken out of this activity.

I don't know if that was a correct impression or an incorrect one. Can you comment on that?

MR. SZYMCZAK: Bill Szymczak from Yankee.

Ashok, the post accident monitoring that was called for in that part of the rule, we're saying, it was not to eliminate that equipment explicitly, only to keep post accident monitoring-type equipment if it meets the criteria set beforehand in Section -- this is the definition -- it's 3(c)(1) and (2).

We're saying the criteria that's in 3(c)(1) and 3(c)(2) are -- set the standard for whether a piece of equipment is in or out. It shouldn't be necessary to single out any specific group or type of equipment. That's all we're saying. We're not saying it should be equivocally excluded from the scope. We're just saying, let's use the criteria that have been written in and not point out equipment directly. Let the criteria determine that for us rather than keep on having these exceptions that could be post accident monitoring. It could be other equipment that go along.

We don't mean to exclude anything that is important to safety as defined by 3(c)(1) and 3(c)(2).

MR. THADANI: I have one more question of you, Bill, and that is, similarly, do you think equipment located in mild environment should be treated in a similar fashion?

MR. SZYMCZAK: Similar to post accident monitoring?

MR. THADANI: Yes.

MR. SZYMCZAK: I think my answer will fall along the same lines. We feel that a mild environment, electrical equipment will be treated as any other component will be that's been identified as important to safety. It's going to go through the same steps as say a pump will or a valve will, what not, in that if there are degradation mechanisms identified or if it's determined to be subject to an effective program, it will be dispositioned accordingly.

So what we're saying is that mild environment electrical equipment does not need to be singled out specifically. Let the process do its job.

MR. THADANI: Thank you.

MR. CUNNINGHAM: The discussions before the break between Bill Vesley and others on the models that he presented, clearly one of the key issues is the adequacy of the data base that is supporting any of these models. One of the specific questions that was asked, of the set of 15 for the session, was the role of a mandatory plant-specific data base to allow better differentiation as to whether Dr. Vesley's models, or if the data that he has looked at is the right kind of data or is not quite complete, or what have you.

It sounded like the people from Yankee in effect were doing this type of plant-specific data base development already. Does anybody have any particular comments on that aspect of that particular question that was raised in the set of 15?

MR. CHAPMAN: Jim Chapman from Yankee. I am going to read you our answer, which I believe you are going to receive:

"Data bases may be beneficial but should not be mandatory for license renewal. Other suitable methods are available for management of license renewal activities."

Clearly, we have done a fair amount of data work at Yankee, because we have been in the PRA business for quite a while now, and we find it to be very useful for gleaning insights into the plant past performance, and also in terms of speculating into the future.

We do it selectively for what we consider to be key components, and in essence do a broad screen for other insights in terms of other equipment that we don't want to take the time to collect data on. And again, it depends on the issue.

We also, for other selected issues, have been able to look at plant performance very conservatively and come up with the same conclusion as if we had collected a lot of information. So again, it is very issue-dependent, as I am sure you are aware.

MR. CUNNINGHAM: Again, just a question. It sounds like that kind of follows the same reasoning, to have the general approach that the PRA aspect of this is an optional approach. Does it follow from the same logic, if you will?

MR. CHAPMAN: Yankee has one very simple goal. And that is to understand the performance of the plant and convince ourselves and you that we are controlling aging. And that means getting it done within the next couple years.

I don't think, for our particular situation, we are going to be able to convince you of that with PRA. I think the traditional approach, deterministic approach, is much more appropriate.

However, in the future I think that that option should be available. And I can assure you that when Bill Szymczak, who is our screening wizard, does some systems screening and component level screening, we look at it to make sure he has his blinders opened up. And so far, he is doing pretty well.

MR. CUNNINGHAM: Another question or comment?

MR. HOWEY: Another question.

I am Neil Howey from the State of Illinois. I have a question for Bill from Yankee Atomic.

How essential is it in your opinion to have a good handle on your design basis configuration before you start out on this methodology that the industry is proposing?

Asked another way, do you really need to know how your systems are configured currently before you start out on this approach?

MR. HASELTINE: John Haseltine from Yankee Atomic.

I think the answer in our case was we had to do a lot of work; in fact, we did go into data base type of format. Yankee is an old plant. And back when we started building, we didn't have data bases like newer plants. So we did take a systematic look at the systems, the components in them, put them in the data bases. And that is how we are doing our screening process. Other plants I think probably already have them and don't have to create them. But you do have to have some organized method to go through your plant in a comprehensive manner to look at the systems and the components within the systems, and then to disposition them.

So it does require that you know what the systems are and what the components are and then you can get into age degradation or effective maintenance programs, et cetera, et cetera.

I don't know i that answered your question. But I tried.

MR. HOWEY: I think it did.

MR. THADANI: I guess I am not sure I understood the response, either.

Does anyone else want to take a shot at it?

MR. HOWEY: Maybe let me clarify the question.

The issue seems to be between the NRC, or one of the issues is that the current regulations and licensing concepts are okay the way they are. And yet a lot of utilities seem to be spending a lot of money to try and get their arms around their design configurations.

In other words, starting with their FSAR, over the years, either information was not available because they were an old plant and the architect-engineers didn't supply that kind of information at first, or they had done a lot of modifications that did not get reflected in design drawings, procedures, training lesson plans, et cetera.

And I am wondering, for those plants that have not accurately captured through the configuration management programs what their design basis is, is that essential to starting this process of the industry-sponsored methodology for asking these questions and going through the screening process.

MR. PICKENS: I will take off my NUMARC hat and put on my NSP plant as a lead plant.

In performing the screening, and this goes along, I think, with some of the comments that I made, there is varying levels of information that you need as you go through the system, structure and component evaluations.

While you might not need to have that in a single place, in a single data base, in a single source, you have to have the ability to access that information and have the confidence that that is the current information, indeed, that you are using, so that you can put it into your application and evaluation.

So I think the answer to your question is, there are varying degrees of amount of information that you need but yes, you have to have the processes and the information available to you in-house such that you know what you are working with, with the plant, in terms of the design basis of an individual component, how it is supposed to function in the system, and all those types of things.

And I think what John was trying to say is they have tried to systematically put that into a data base and that is the type of information that is in there.

MR. THADANI: Thank you.

Any other comments?

MR. GARDNER: This is J.B. Gardner, consultant, again.

This morning, we have heard, and this afternoon, too, a good deal of talk about current level of plant safety. And I am not familiar with the definition of the term, but I think it is probably a very subjective one.

And in one of the presentations, it says that we should focus attention on managing age-related degradation that is unique to extended life. And it occurs to me that trying to identify equipment that has unique degradation during extended life might have something to do with the screening process.

I have no idea what the NRC people had in mind when they wrote this. But I wonder if indeed it has any thing to do with screening, and what in the world is degradation that is unique to extended life?

MR. THADANI: I certainly don't know a degradation mechanism that is unique to extended life.

I will tell you, let me try to infer what that means.

There are a whole series of programs that are in place that are expected to monitor performance and effectiveness of components and structures and place. Some of the programs, one that comes to mind certainly, is equipment qualification, for example. They specify a profile that components might see, the environment the components might see inside containment.

The effects of radiation, for example, are based in terms of 40-year life of a component, or some period at which time the component would presumably be replaced.

And that statement I would infer to mean that you need to recognize now that these components are going to be in service for a period longer than what had been considered early on and because of this change, in midstream so to speak, you have to pay special attention and see if that changes anything. For example, does that change your program that you have in place? Does that change the profile that one should consider for those components?

Not seeing it in the context, that is how I would infer that statement, anyway.

MR. ALLEN: Bob Allen, a consultant.

I hear a lot about aging today. But aren't the licensees required, under present regulations, to keep their safety-related systems in an as-new condition?

In other words, they must meet a code that is minimum and they are absolutely required to do that.

Is that not required today?

MR. BOSNAK: Bob Bosnak, NRC Staff.

There isn't any requirement to keep it as good as new. When you reach a level that code criteria or regulation criteria, or whatever, requires you to take some action, then you have to do something in the way of restoration. You don't necessarily have to go back all the way to where you started, at time zero. But you do have to know where you are and you do have to restore some of the property, whatever the property happens to be.

I don't know if that answers the question.

MR. ALLEN: I think it is partially answered. But, when you go into fit, form, or function type things that are required, if you have a pipe, for example, that has mid-wall requirements, if you replace that pipe, you have to replace it with original equipment, that meets the original standards. It is not acceptable to do anything else.

So in effect, what you have, which is different than most other utility functions, you are required, as a nuclear licensee, to maintain that plant essentially -- it is essentially now -- whenever you detect deterioration that doesn't pass the screening for that particular code, to replace it with as-new equipment.

Now, if I am wrong, then a lot of utilities are spending a lot of money needlessly.

MR. BOSNAK: Again, there is a difference between replace something, and if you replace something, obviously you are going to go back to what your FSAR said, and if you are going to replace it with a new pipe new valve, you will meet what you had to meet originally; but if you are going to effect a repair, again, how far do you go to get your above the minimum criteria? Most utilities are probably going to go back and, if they are doing a repair or modification, to try to go back as far as they can. But if they get above the line, the criteria, that is what they need to do in that area. But there are differences between repair and replace.

Does that answer your question?

And if you are replacing something, you are going to replace it with what you had to have when you started out.

MR. ALLEN: Just my experience, in just a few years in this business, but my experience has always been that if we are going to do a repair, that the repair must meet, okay, the original specifications that you are built by, or you had to go to the NRC and ask for relief from that.

And I haven't seen it ever in my experience, and as I say, I haven't been at every plant, but in my experience I have never seen it to where you didn't have to do that. And that is explicitly on record.

MR. BOSNAK: Most repairs will meet the original criteria, what they started out with, and that is as good as new. But again, if you are going to repair it for a certain period of time and you still meet the code requirements or the original requirements, that would be also an acceptable way of doing things.

MR. SLITER: George Sliter of EPRI. Sir, I think your question comes from the metallics, and there, I think, the question has been adequately handled, the fact that fatigue considerations -- the thing isn't as good as new, but when you replace it, indeed it has to be as good as new. But perhaps you aren't as familiar with the electrical world in which the qualification standards and approaches are based not on the fact to keep it as good as new, but rather to attempt to predict what condition it would be in in its end of life condition, and that end of life conditions, for example, for cables, is after 40 years.

So the standards explicit account for degradation that could occur over the installed interval. And then when it reaches that qualified life in which it has its end of life degraded condition, it is replaced with a component as new, as you have described.

MR. CUNNINGHAM: Any other questions?

MR. VAGINS: Milt Vagins, NRC Office of Research.

Dr. Gardner asked some questions that I think are important to this session. They certainly are important to my session, which we just closed. He said, Are there any examples of degradation which are a function of just the license renewal, aging degradation which is applicable only to license renewal?

Well, there are some which we have defined; there are some which exist, and we can rattle those off, and I think we should. There are some which trouble both presence license period and license renewal. It depends upon the condition.

Let's take the pressure vessel embrittlement. We have a good criteria for pressure vessel embrittlement life. It's called the PTS criteria, the PTS screening criteria. There are some plants that may not get to the end of life before they hit their embrittlement level -- limit. Most plants, however, will hit them in the 45th, 50th, or 60th year. Very clearly, an issue to be addressed as part of license renewal.

Let's take erosion/corrosion. There are plants now that have some serious erosion/corrosion, and they're handling them now. However, with -- in some plants, with inspection and with analysis, show that they're all right with the present configuration for their 40-year life, but they won't go to 42 years. Those kinds of examples.

Of course, fatigue is a classic example. Most plants, most components were designed working backwards from a 40-year life. I know I did it that way, and I think most of us did it that way. And there were many units, because of the availability of scheduled pipe, that have plenty of fat in them. We didn't purposefully build it in because the code didn't require it. If it came out that way, fine, on an economic basis.

There are some components which have a usage factor of end of life of .2. There are some which have already used up their usage factor, and I refer to some particular plants with unexpected ECC, you know, initiation in early shakedown which have an unfortunate number of ECC injections, inadvertent ECC injections.

There are other issues which are not clear, and we addressed those in my session also, which is how do you handle things that are aging and had no initial fatigue criteria, such as Class II and III piping, which, however, have been subject to unscheduled transients, water hazard, etcetera, which, really, in some sense, exceeded their initial criteria when we looked at fatigue equivalency.ency.

So you can go on and on. There are issues involving thermal fatigue, where we have been developing some thermal fatigue, and analysis has shown, because they were today's problems, that the license period is sufficient, that the components will make it through the license period. Whether it'll make it through the 41st, etcetera, that's another issue.

So there are some clearly defined issues right now, and I just spoke of some which most of us generally know of. There are some in the electrical area.

Obviously, the statement was brought up about equipment qualification. All equipment qualification goes to the end of present day life, period. So we have that issue to handle.

So there are very well and clearly defined issues which are clearly degradation issues beyond present life -- beyond present license period. Does that answer your question?

MR. EELEN: Yes. Degradation may have been going on, but the criteria on its acceptability is post 40 years.

MR. VAGINS: Correct. There is no such thing as degradation starts the 41st year. You know that; I know that; look at us.

[Laughter.]

MR. VAGINS: Aging is a continuous process. If we knew how to mitigate it, we'd do it now. At least in my case, I'd do it now. But anyway, there are some clearcut issues. We wish that every issue was clearcut. Unfortunately, they're not. And that's why we have to do an in-depth look at these systems, and that's why the screening process is so very, very important.

MR. THADANI: Any other comments?

MR. TALLY: Charles Tally from Babcock & Wilcox.ox.

This morning, it was mentioned in passing about the fact that safety is an important function of trip initiators and balance of plant systems that are not generally considered safety systems. They're not safety systems. No one has mentioned this afternoon how these systems would be treated. I'd like to know what the industry is thinking, both the NRC and industry reps, in regard to how these systems would be treated.

MR. SZYMCZAK: Bill Szymczak, Yankee Atomic. What we're doing as far as trip initiators, trip initiators in and of themselves are not sufficient criteria to get the system into the hopper. The criteria that we are using, okay, is geared towards mitigation.

At Yankee, we are in the process of screening our plant as part of the lead plant program. A system such as feedwater is in, but not solely due to its initiating aspects; it's due there because it is viewed as another mitigating system that can be used to put water into the steam generators. So from that aspect, the balance of plant systems like feedwater would be considered, but if solely due to being a trip initiator, it would not be considered.

MR. THADANI: Bill, may I just ask you a clarification on that? It seems to me that most of the major systems that cause reactor scrams would also come into the category you described as mitigation. So, sort of implicitly that's covered, then.

MR. SZYMCZAK: Yes.

MR. THADANI: Thank you.

MR. TALLY: Maybe I'm making too much out of this, but it seems like to me that most serious events that occur at the plants, and the operating record shows it, are caused by failures in the BOP, and it would seem like to me that it would be unacceptable to have a frequency of occurrence of these kinds of events increase substantially. Even though the mitigating systems may be perfectly capable of responding, it seems like to me the NRC would be interested in that, and I'd like to know what you're thinking about, how to address that, or do you not consider that to be a problem?

MR. THADANI: Initiators are clearly a very important point of overall safety of a plant. There's just on question about that. And, in fact, you probably know there are a number of programs that are in place now to further reduce -- the frequency has been going down, and to further reduce the frequency of these transients.

I guess the context I was coming in at was the following: What are the most significant challenges in terms of overall safety, and Bill talked about main feedwater system. Clearly, that's very important, and if you look at main -- you can look at main feedwater system two different ways, and say failure occurred that causes reactor scram.

Another way you can look at the same system is to say you have a problem that took place, now you want to get water in the vessel, or steam generator, and you essentially would take a look at the same system, then, because this is yet one different way -- it doesn't matter, i 's balance of plant system -- it's one different way of taking care of a potential problem.

So I think you're quite correct -- initiators are very important to the safety of the plant, and that systems that play a part in those initiators therefore are important and should be looked at. And it's a matter of just how you look at it, and the sense I got was you can call them mitigation systems and look at them as mitigation systems instead of initiators. But overall, I do agree with you that the initiators are very important to safety.

Go ahead.

MR. ALLEN: Bob Allen, a consultant. I listened to the exchange, but I'm left -- I still don't feel like I know whether that's considered important to safety or not important to safety, and whether it would be included or not included.

MR. THADANI: It is important to safety. Initiators are important to safety, period.

Any other comments?

[No response.]

MR. THADANI: Well, thank you very much. Good night.

[Whereupon, at 3:51 p.m., Session 4 was adjourned.]

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This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission

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T-12 (1)

LICENSE RENEWAL WORKSHOP

SESSION 4

SCREENING METHODOLOGY FOR SYSTEMS, STRUCTURES AND COMPONENTS IMPORTANT TO SAFETY

1. THE ADEQUACY OF THE SCOPE OF SYSTEMS COVERED BY THE PROPOSED RULE

2. THE CLARITY OF REQUIREMENTS IN THE RULE

3. THE CLARITY OF THE SCREENING PROCESS

4. THE APPLICABILITY OF PRAs

5. THE NEED FOR EXPERIMENTAL AGING MODELS

6. THE RESOLUTION OF POTENTIAL ADDITIONAL PROBLEMS IN MEETING THE PROPOSED REQUIREMENTS

7. INCORPORATION OF DEFENSE IN DEPTH

LICENSE RENEWAL WORKSHOP

SESSION 4 - CONTINUED

SCREENING METHODOLOGY FOR SYSTEMS, STRUCTURES AND COMPONENTS IMPORTANT TO SAFETY

8. THE ADEQUACY OF THE AGING DATA MODEL

9. THE ROLE OF MANDATORY PLANT-SPECIFIC DATA BASE

10. DATA ANALYSIS TO DETECT INCREASING FAILURE RATES

11. THE ROLE OF PLANT-SPECIFIC DATA IN PRAs USED IN LICENSE RENEWAL

12. THE TREATMENT OF PASSIVE COMPONENTS IN PRAs USED IN LICENSE RENEWAL

13. THE TREATMENT OF HUMAN ERROR PROBABILITIES IN PRAs USED IN LICENSE RENEWAL

14. THE LEVEL OF DETAIL AND THE NEED FOR SPECIFIC GUIDANCE FOR PRAs USED IN LICENSE RENEWAL

15. THE ROLE OF LEVEL I THRU III PRAs IN LICENSE RENEWAL

T-12

SESSION 4

SCREENING METHODOLOGY FOR SYSTEMS, STRUCTURES, AND COMPONENTS IMPORTANT TO SAFETY

PRESENTED BY
TERRY PICKENS,
NUMARC NUPLEX WORKING GROUP

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

- NRC PHILOSOPHY

  - SCOPE OF SYSTEMS, STRUCTURES AND COMPONENTS TO BE ADDRESSED SIMILAR TO THAT OF ENVIRONMENTAL QUALIFICATION OF ELECTRICAL EQUIPMENT - "IMPORTANT TO SAFETY"

  - LICENSEES REQUIRED TO IDENTIFY WHERE IN EXISTING PLANT PROGRAMS, THE DEGRADATION MECHANISMS ARE BEING MONITORED TO PROVIDE REASONABLE ASSURANCE THAT REPLACEMENT OR REFURBISHMENT SCHEDULES FOR DEGRADING EQUIPMENT ARE BEING DEVELOPED OR SERVICE LIFETIMES FOR EQUIPMENT ARE ESTABLISHED

  - THOSE STRUCTURES, SYSTEMS, AND COMPONENTS THAT ARE EFFECTIVELY COVERED BY EXISTING ONGOING NRC REQUIREMENTS AND/OR LICENSEE PROGRAMS, OR ARE NOT SUBJECT TO AGING MECHANISMS NEED NOT BE ADDRESSED IN THE APPLICATION (AND NEED NOT BE WITHIN THE SCOPE OF THE HEARING PROCESS)

SYSTEM, STRUCTURE AND COMPONENT EVALUATION (SSC)

o NRC APPROACH: (XX.9)

1) IDENTIFY ALL SSC IMPORTANT TO SAFETY (ITS)

2) IDENTIFY DESIGN REQUIREMENTS, FUNCTIONS AND ENVIRONMENTAL CONDITIONS FOR OPERATION

3) IDENTIFY APPLICABLE DEGRADATION MECHANISMS

4) DESCRIBE MEASURES TAKEN TO MANAGE DEGRADATION MECHANISMS

5) DESCRIBE AND PROVIDE TECHNICAL BASIS FOR MONITORING EFFECTS OF <u>ALL</u> RELEVANT AGE-RELATED DEGRADATION FOR <u>ALL</u> SSC'S ITS

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

SYSTEM	DESIGN REQUIREMENTS	FUNCTION	ENVIRONMENTAL CONDITIONS	MEASURES	PROGRAM
SYSTEM XXX - COMP 1 - COMP 2 SYSTEM YYY - COMP 1 - COMP 2 " " "					

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

REQUIREMENTS OF CONCEPTUAL OUTLINE ARE INCONSISTENT WITH NRC'S PHILOSOPHICAL APPROACH

1) LEVEL OF DETAIL AND TYPE OF TECHNICAL DATA FOR ALL SSC'S IS NOT NECESSARY TO DETERMINE THE ABILITY OF THE PLANT TO CONTINUE TO OPERATE SAFELY

2) NEED TO STRIVE TO FOCUS THE APPLICATION OF RESOURCES OF EVALUATING SSC'S TO THOSE WHOSE <u>SAFETY FUNCTION</u> CAN BE AFFECTED BY AGE-RELATED DEGRADATION

3) INDUSTRY APPROACH SUBMITTED TO THE STAFF PROVIDES THE APPROPRIATE LEVEL OF EVALUATION AND IS CONSISTENT WITH THE NRC PHILOSOPHY

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

NRC APPROACH VS INDUSTRY METHODOLOGY

O SYSTEM AND STRUCTURE LEVEL EVALUATION

- STEP 1A IDENTIFIES SYSTEMS AND STRUCTURES RELIED UPON TO OPERATE THE PLANT SAFELY
- NRC APPROACH IDENTIFIES SYSTEMS, STRUCTURES AND COMPONENTS IMPORTANT TO SAFETY
- GENERAL PHILOSOPHY APPEARS CONSISTENT AND DOES NOT NEED TO BE ADDRESSED HERE

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

NRC APPROACH VS INDUSTRY METHODOLOGY

O SYSTEM AND STRUCTURE LEVEL EVALUATION (CONT.)

- STEP 1B IDENTIFIES SYSTEMS AND STRUCTURES THAT SIGNIFICANTLY EFFECT THE RADIOLOGICAL HEALTH AND SAFETY RISK TO THE PUBLIC

- THIS REQUIRES DETERMINATION OF SYSTEM SAFETY FUNCTION (DETERMINISTIC) OR SAFETY IMPORTANCE (PROBABILISTIC)

- TO BE DISPOSITIONED FROM FURTHER EVALUATION THE INDUSTRY APPROACH WOULD DOCUMENT THE SYSTEM FUNCTION AND THE CONCLUSION THAT IT DOES NOT AFFECT THE RADIOLOGICAL HEALTH AND SAFETY RISK TO THE PUBLIC

- NRC APPROACH WOULD REQUIRE ALL INFORMATION CALLED OUT IN XX.9(C) TO BE PROVIDED EVEN FOR THOSE SYSTEMS WHICH DO NOT AFFECT THE RADIOLOGICAL HEALTH AND SAFETY RISK TO THE PUBLIC

SYSTEMS, STRUCTURES AND COMPONENT EVALUATION

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NRC APPROACH VS INDUSTRY METHODOLOGY

O COMPONENT LEVEL EVALUATION

- STEP 2A IDENTIFIES THOSE COMPONENTS WHICH ARE NECESSARY FOR A SYSTEM TO PERFORM ITS SAFETY FUNCTION

- THIS REQUIRES A DETERMINATION OF THE COMPONENT'S CONTRIBUTION TO THE SYSTEM'S SAFETY FUNCTION

- TO BE DISPOSITIONED FROM FURTHER EVALUATION THE INDUSTRY APPROACH WOULD DOCUMENT THAT A COMPONENT IS NOT NECESSARY FOR A SYSTEM TO PERFORM ITS SAFETY FUNCTION AND THAT ITS FAILURE WOULD NOT PRECLUDE THE SYSTEM'S SAFETY FUNCTION FROM BEING PERFORMED

- NRC APPROACH WOULD REQUIRE ALL INFORMATION CALLED OUT IN XX.9(C) TO BE PROVIDED EVEN FOR THOSE COMPONENTS WHICH ARE NOT NECESSARY FOR A SYSTEM TO PERFORM ITS SAFETY FUNCTION OR COULD NOT PRECLUDE THE SYSTEM FROM PERFORMING THAT SAFETY FUNCTION

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

NRC APPROACH VS INDUSTRY METHODOLOGY

O COMPONENT LEVEL EVALUATION (CONT.)

- STEP 2B IDENTIFIES THOSE COMPONENTS WHICH ARE SUBJECT TO AN ESTABLISHED EFFECTIVE REPLACEMENT, REFURBISHMENT OR INSPECTION PROGRAM

- THIS REQUIRES A DETERMINATION OF THE CONTRIBUTION THAT A COMPONENT MAKES TO THE SYSTEM'S SAFETY FUNCTION AND OF THE EFFECTIVENESS OF ESTABLISHED PLANT PROGRAMS IN MANAGING KNOWN AGE RELATED DEGRADATION MECHANISMS WHICH MIGHT PRECLUDE THAT COMPONENT FROM PERFORMING THAT FUNCTION.

- TO BE DISPOSITIONED FROM FURTHER EVALUATION THE INDUSTRY APPROACH WOULD DOCUMENT THAT COMPONENT'S SAFETY FUNCTION(S), THE DEGRADATION MECHANISMS WHICH COULD PRECLUDE THAT COMPONENT FROM PERFORMING THAT SAFETY FUNCTION(S), AND THE PROGRAM(S) WHICH ENSURE THAT FUNCTION IS MAINTAINED

- NRC APPROACH WOULD REQUIRE ALL INFORMATION CALLED OUT IN XX.9(C) TO BE PROVIDED EVEN FOR THOSE COMPONENTS WHICH ARE SUBJECT TO ESTABLISHED PROGRAMS AND ARE EFFECTIVE IN MANAGING AGE RELATED DEGRADATION

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

NRC APPROACH VS INDUSTRY METHODOLOGY

O COMPONENT LEVEL EVALUATION (CONT.)

- STEP 2C IDENTIFIES THOSE COMPONENTS WHICH ARE SUBJECT TO SIGNIFICANT AGE-RELATED DEGRADATION

- THIS REQUIRES A DETERMINATION THAT AN ESTABLISHED, DOCUMENTED SOURCE HAS PROVIDED A THOROUGH UNDERSTANDING OF THE COMPONENTS BEHAVIOR IN THE EXPECTED ENVIRONMENT AND PROVIDES THE BASIS TO CONCLUDE THAT THE COMPONENT WILL NOT BE SUBJECT TO AGE-RELATED DEGRADATION IN THE RENEWAL PERIOD (DETERMINISTIC) OR THAT IF THE COMPONENT FAILS DUE TO AGE-RELATED DEGRADATION THAT THE INCREASE TO RISK IS NOT SIGNIFICANT (PROBABILISTIC)

- TO BE DISPOSITIONED FROM FURTHER EVALUATION THE INDUSTRY APPROACH WOULD REFERENCE THE DOCUMENT(S) WHICH PROVIDE THE BASIS FOR THE CONCLUSION THAT THE COMPONENT IS NOT SUBJECT TO SIGNIFICANT AGE RELATED DEGRADATION OR PROVIDE THE RISK ASSESSMENT RESULTS

- NRC APPROACH WOULD REQUIRE ALL INFORMATION CALLED OUT IN XX.9(C) TO BE PROVIDED EVEN FOR THOSE COMPONENTS WHICH ARE NOT SUBJECT TO AGE RELATED DEGRADATION

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

NRC APPROACH VS INDUSTRY METHODOLOGY

- O COMPONENT LEVEL EVALUATION (CONT.)

  - AT STEP 2D ALL COMPONENTS WHICH HAVE BEEN IDENTIFIED ARE SUBJECT TO POTENTIALLY SIGNIFICANT AGE RELATED DEGRADATION WHICH IF ALLOWED TO OCCUR UNMANAGED COULD AFFECT SAFETY

  - OPTIONS TO ADDRESS THIS POTENTIALLY SIGNIFICANT AGE RELATED DEGRADATION WOULD BE EVALUATED AT THIS STEP. DEPENDING ON THE OPTION CHOSEN VARYING DEGREES OF THE INFORMATION REQUIRED UNDER XX.9(C) WOULD BE NECESSARY. UNDER THE INDUSTRY APPROACH THE APPROPRIATE INFORMATION WOULD BE PROVIDED

  - NRC APPROACH WOULD REQUIRE ALL INFORMATION CALLED OUT IN XX.9(C) TO BE PROVIDED EVEN FOR THOSE COMPONENTS WHERE OPTIONS ARE CHOSEN WHICH DO NOT NECESSITATE THAT LEVEL OF DETAILED INFORMATION

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

- XX.9(C)(3) LIST OF DEGRADATION MECHANISMS
  - DEGRADATION MECHANISMS IF LISTED IN THE RULE SHOULD BE GROUPED BY EQUIPMENT TYPE
  - ADDITIONAL CLARIFICATION IS NEEDED REGARDING "DEGRADATION DUE TO OPERATIONAL ENVIRONMENTS"

SYSTEM, STRUCTURE AND COMPONENT EVALUATION

O SUMMARY

- THE INDUSTRY APPROACH PROVIDES A METHOD CONSISTENT WITH THE STATED NRC PHILOSOPHY

- THE REQUIREMENTS UNDER XX.9(C) ARE INCONSISTENT WITH THAT STATED PHILOSOPHY AND REQUIRE A LARGE AMOUNT OF UNNECESSARY INFORMATION TO BE PROVIDED

- THE INDUSTRY APPROACH FOCUSES THE USE OF RESOURCES AND PROVIDES A SOUND TECHNICAL BASIS FOR THE LEVEL OF EVALUATION AND DISPOSITIONING OF COMPONENTS AT EACH LEVEL OF EVALUATION

- LEAD PLANTS ARE CURRENTLY APPLYING METHODOLOGY, DEMONSTRATING ITS VALUE

- NRC SHOULD CONSIDER THE APPLICABILITY OF THE METHODOLOGY