BEFORE THE UNITED STATES
NUCLEAR REGULATORY COMMISSION

IN RE THE MATTER OF: )
)
Public Meeting Between the U.S. ) Docket #50-346
Nuclear Regulatory Commission )
and FirstEnergy Regarding the )
Davis-Besse Nuclear Power Station )

NUCLEAR REGULATORY COMMISSION PUBLIC MEETING
August 15, 2002
1:00 o'clock P.M.

PROCEEDINGS HAD before the UNITED STATES NUCLEAR REGULATORY COMMISSION, taken at the United States Nuclear Regulatory Commission, Region III, 801 Warrenville Road, Lisle, Illinois, before Marlane K. Marshall, C.S.R., License #084-001134, a Notary Public qualified and commissioned for the State of Illinois.

PRESENT FOR THE NUCLEAR REGULATORY COMMISSION:

MR. JACK GROBE, Director, IMC 0350 Oversight Panel;

MR. JAMES DYER, Regional Administrator, Region III;

PRESENT FOR THE NUCLEAR REGULATORY COMMISSION: (continued)

MS. CHRISTINE LIPA, Chief, Branch 4, Division of Reactor Projects;

MR. GEOFFREY WRIGHT, Project Engineer, Branch 2 Division of Reactor Projects;

MS. LAURA COLLINS, Project Engineer;

MR. JOHN JACOBSON, Team Member;

MR. SCOTT THOMAS, Senior Resident Inspector;

MR. DOUGLAS SIMPKINS, Resident Inspector.

PRESENT FOR THE LICENSEE:

MR. LEW W. MYERS, CEO, FENOC;

MR. STEVEN A. LOEHLEIN, P.E., Principal Staff Consultant, FirstEnergy;

MR. MARIO P. DeSTEFANO, QA Supervisor, FENOC;

MR. BOBBY G. VILLINES, Senior Nuclear Engineer, FENOC;

MR. KEVIN A. SPENCER, Licensing Specialist, FirstEnergy;

MR. STEVEN P. FRANTZ, Morgan Lewis;

MR. GERALD M. WOLF, Engineer - Licensing, FENOC.

PRESENT FOR THE LICENSEE: (continued)

MR. WILLIAM MUGGE, Manager, Nuclear Training

MR. TODD SCHNEIDER, Manager of Communications, FENOC.

CHAIRMAN GROBE: Good afternoon. My name is Jack Grobe. I am the chairman of the NRC's oversight panel for the Davis-Besse facility. This is a meeting of the NRC's oversight panel and FirstEnergy Nuclear Operating Company regarding activities at Davis-Besse. We particularly are focusing on today a discussion of the organizational management and human performance issues that resulted in the degradation in the reactor pressure vessel head at Davis-Besse. I would like to emphasize the importance of this meeting and this discussion. Davis-Besse has undertaken a restart activity that has many components to it, and we're going to be talking about that a bit later. One of the components is improving the organizational effect of this area. Metals crack, boric acid is corrosive. These are not new concepts in the nuclear power industry. They're activities that need to be identified, managed and resolved. In fact, what caused the head degradation at Davis-Besse was not corrosion or boric acid and cracking materials. It was the fact that it was allowed to go unfettered for years. And we're looking forward to hearing the results of FirstEnergy's evaluation as to why that occurred.

I am going to turn the beginning of the meeting over to Christine Lipa. And Christine is the chief of the Division of Reactor Projects, Branch 4 in our Division of Reactor Projects here in Region III. Christine is going to provide some logistical discussion about how this meeting is going to be set up and run today as well as she and Scott Thomas, the senior resident inspector, will provide some background information on the Davis-Besse activities. So Christine?

MS. LIPA: Thank you, Jack. First of all welcome to FirstEnergy and to members of the public. And I am the branch chief here in Region III, and I have overall responsibility for the NRC's inspection program at Davis-Besse. We'll go through the rest of the introductions in a few minutes. I want to refer to the agenda that we have up on the screen here, and it discusses the purpose of the meeting and the first few items. Right now we are in introduction and opening remarks. I wanted to talk a little bit about protocol before we get started. This meeting is open to the public, and the public will have an opportunity before the end of the meeting to ask questions of the NRC. This is considered a Category 1 meeting in accordance with the NRC's policy on conducting public meetings. In addition to public access here in the Region III office in Lisle, Illinois, we are also video conferencing this meeting to our headquarters office in Rockville, Maryland. At headquarters the video conference is also open to the public. Also we have arranged for one hundred phone lines for participants to call in and listen to the meeting. Before the meeting is adjourned, there will be opportunities for members of the public at all three spots, here in Lisle and headquarters and on the phone lines, to ask questions. Due to the various means of communication we're using today through phone lines and video conferencing, it'll be really important that all speakers use the microphone when talking so that people can participate on the phone lines. We're also having this meeting transcribed today to maintain a record of what we will be discussing, and the transcription will be available on the web page several weeks after today's meeting.

Also on the NRC's web page today and the Davis-Besse web page we have the agendas and the handouts. The NRC agenda that you see on the screen here and then the handouts that the licensee brought with them today, those are already available on the NRC's web site for people who are calling in by phone. Also at the back of the room and here are the meeting feedback forms that you can fill out to provide feedback to us on how the meeting goes with respect to format or content or any other aspects of the meeting because we would like to improve the quality of our meetings if we can.

Let's start off with introductions. We will start off at the table here, and then we will go around the rest of the tables.

MR. THOMAS: This is Doug Simpkins. He is the resident at Davis-Besse. I am Scott Thomas, senior resident inspector.

MR. DYER: Jim Dyer, regional administrator, Region III.

MR. JACOBSON: John Jacobson, panel member.

MS. COLLINS: Laura Collins, project engineer for Davis-Besse.

MR. WRIGHT: Geoffrey Wright, team leader for evaluating this particular area for the NRC.

MS. LIPA: Would you introduce yourselves?

MR. VILLINES: Bobby Villines.

MR. DeSTEFANO: Mario DeStefano.

MR. LOEHLEIN: Steve Loehlein.

MR. MYERS: Lew Myers, chief operating officer.

MR. SPENCER: Kevin Spencer.

MR. MUGGE: Bill Mugge.

MS. LIPA: Thank you.

MR. MYERS: We also have some staff here in the back. Todd Schneider, manager of communications for FENOC; Steve Frantz from Morgan Lewis; and Jerry Wolf, Regulatory Affairs.

MS. LIPA: We also have a transcriber today, Marlane Marshall. Welcome, Marlane. And also do we have any representatives of public officials? I know I saw Gere Witt.

MR. GERE WITT: Gere Witt, county administrator, Ottawa County.

MS. LIPA: Welcome. Any other representatives of public officials? Okay.

Now, next we will talk about a brief summary of the major NRC activities related to Davis-Besse since March, 2002. And if you will go to slide 1, please? Okay. For background, this is a summary of some of the major milestones beginning with the March 6th date when the degradation was first identified, and over the next few days following March 6th the severity of the corrosion was realized. On March 12th Region III sent an AIT, which is an augmented inspection team, to the site. That was a five-person team of inspectors from the region, resident inspector and person from NRC's Office of Research. On March 13 Region III issued a confirmatory action letter to the licensee describing our understanding of the specific actions the licensee intended to take prior to restart.

And then on April 29th, 2002, the agency decided to use an IMC 0350 oversight panel. We have been having monthly public meetings with the licensee in Oak Harbor, Ohio, and we will continue to do so approximately once a month. Just for reference -- we discussed this in detail at the May public meeting -- this supplies an overview of the goals of the Manual Chapter 0350 panel. We will go through them all in detail. Go to the next slide.

And this is a continuation of the goals of our panel. And this is a listing of the NRC members that comprise the IMC 0350 oversight panel. You can see we have managers and staff from Region III and from NRR on the panel.

Next I will turn it over to Scott Thomas. He's the NRC senior resident inspector at Davis-Besse, and he will summarize the degradation issue for you.

MR. THOMAS: Acknowledging the fact that there may be members in the audience that have varying levels of understanding of the issue, this is kind of just a general description of power plant operations and reactor vessel head construction.

A power plant is composed of a primary loop and a secondary loop. The primary loop contains high pressure, high temperature water which transfers heat generated in the reactor to the steam generators. This transfer of heat in the steam generator causes feed water in the steam generator to boil and produce steam. This steam drives a turbine generator which generates electricity. The steam that has passed through the turbine is condensed and recycled back to the steam generator as feed water to begin the cycle anew.

The containment structure basically contains the primary loops in the reactor. It's composed of an outer shield building which is approximately two and a half feet of concrete -- excuse me -- rebar reinforced concrete, and the containment itself which is an inch and a half thick steel vessel that's within the shield building. Next slide.

This is a diagram of the top of the reactor. It shows the closure head itself which is the domed part. It shows the nozzles which penetrate the head. It shows the lower support assembly which on top of the lower support assembly is the insulation, the head insulation, and above that is the service structure itself. Now, on the lower support structure are the weep holes, which I will go more into that in just a moment. Go to the next slide.

This is a typical diagram of a control rod drive nozzle. As you can see it penetrates the reactor vessel head. In the upper portion is a compression fitting, and down at the bottom is a J weld which secures the nozzle to the head. Go to the next one.

This is a picture of the top of the reactor vessel head in the 2000 outage. A couple things I would like to point out in this slide are the bolts that hold the head to the vessel itself, and you can also see the weep holes that I described earlier. These are approximately 5 x 7-inch rect- angles. And this was the area where the licensee did their inspections and their cleaning. There are a number of them around the periphery of the head. What you see in red is a combination of boric acid and baric oxide that originated from the top of the vessel head. And that's all I have. Oh, one more slide. I am sorry.

This is a depiction of the drawing of the vessel head. You can see two nozzles and what's left of a penetration. The area that Doug is point- ing to right now is a depiction of the cavity itself that was found on top of the reactor vessel head. Basically that area right there is void; I mean there is nothing there. And all that was left at the bottom was the cladding on the inside of the reactor vessel head. And I believe that's all.

MS. LIPA: Okay. Thank you, Scott. We're ready next for Lew Myers if you would go ahead with your presentation.

MR. MYERS: Thank you, Christine. My name is Lew Myers. I am the FirstEnergy Nuclear Operating Company chief operating officer. We're here today to discuss the management and human performance root causes and how we arrived at these root causes if you will.

I guess the thought that I would have is that as we discuss these issues and come to an understanding of the management and its performance issues, as an organization we are very humbled and, in fact, embarrassed. I am personally embarrassed about where we're at today, and I think the depictions that are ahead indicate it all.

Our desired outcomes are we will talk about the root causes. And let me summarize those. They deal with management oversight. And what we will tell you today is if you look back in the history of our Davis-Besse plant, there has been some very good performance and there has been some good rigor. There has been some good management oversight. And we can clearly document where that started to deteriorate away.

The corrective action program is another major issue. That's the lifeline of a management program, to find and fix problems. And we identified several performance problems in the corrective action program where our corrective actions did not elevate to the proper level. We classify our CRs as we get them, and we did not classify CRs properly nor did we perform the proper safety analysis of CRs we discovered.

From a technical rigor standpoint over the years we appeared to lose the processes or programs or thought processes that drive you into the 50.59 review or safety review process. So from a technical rigor standpoint you see that we often jump to the first conclusion, a conclusion that was in many cases production orientated. And that rigor of finding and fixing problems and not addressing the hard issues that once again deteriorated away over time well demonstrates from a program compliance standpoint we did not implement our program effectively. We did not have good ownership nor was our program technically adequate. It wasn't adequate to find and fix this problem, let's understand that. It did meet the regulatory requirements, and if used properly it should have been able to fix this problem.

And finally the most important thing that we want to talk about today is some of our key corrective actions that we have been undertaking to ensure that we can return the plant to service in good material condition, and even then we can operate the plant safely and reliably for the long-term in a consistent manner.

I would like to take a moment to talk about the original root cause. When we had the event, we had the augmented inspection team come in. And Steve Loehlein next to me chaired the group of people that addressed a technical root cause that indicated that we had not as management effectively implemented our process and thus failed to address plant problems as opportunities arose. We had many opportunities to identify and fix this problem over the years and failed to recognize them. It was obvious that our processes if you will were somewhat broken and that we had not only -- when we had addressed problems we had not addressed the root cause early at the very beginning. So from a management standpoint we recognize that we need to make some changes in our management.

At that time my boss, Bob Saunders, the chief operating officer, and Gary Leidich, executive officer of FENOC, was our oversight organization. And we promoted Bill Pearce to the vice-president of Nuclear Oversight. And he meets regularly with our board now, and that will strengthen our oversight process. We completed the technical root cause because we knew that in the past we had overlooked issues that should have found and fixed this problem. So we couldn't depend on that same process solving the problem again. So we waited. We addressed the technical root cause. And then later on in the May timeframe I was assigned as basically a full-time employee of the Davis-Besse team for recovery. In the May timeframe I appointed a root cause team that was independent to go look at the management aspects of this event, and that's what we're discussing now. And that's the reason we waited so long. Really the reason we didn't do both at the same time is we knew that we couldn't depend on the management organization getting at the root cause because they hadn't in the past.

So we chaired that team. We asked ourselves what kind of people we want on the team, the competition if you will. We found that we used the same leaders, Steve Loehlein next to me. Steve is from our Beaver Valley plant trained in root cause analysis who participated in a lot of the root causes we have done there in a very good manner. We wanted to get some people from our other plants, the FENOC plants, to provide input so that we could not only have an independent study, but we could take these issues that we were finding back to our other plants and make sure the same issues don't exist. We have some oversight support on the team to look at how our oversight failed. And then we wanted to bring in some process people that are recognized as industry experts. So we hired Conger & Elsea who use a root cause method called MORT which we will talk about later on. Then we wanted to involve some of the Davis-Besse management and people to ensure that we got good buy-in on these issues that we would come up with. That's how we formed the team that reported directly to me to develop this root cause.

We also wanted to make sure we went down the right track. So during the middle of the root cause process we asked the Institute of Nuclear Power Operation to have some other utilities come in and evaluate the process that we were taking and make sure that we were looking at things from a broad perspective and the right depth. So we brought people in from several other utilities. Then at the end of the evaluation, the root cause evaluation if you will, we brought in an organizational effectiveness expert to help us decide some of the corrective actions that we might take as we moved forward. And then we staffed from the Lincoln Company two full-time people that have helped us develop and make sure that our corrective actions are effective. And they're organizational development consultants. They're on my staff now.

The team consisted of some really pretty good people. We had Steve Loehlein once again from Beaver Valley who was on the team. Bill Babiak from Perry. He is a long-term root cause type person from our Perry plant. Mario DeStefano is on our team from Perry. Mario came to us -- He is a root cause person from our quality group and was a previous maintenance manager at one of our plants. Randy Rossomme from our Beaver Valley plant, the oversight agents. Lesley Wildfong was from the management oversight process group, the MORT group if you will. This is the group I was talking about. They do instant investigations on all kinds of industry events. So we wanted to bring in some very high level technical experts, and we did that there. Bill Mugge is from our Davis-Besse plant. He's spent some time at INPO recently and came back as their training manager. He is an employee there. Joe Sturdavant is at our Davis-Besse plant also. Bobby Villines is from Davis-Besse in the plant engineering area. They're both more than qualified. Dick Smith came in. Dick is a manager with Conger & Elsea and has been involved with some major events. And he came in and worked with the team for a couple weeks. Then Dorian Conger and Ken

Elsea came in. They own the company. What they did was make sure that we were analyzing things correctly, putting them in the right baskets in the trees, and just provide some general management oversight to the team. And then Spyros Traiforos who is a Ph.D. that we used to help us was an experienced root cause Ph.D. in materials. A lot of experience there. So we brought him in also. So we think the team was a very credible team. And it was the best team we could find to put together, and we're very pleased with the qualifications of people on the team.

That concludes my introduction. What I would like to do now is turn it over to Steve Loehlein. Steve is going to talk through the process if you will that we went through. For people that are not familiar -- and many people here I know are -- we will go through the process, and then we're going to go through the various root causes and how we concluded the root causes were valid, the basis for that. I will turn it over to Steve.

MR. LOEHLEIN: Thank you. I want to make sure that I have this -- Can everyone hear me fine with the microphone?

MR. DYER: If you have got the bright green light, you should be good to go.

MR. LOEHLEIN: How is that? I will be going through a number of slides. I want to make sure --

AUDIENCE MEMBERS: If all the speakers could do that, we'd appreciate it.

MR. LOEHLEIN: Okay. Again thank you, Lew. And I would like to say a few things up front. First on behalf of the team I want to recognize them for the very difficult job this was for them. We painstakingly reviewed many documents, a lot of interviews to form the conclusions that we'll be sharing with you today. We believe in the results and we believe in the product, and we'd like to share them with you. I think it would probably be very positive for us if as I go through this presentation that unless there is a point that I am making that needs clarification, there's a few areas in here where it'll be appropriate for me to stop and ask for questions, but there's a certain flow to this I would like to maintain. So if that's agreeable with everyone, I will pause when I think is a good place to interject questions. There will be certain conclusionary points.

CHAIRMAN GROBE: Thanks, Steve.

MR. LOEHLEIN: We're now on slide number 9 for whoever might be looking at this from a computer or whatever. What we have shown on this slide is the initial statement that was used in our team's charter to focus our thoughts to. What we wanted to know is we wanted to understand why over a period of years Davis-Besse personnel failed to identify corrosion of the reactor pressure vessel head base metal. Now, this focused objective resulted in an investigation that led to very broad understandings of the issues, and that's what we'll be sharing with you today.

Slide number 10. We thought we would share with you right up front the overriding management oversight root cause statement. As stated there, there was a less than adequate nuclear safety focus at the station. The focus was on production established by management that which combined with taking minimum actions to meet regulatory requirements resulted in the acceptance of degraded conditions. Now, before we get started into all the supporting conclusions -- and there are a number of them -- I think it's really important that we understand the context of this root cause statement.

First, a production focus has to be understood as it relates to nuclear power. The station is a production facility, and its desire to produce power is an assumed priority for the business. However, in nuclear power nuclear safety is the primary objective of everyone involved with nuclear power, and this takes precedence over the desire to produce electricity. Now, in the past Davis-Besse had -- We will show you in the late '80s and early 1990s the station had good production numbers and still displayed the proper concern for nuclear safety. But what our presentation is intended to share with you is our conclusions regarding what changed and when at the plant that allowed this loss of safety focus.

Slide 11 is just a header slide. I will tell you what we're going to be doing in terms of presenting the process. I will be first discussing how we developed our scope, how we obtained data, how we performed our data analysis and then finally formed our conclusions in each of the areas.

First in terms of scope development, we had before us the results of the technical root cause that were completed in April, and it provided us with some very clear clues. One was that we had errors that occurred over several years, that program effectiveness in a couple of key areas needed to be assessed, and that the potential for boric acid to cause damage had been an issue for this station in 1998 and 1999, the pressurizer spray valve in particular, yet that event did not result in corrective action that allowed the station to identify this corrosion sooner.

Next slide please. We're now on slide 13. The techniques we used are recognized root cause analysis techniques. We used causal factors charting, we used hazard barrier analysis techniques and also, as Lew mentioned before, the management oversight and risk tree technique. This is a very effective tool in evaluating management performance in particular. Then the sections we used from there are listed there. And these result in recommendations for corrective actions.

In terms of data sources the technical root cause analysis report was useful from a couple of perspectives. One, it summarized lots of information on the subject up until that point. It also had a lot of reference information that was readily available to us. The total number of inter- views from which we were able to extract information was over one hundred and twenty. Over the course of the investigation we examined approximately seven hundred documents. The data we examined took us across more than twenty years. The event and causal factors chart contains nearly a thousand discrete items of information, and in full scale on a CAD machine it prints out to 126 feet long. All the references that were used and tied to the facts are numbered and filed so we can tie -- from our conclusions we can go back to the facts that supported them and back to a file that shows us where we got those facts.

The next slide, 15, is a cover sheet. What I want to say is on slide 16 which talks about the sequence that I will go through in our actual data analysis.

CHAIRMAN GROBE: Steve, would this be an appropriate time? It seems like a break where you talked more about process and now you're --

MR. LOEHLEIN: Okay.

CHAIRMAN GROBE: I had two questions, actually one question and then a request that you go into a little bit more detail on one item. On page 10 you said there was less than an adequate nuclear safety focus and the focus was on production.

MR. LOEHLEIN: Yes.

CHAIRMAN GROBE: If you could include in your dialogue that you're going to go through also your thoughts on whether there was an inordinate focus on dose minimization, I would appreciate that in addition to nuclear production.

MR. LOEHLEIN: Yes, I can comment on that. Surely.

CHAIRMAN GROBE: And the second thing if you could do now, if you would talk just a bit more about MORT and the MORT analysis approach? Folks on this side of the table are quite familiar, but many folks in the audience probably aren't.

MR. LOEHLEIN: Okay. The MORT technique -- And I am personally not an expert in it. I am an expert in root cause. Not expert, but I am more qualified in root cause techniques. MORT is specifically geared toward management-type investigations. We had four or five members on the team that are qualified in it. But what it does is it exams or it asks questions in a tree analysis type of arrangement that takes you through a process of asking questions about how is the process put together, how does the organization use it. So it takes you from cradle to grave, infancy to implementation on processes and personnel performance. So there are areas that are dedicated to process, there are areas that are dedicated to how people make errors, and there are areas dedicated to how management assesses risk. And those are the kinds of areas that we targeted in this investigation. And that's what I will be going through. Is that an acceptable upper level discussion of how it's arranged?

CHAIRMAN GROBE: Yes, that's fine. Are there any other questions before Steve continues?

MR. DYER: Yes.

MR. LOEHLEIN: It's a tree and branch type of thing. There's upper level questions. It'll ask -- For example, there's one on management policy where it says management policy, the first thing is it written, then how is it communicated and so forth. So it goes down the branches and gets more detailed. If you get through the process of answering these questions that are on the branches of this tree, it's like formulating where the breaks in these branches are and, therefore, there is a failure in the process.

MR. DYER: I have one question. In the scope in your -- On page 12 you talk about the scope development map. And you talk about -- the last subject bullet or star there talks about the potential boric acid that caused damage in 1998-'99 which is the timeframe with the spray valve RC 2 which we had some enforcement action on. Also earlier in the year -- Earlier in the life -- I think in the early '90s there was a boric acid corrosion problem with the -- I believe it was the high point vent to the steam generators. Did you look at corrective actions from that also?

MR. LOEHLEIN: We took a look at how the organization responded in several ways back in that timeframe. I think it was 1992 the containment air coolers had issues with boric acid accumulation. And we will be talking about that contrasting with how the organization reacted to that situation as compared to how it reacted to situations in the late '90s. We will be talking about that later in the presentation.

MR. DYER: Okay. So that's sort of the before and after then? Is that what you are telling me?

MR. LOEHLEIN: By comparison it shows how the organization had an awareness and supported with technical analyses and a sense for safety focus and so forth at that time period in response to what the plant indicated as compared to the difference in how it was approached in the late '90s. So if we don't answer that adequately at that time, then we will talk to it more then.

MR. JACOBSON: I am curious. Touching on the same thing that Jim just mentioned, there were indications in documents that Davis-Besse was aware of the potential for corrosion on the head weld before 1998 and '99. I am wondering why you picked that date here in your slide to say that, you know, it was a potential from there.

MR. LOEHLEIN: The reason why it appears on the slide -- And you will see when we get to the timeline discussion. '98-'99 is only relevant to the pressurizer spray valve RC 2. And the reason it's relevant and the reason why we thought it was so key here is because that event led to enforcement actions and numerous corrective actions on the part of this site. Yet immediately after it occurred and after these corrective actions had taken place, 12RFO occurred. And we saw the slide with the boric acid on the head. So we said the obvious question is how could the site have an experience like this spray valve event and not have made the connection to what was going on on the reactor head. So that made that particular event really important to understand why that was not effective.

MR. DeSTEFANO: Plus we were using the pressurizer spray valve event as a benchmark for ourselves as a team. Because as you mentioned you read that report, it's very obvious that that could have -- the actions from that should have prevented anything else and did not. So we used -- we made sure we read that, understood it, found out why it wasn't effective. So that we know we couldn't do the same thing as far as actions go; we had to go much further than that. So we also used that document internally with a full understanding -- so we had a full understanding of what happened there.

MR. JACOBSON: There is no implication here then that you all were unaware that there was this potential before '98.

MR. LOEHLEIN: That's correct.

MR. DeSTEFANO: That's correct.

MR. LOEHLEIN: That's a correct interpretation.

MR. MYERS: If you look at the report there is a list, a couple pages of all the documents and documents back out from the '80s to now.

MR. JACOBSON: Right.

CHAIRMAN GROBE: Okay, Steve.

MR. LOEHLEIN: Thank you. Going to now the data analysis and end result section, we have got this broken into five parts. And we decided to present it this way because this is pretty much the way the team evaluated these. It wasn't exactly in this sequence -- there was some overlap -- but pretty much this way. It started with the boric acid corrosion control and in-service inspection programs and assessment of those, went to how the site handled technical information, the corrective action program effectiveness, hazard assessment -- which in this case we'll talk about that 50.59 safety evaluation type of hazard assessment process -- and then the management oversight and risk assessment process.

So on slide 17 I think we're on now, the way we evaluated the boric acid and in-service inspection programs was to apply the hazard-barrier-target analysis. We applied it to two refueling outages, the 11RFO outage and the 12RFO one. So that's 1998 and the year 2000. In it the model assumed that the boric acid was the hazard and that the reactor head was the target. And for those that maybe aren't real familiar with how this is done, you identify these barriers, and many of them are procedure steps and things like that. But the key ones that I think were worth mentioning here are the design of the system, training that people get, inspection for leaks and corrosion, cleaning, and corrective actions. We looked at nearly fifty in all barriers in the boric acid in-service inspection programs.

For those two outages the conclusions appear on the next slide which is 18. The first statement I would like to make is that the boric acid and ISI programs did not meet expected standards. However, the process, we concluded, was adequate to have prevented the damage to the head. The key failed barrier was the failure to clean the head. That failed barrier prevented us even from analyzing what our behaviors would have been like at the station if the head had been cleaned and we would have been able to evaluate whether the nozzle inspections were adequate and so forth. But a number of barriers beyond there could not be evaluated.

Another thing that we concluded was that the reactor head was not a focus in the process as we would have expected in response or in the aftermath of the issuance of Generic Letter 97-01. Nonetheless, in closing we concluded that the programs, had they been followed as required, they would have been adequate to have prevented this serious head damage. And I will say at this point as we go through these conclusions on programs and processes is that the processes themselves even if they were not state of the art at that time were adequate to have prevented the damage, but implementation of them was less than adequate.

MR. MYERS: Again we are not saying that the program or process met the requirements. We are not saying that at all.

MR. LOEHLEIN: That's probably a good clarifier here. As far as a rigorous root cause analysis technique, the real measure for adequacy is not whether it meets all requirements; it's whether it would have succeeded in preventing the unintended outcome, which in this case was the damage to the head. And so if you purely apply the process, that's the definition of adequacy and that's the one we used. So you will see us comment today in two ways. One, we will recognize that our processes in some ways were not everything they should be, but we may still have concluded had they been followed as required they would have been adequate to have prevented the event. If you don't have any questions on this at this point, I will move on to handling tech information.

Handling technical information is on slide 19. We evaluated using the MORT technique. Now, what this really examined is how is information received and how is it processed and ultimately incorporated into the site processes. And in this case what we looked at was how the station performed through the history of industry knowledge with boric acid. So this took us back into the 1980s. And really it was the reason why our earliest date points on our causal factors chart went to the 1980s when issues on boric acid were first being communicated of relevance.

The next slide shows our conclusions in that regard. In this case also we concluded the process itself for disseminating and incorporating technical information was adequate; personnel failed to correctly apply key industry information. By way of example, really what we found is only certain elements of the information would be incorporated in the process. As an example, the fact that dry boric acid on a hot component like a reactor pressure vessel head would not by itself cause corrosion was understood by the organization. But the associated potential concern for corrosion if boric acid was wetted from beneath was not adequately captured. That concept was not captured by the site.

Another key item was the heavy reliance by the site on the fact that nozzle leakage was a low probability for them as a reason to not be concerned was also another key ingredient. Low probability meant low concern.

The next thing we looked at was the corrective action program. Again in this case a primary evaluation tool was the MORT technique. And we did use some change analysis with it as well. In this case what we chose to do is break the process up into steps that are clear. In a corrective action program process what you have is an initiation step by the person who identifies it, there is an initial operability review done by the control room, and then after that there is a review by management for categorization. It's given an initial category and gets another review for categorization. From there it goes to someone who works on it, determines the cause and corrective actions to be taken for it. And then on the back end of the thing is the process should provide a means for trending and determining effectiveness.

Now, our primary focus for quite a few condition reports, some of them are referred to as potential conditions adverse to quality which is a term that was used at the site before the MORT. Now, the common term condition report is used generically really for both types of forms. We looked at the issues of boric acid on the head, the containment air cooler cleaning frequency issues, the plugging of the radiation monitor filters. We looked at the panel handling of the pressurizer spray valve, RC 2, and we looked at the reactor coolant system unidentified leakage, those five major areas for condition reports.

Slide 22. Once again the process was found to be adequate to find and fix problems. In all these cases there was an adequate number of condition reports generated to have resolved these issues. They were adequately identified and documented as nonconforming conditions. However, implementation was less than adequate. Personnel at all levels did not effectively implement the corrective action process. It started off at the front end in which operability impact was under-estimated. Categorization did not recognize the significance adequately. The low categorization lent support to shallow cause analyses. And the corrective actions, therefore, tended to focus on symptoms, cleaning, for example, of containment air coolers rather than trying to eliminate the cause. And trending of recurrent equipment problems was not effective either.

MR. JACOBSON: Steve, before you go on to the next evaluation, you mentioned that there was a sense that this was a low probability. And I am curious as to what did you find as the basis for that feeling on site?

MR. LOEHLEIN: It was a reliance on analytical support that the probability of a leak was low. In our interviews and so forth that is the feedback that was received. And the interview record is that the probability of a leak was low because of the plant's relative age.

MR. DeSTEFANO: More specifically it was known and well documented -- I am including by Commission documents -- that cracking will occur at some point in time. So the industry documents specifically done by the owners group for these design plants went ahead and tried to specifically analyze when cracking would occur, under what conditions, and who was most susceptible to it. When the station heard the good news piece being this is an age-related item -- believed to be at the time -- and the station is one of the younger ones, we will see it elsewhere first. So the pressure on keeping the attention on that was backed off waiting for other folks to find it first.

MR. JACOBSON: This is a B&W report?

MR. DeSTEFANO: Correct.

MR. LOEHLEIN: Thank you, Mario, for that clarification.

CHAIRMAN GROBE: I am not sure that completely answers the question. The probability of most untoward issues to occur is very low. I mean the plants are designed well, they're maintained well. So the probability of unlikely things that occur, unacceptable things to happen, all unacceptable things, is very low. There's got to be another piece to that. It went beyond a recognition that the probability is low to a level of it can't happen, a complete denial because the evidence was clear that there was something going on. And I think you indicated that the corrective actions from your RC 2 should have allowed the people to be in a position to recognize that evidence and they didn't. So they didn't have a recognition that it was low. It seems like there was something more, like a recognition that it's not going to happen, it's zero.

MR. DeSTEFANO: We had evidence of both at the station, Jack. From most interview data the pervasive attitude was that it's not going to happen here.

CHAIRMAN GROBE: Okay.

MR. DeSTEFANO: However, the folks who were responsible for responding to condition reports understood what was going on in the industry, and they realized that the possibility of cracking is there. However, it's okay for now to leave the boric acid on the head because that's the context where we were talking about the leakage underneath the boric acid. And that was where the failure was. They decided it was acceptable to leave the boric acid there without proving that there was no leakage at the time, instead relying on, well, it's still early in this issue and we probably don't have any leakage yet. So that's the context of how that was justified.

MR. LOEHLEIN: I think the other piece of it was this selective understanding of the technical information that the hot head was going to mean it would not result in corrosion anyway. That was the other piece of it, I believe, Mario.

MR. JACOBSON: Was this consciously used then to arrive at the position that you didn't have to look, that you didn't have to look at the head, you didn't have to inspect under the head? Was that a key to concluding that?

MR. LOEHLEIN: You use the term consciously. I mean in our type of investigation we really are never in a position to judge peoples' motivations. We certainly can tell by the end of this investigation that -- and that's what we're leading up to -- that the organization had a mind set of supporting this production focus and what nuclear safety meant to them in their minds. And if I was going to characterize it collectively, it just was a -- it was a culmination of factors. We see a less than adequate rigor in assessing the technical issue and so many other pieces that fit together with not having the right nuclear safety focus. Jack pointed out, sure, a lot of the nuclear safety issues are low probability. That doesn't mean they can't -- they aren't treated as real possibilities. That's our job to do that. Anything you can add to that, Mario?

MR. MYERS: I also think we wrote the safety evaluation back in, I think, '88. Then 97-01 came out. If you look at the documents that were signed off, this is not a nonconformance or stuff like that. It was never a recognition that there was a commitment to 97-01 and the items in 97-01. It was like it was not a regulatory requirement. And we got to the point -- Meeting the regulatory requirements is okay. We got to the point where they were justifying meeting the regulatory requirements not realizing that it was a regulatory requirement. These are things that -- I don't think we ever recognized 97-01 as a regulatory requirement, something we committed to and internalized. Is that fair?

MR. LOEHLEIN: Yes.

MR. DeSTEFANO: It's also true with 88-05 also.

MR. DYER: Steve, I am having a problem. I don't know if it's terminology or what. I don't know that I really understand what you mean by hazard assessment process.

MR. LOEHLEIN: We didn't get on that slide very much yet. It's been up there, but we have been kind of backpedaling here.

MR. DYER: I didn't know if you had gone to that.

MR. LOEHLEIN: That will be our next slide. I am doing a mental check. What slide are we on? We're on 23, the hazard assessment process. I will talk about that next.

CHAIRMAN GROBE: Any other questions? Okay. Go ahead, Steve.

MR. LOEHLEIN: Okay. Now, the hazard assessment process within MORT can be looked at from personnel safety, and it can also be looked at from other ways as we did in this case which is nuclear safety. And our focus was really treatment, 10CFR50.59, a safety evaluation process which all of us in the industry are aware of. This is what we do to examine nuclear safety from the perspective of how risks are analyzed for their significance. So again in this case our focus was on the 50.59 process in two ways. And that is the process itself, and the other thing is how do you know when you're supposed to begin that process.

MR. MYERS: I call this decisionmaking, you know. When you have a problem and you get in the 50.59 process, are you meeting your licensing basis, your design basis? You have to ask all these questions to determine if you are. And it seemed like we didn't even go to that process, you know. We're not asking these questions. Rather than doing that we were justifying why something was operable. Is it nonconforming? We still are meeting our license basis. Why is it operable instead, you know? That's what this does, decisionmaking. Is that fair?

MR. LOEHLEIN: Yes. What we did here we looked back in time all the way back to the '80s timeframe up until the late '90s and into the current process. And we concluded that once again the hazard analysis process itself, 50.59 if you will, contained the necessary elements to ensure that the design licensing basis was maintained. What changed over time was the process described and required for entering that evaluation process became less restrictive over time. And Mario is going to be able to expand on this some because he investigated this, he and another guy in quite some detail. But what we found was in the late '80s and early '90s the recognition of the applicability of the safety evaluation to issues like boric acid on the head and so forth were recognized and the process was entered, and these types of things were treated as potential nuclear safety issues. Whereas by the late 1990s -- and we will go into the areas later, the issues with the containment air coolers and radiation monitor filters and the boric acid on the head -- the concept that the safety evaluation process needed to be entered wasn't even considered by the organization. Mario, you want to say some things about that change in time?

MR. DeSTEFANO: Yes. Basically the process and the structure for performing safety analysis has been present at the station constantly. And then again it's one of those processes that if applied would work. What we saw in our investigation were several times -- One, for instance, in 1987 when after having some leakage of steam generator penetrations -- I am sorry, pressurizer penetrations, the plant manager specifically requested an independent safety engineering group to perform analysis of the effects of that kind of leakage. So they went off and applied safety analysis techniques to that issue. And there is a good example of did the station understand that boric acid issues were there early? Yes, because they extensively referred to information known as 86-108 in that report and said basically they didn't find any problems with the current conditions. However, under even very hot metal conditions boric acid -- severe boric acid corrosion could occur if there is also an active leak underneath it or a leak of sufficient quantity to where it cools the base metal to the state where it becomes a very aggressive corrosion rate.

Another example would be in 1991 there was boric acid found on a reactor vessel head due to control rod drive flange leakage. That was identified using the corrective action process at that time. They were the potential conditions adverse to quality. That process had a waiting factor system in it to where the analysis of the issue itself was applied a rating based on its significance right up front, and the higher the rating the more stringent the evaluation and analysis techniques that would be applied. And that full condition report was, in our view, done the way they all should be done. A 10CFR50.59 applicability review was performed, all questions were no, so a safety analysis was not performed. The item was determined to be rework. They removed all the acid from the head, fixed the flange leaks and started the unit back up leak free without any boric acid or any conditions that hadn't been evaluated.

Now, what happened, though, in the later years, in the mid-'90s and 2000, you don't see that occurring any more when a condition report identifies leakage on a reactor vessel head. So that was the stark contrast. And what we found is that even