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PUBLIC NOTICE BY THE

UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFECUARDS

DATE: Thursday, January 10, 1991

The contents of this transcript of the proceedings of the United States Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards, (date) Thursday, January 10, 1991, as reported herein, are a record of the discussions recorded at the meeting held on the above date.

This transcript has not been reviewed, corrected or edited, and it may contain inaccuracies.

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

369th ACRS MEETING

Nuclear Regulatory Commission
Conference Room P-110
7920 Norfolk Avenue
Bethesda, Maryland
Thursday, January 10, 1991

The above-entitled proceedings commenced at 8:30 o'clock a.m., pursuant to notice, D. Ward, Committee Chairman, presiding.

PRESENT FOR THE ACRS:

D. Ward
P. Shewmon
C. Michelson
C. W''ie
H. Lewis
I. Catton
W. Kerr
E. Wilkins
J. Carroll

R. Fraley

PARTICIPANTS:

D. Lange

N. Hunemuller

J. Roe

R. Enkeboll

R. Whitesal

R. Baer

F. Cherny

R. Johnson

T.Y. Chang

J. Davis

C.Y. Cheng

W. Minners, NRC/RES

E. Beckjord, NRC/RES

T. Speis, NRC/RES

B. Sheron, NRC/RES

C. Heltemes, NRC/RES

L. Shao, NRC/RES

A. Burda, NRC/RES

E. Rossi, NRC/NRR

A. Chaffee, NRC/NRR

B. Kaufer, NRC/ACOD

N. Fields, NRC/AEOD

P R O C E E D I N G S

[8:30 a.m.]

MR. WARD: The meeting will now come to order.

This is the first day of the 369th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will discuss or hear reports on the following. First, the proposed final rule 10 CFR Part 55, concerns fitness for duty requirements for licensed operators. Second, a proposed resolution of the GSI-29 bolting degradation in nuclear -- and failure in nuclear power plants. Third, we'll meet with the Director of the Office of Research to discuss items of current interest. Fourth, we'll review some recent nuclear power plant operating experience and events.

Portions of today's session will be closed as necessary to discuss information which the premature release would be likely to significantly frustrate the NRC in the performance of its statutory function.

Topics for tomorrow's discussion are listed on the schedule posted on the bulletin board in the rear of this meeting room.

The meeting will be conducted in accordance with provisions of the Federal Advisory Committee Act. Mr. Raymond Fraley is the designated Federal official for the initial portion of the meeting.

We've received no statements nor requests for time to make oral statements from members of the public regarding today's sessions.

A transcript of portions of the meeting will be kept. I request that each speaker use one of the microphones, identify himself or herself and speak with sufficient clarity and volume so that he or she can be readily heard by the reporter as well as the people in the room -- other people in the room.

Let's see, some items of current interest. First, last month the ACRS issued a report on design certification for Part 52, the level of design detail for future designs. We received a note from Commissioner Remick, or I guess Commissioner Remick called Mr. Fraley to specifically note that the ACRS report was of great interest to the Commission, very timely and helpful.

The Commission was briefed, as we heard, on this matter by NUMARC last month. As yet, the Commission hasn't taken any action.

Another item of interest. The Commission staff has identified a -- as an emerging technical concern, in a SECY paper, which I think some of you have seen -- SECY 90-406. Charlie, this relates to you. This is a concern that could have been identified some time ago, I guess. But the concern is over the status of non-safety system in the advanced passive reactors.

There are systems that perform traditional safety functions, but in the EPRI requirements document for passive reactors, they're apparently not being considered as safety-related systems.

So, anyway, you'll have to -- after getting exercised over that, and it's your subcommittee that will need to follow that.

MR. KERR: What do you mean by the Commission's staff, as identified? Do you mean the NRC staff?

MR. WARD: The NRC staff. I didn't mean the Commission staff, uniquely.

MR. KERR: Okay. Excuse me.

MR. WARD: I think the rest of the NRC works for the Commission, as I -- sometimes it's hard to tell.

MR. KERR: Want to make sure I understood the nomenclature.

MR. WARD: Let's see, this evening, we're asking the members to attend a dinner at 6:30 at O'Donnell's Restaurant to honor our retiring Chairman and, in reviewing our records, we found that we never similarly honored Dr. Kerr, who served.

MR. KERR: I realize it took this long to decide whether we'd --

[Laughter.]

MR. LEWIS: It's even worse, we just forgot.

[Laughter.]

MR. WARD: But, at any rate, we'd like you all to participate in that and I think, as far as the members are concerned, if you don't plan to attend, please notify Mabel so she can count heads.

I'd particularly like to invite members of the ACRS staff to attend with us. You should notify Mabel if you plan to attend, so we can get a head count for reservations.

MR. CARROLL: So, members, if they plan to attend to nothing.

MR. WARD: That's right. Just show up. Right.

Let's see, Chet Siess is not available this week. He does plan to begin participating with ACRS activities again at the end of this month. As you know, Helen, Chet Siess' wife has been seriously ill. I talked to him on Sunday, and she's apparently doing somewhat better. She had been in a coma, as you know.

MR. SHEWMON: Last week -- last month it was just a broken hip or something.

MR. WARD: Well, she went into the hospital with a lot of pain from what was apparently a cracked pelvis. After she got in she had -- as I understand it, well, they still haven't identified the problem. She actually was in a coma for several weeks. She's coming out of that and doing considerably better, but still very seriously ill.

Let's see, one other thing.

Dr. Shewmon has some entertainment at noon today. There is a EPRI tape -- videotape on microbiologically influenced corrosion.

MR. SHEWMON: Induced.

MR. WARD: Induced. It looks like we're going to have an hour and a half for lunch today. We expect to finish item 3 at about noon instead of 12:30, and we want to stay on the 1:30 schedule. So, Paul, do you want to set a time for showing that tape?

MR. SHEWMON: 12:30, you know, after we've gone across the street and got our sandwiches.

MR. WARD: Okay.

Let's see, is there anything else that we should bring up? Bill?

MR. KERR: How did Jay Carroll get promoted to this side of the table?

[Laughter.]

MR. CARROLL: I was between Ivan and Hal most recently.

MR. WILKINS: This is definitely a promotion.

MR. CARROLL: Although I think there's something sinister about breaking up the California mafia here.

[Laughter.]

MR. WARD: Okay. I guess that's all. Kay, is there anything else you can think of we should --

MR. FRALEY: No, I think that's it.

MR. WARD: Okay. We'll go to our first topic then, item 2 on the agenda, which is the proposed final rule for Part 55, Fitness for Duty Requirements for Licensed Operators.

We heard about this topic some months ago. This is a -- I guess I'd call it -- it was a revision to the rule which provided -- would provide for penalties directly to the holders -- individual holders of operating licenses for any fitness of duty violations.

When the ACRS reviewed this some months ago, when the rule was going out for public comment, we -- we really made no comment, other than acknowledging that it was reasonable to send it out for public comment. We said we'd wait until we hear what those public comments were.

The public comments have come in. You'll hear about it, but I think they're, in general, rather negative about the rule. The staff has not -- has -- is going to give us this morning, a review of those public comments and, in another month or two, they'll be coming back with a -- I understand, with a proposed final rule.

The briefing today is just for our information.

We don't necessarily need to comment on what we hear in a formal letter today. Although, you know, when and if a final version of the rule comes around, we'd expect to hear about this again and make any comments that we consider appropriate at that time.

So, I'll go now to the staff. I believe Dave Lange of the staff is going to lead the presentation.

Mr. Lange.

[Slide.]

MR. LANGE: Good morning.

My name is Dave Lange, as David Ward has mentioned.

I work in Nuclear Reactor Regulations. I'm a Section Chief in the Operator Licensing Branch.

I've gone ahead and made a presentation to you folks earlier in the year, based on the submittal of the proposed change to 10 CFR for licensed operators on fitness for duty.

The proposed rule went out in April of this year, of last year, had a comment period up to July. We received 39 comments, and right now, we're in the process of responding to those comments, so we can address it in the final rulemaking package.

The staff still plans on going forward with the rulemaking package. We don't see substantial changes, other than clarification of the language and some of the background information and some of the statements of consideration.

There is going to have to be some clarification on the use of over-the-counter and prescription drugs, and we're working on that right now.

Right now, the schedule that I am working towards is to have the final rulemaking package to my Division Director by the first week in February and have it to the EDO by the end of February.

After that, it will get forwarded to the Commission. So, we're probably looking at a timeframe sometime in March, beginning of April, for publishing the rule, if everything is all right with the Commission and the EDO.

MR. WARD: So, Dave, when would you be coming back to the Committee with that, then?

MR. LANGE: I think a good time to get the final package to you folks would be once it has reached our Division Director level.

MR. WARD: Okay.

MR. LANGE: And I'm hoping to do that -- I'd like to be able to do that next month.

MR. WARD: So, it will have reached -- so, at our February meeting, you should be ready to come in with the final package through the Division level.

MR. LANGE: That's the schedule I'm working on right now, yes.

Okay. I've got a couple of slides.

You've been given a handout, just a brief overview of the status that I'm going to bring up to speed with, and like David said before, this presentation today is just to inform you and let you know where we stand, what time schedule we're on, and a brief summary of the comments that we have received.

[Slide.]

MR. LANGE: Okay. On the comments that we have received, we received one overall comment from the NUMARC organization. This is the Nuclear Management Resource Council.

We received 25 comments from utilities and contractors, 7 from individual licensed operators, 4 from employee organizations and 2 from universities. These would be your non-power-reactor universities.

MR. WILKINS: What's an "employee organization"? You mean a union?

MR. LANGE: Yes.

MR. CARROLL: What's a contractor in the context of "utilities and contractors"?

MR. LANGE: Just individual contractors that have been working on fitness-for-duty programs for utilities.

I was trying to separate those comments from a sales pitch between you and I.

[Slide.]

MR. LANGE: The next handout just basically says the issues and proposed draft resolutions, and getting right into them, we've got six categorical areas that comments were made on.

The first one was probably the most substantial comment we received of the 30 of them, and it isn't something that we had not heard before, and what it was was the proposed resolution. Is the rule really necessary?

There was a number of commenters that felt that the rule was not necessary, that the existing regulations, as they stand right now, were sufficient to take the enforcement action, if we need to take enforcement action, and to let the operators know that they had to conform to the facility Part 26 program, and they basically have obeyed rules and regulations of the Commission.

We understood that. We talked about that at the beginning of the rulemaking package at senior management level, and we were directed by the Commission -- and this came from the staff requirements memorandum, when Part 26 was signed -- we were directed by the Commission to clearly let the operators know their responsibilities for violating fitness-for-duty requirements and to clearly let them know what the enforcement sanctions would be.

MR. CARROLL: Is rulemaking the only way you could accomplish that?

MR. LANGE: There was a number of other areas we looked at -- generic letters, information notices. The Commission wanted, directly, to go with the rulemaking as a condition of the operator's license.

It wasn't a large change to the rule. It could be easily done. There wasn't a lot of resources spent on it.

If you look at the rule that was published, it's a very short rule. It's clear, it's concise, and right to the point.

We don't see a change -- as a result of these comments, we don't see a change to the proposed rulemaking language.

MR. WILKINS: Is it fair to say, then, that you read those 30 comments and threw them in the wastebasket?

MR. LANGE: No, we didn't throw them in the wastebasket. We understood exactly what they said.

MR. WILKINS: But you are taking no action on the basis of them.

MR. LANGE: That's correct.

MR. KERR: Does the rule still read the licensee shall not use alcohol within the protected area?

MR. LANGE: We've changed that to "consume." We talked about ingestion.

That was the one comment I brought back with me from the last meeting I had with you people, and we went from "use" to "consume."

Keep in mind, Part 26 does use the word "use" in the language.

MR. KERR: Cough medicine frequently contains alcohol. I don't know whether it's -- is that counted as consumption?

MR. LANGE: If it's taken to excess and it causes impairment. The Part 26 program --

MR. KERR: But the rule first says that licensees shall not use or not consume alcohol within the protected area. It doesn't refer to anything having to do with being under the influence. The under the influence comes later.

MR. LANGE: Alcohol, in that context, is talking about straight alcohol, other than medicated, over-the-counter, prescription.

MR. KERR: I don't know of any alcoholic beverages that are made up of straight alcohol.

MR. WILKINS: Straight alcohol is very likely to be fatal.

MR. KERR: So, that would be almost unheard of.

MR. LANGE: You're right. I agree with that.

In that case, what we are talking about is those beverages that a person would not be taking --

MR. KERR: I am simply suggesting that the rule be clear enough so that it can be interpreted unambiguously by people who didn't write the rule and, therefore, didn't know what the intent was.

MR. LANGE: Okay. That's a good comment. Thank you.

[Slide.]

MR. LANGE: The second issue dealt with the issue of operator morale.

A number of comments, 28 comments were received. They talked about singling out operators to the detriment of their morale. They felt as though the Part 26 program covers everybody who has some sort of access within the facility.

This rule here clearly points out to the operators their responsibilities. We understood that.

The rulemaking does stress to licensed operators that their license is a privilege, and not a right. That was further explained in the recent information notice that was published by the Commission.

MR. KERR: I guess I don't understand that statement, "it's a privilege, not a right."

If an operator fulfills the qualifications to be an operator, it seems to me he has a right to be an operator.

The language there sounds as if there is some --

MR. LANGE: This is the way the NRC license is looked at by the Government, as far as the regulatory impact.

There was a recent bill in front of Congress that talked about this, also.

MR. KERR: So that even though a person may fulfill all the qualifications for being a licensed operator, he doesn't have a right to be an operator until some Government agency has given him that privilege.

MR. LANGE: That is correct.

MR. KERR: Is that the intent?

MR. LANGE: We do that by issuing the license to him, and issuing it with conditions on it.

MR. CARROLL: Interesting semantics.

MR. LANGE: Yes.

MR. WILKINS: Let me follow up on this a little bit.

MR. WARD: Excuse me. I don't that's at all inconsistent with things like, isn't that the legal interpretation of a driver's license, for example, that it's a privilege, not a right?

MR. LANGE: That is correct.

MR. WARD: Yes. Excuse me, Ernest.

MR. WILKINS: I just wanted to mention that example, and also observe that Government agencies are expected to behave in a non-capricious and non-arbitrary fashion. And where we get in trouble, of course, is where Government agencies do behave -- and not necessarily agencies, but employees of Government agencies behave -- arbitrarily and capriciously. And that has not been a problem with driver's licenses, because you've got 100 million people with driver's licenses. But the population of operators, nuclear reactor operators is very much smaller, and the opportunity for abuse, it seems, is therefore greater, for uncorrected abuse, is therefore greater. And that's why I worry a little bit about this language, although I'm not sure I worry enough about it to have justified all the talking I'm doing.

Let me go to something else. You heard these 28 comments and you chose to take no action on the basis of them, if I read your last bullets.

MR. LANGE: We don't see a change to the rulemaking. We may have to add some words to the statement of consideration that talks about the privilege and the right of the license. The actual words in the rulemaking package, in 10 CFR 55, we don't see a need to change it because of these comments.

MR. CARROLL: How do you really, though, respond to this issue of singling out the operators? Why are we singling out the operators, given the fitness for duty program applies to anybody with unescorted access. What is special about them?

MR. LANGE: We feel, from a safety standpoint, that that is probably the one checkvalve you've got left in the plant that needs to be able to respond in an emergency. We grant them a license to operate that plant. We give them a lot of trust and confidence to use that license. The fact that we go ahead and license them and don't license our maintenance people singles them out.

MR. CARROLL: You don't license them, but maintenance people can cause just as big problems as operators.

MR. WARD: Do you think they should be licensed?

MR. CARROLL: Plant managers can cause just as big problems.

MR. LANGE: We count on the licenses to take care of any problems that come up.

MR. CARROLL: Okay. I think that's a pretty good explanation.

MR. LANGE: Plus, the Commission feels very strongly that the operators are probably the biggest safety aspect of the plant. And that's why they directed clear language to them to let them know how serious they were on this issue.

MR. KERR: Did the Commission really think that the licensed operators didn't know how serious this was?

MR. LANGE: I don't think they did not think that. I think they did it. They just wanted to make sure the message got out to them, and that they were all informed. And that's basically what this rule does, is inform them.

MR. LEWIS: I may have missed something. But I'm still a little fuzzy about how we're handling antihistamines. They're both over-the-counter and prescription; they're extremely idiosyncratic in their effects on people. Some people aren't affected by them. Others are in a daze for the rest of the day. They're almost ubiquitous, especially in hay fever areas, during hay fever season.

How are we going to handle that?

MR. LANGE: Right now we're not requiring them to do any more than the Part 26 program requires them to do. Part 26 requires that the facility have procedures and guidelines in place. And that goes down to supervisory training for first-line supervisors, awareness training to employees, that tells them what their responsibilities are if they're taking something like that and they feel drowsy, and when to report it and when not to.

MR. LEWIS: I'm just concerned about the definition of "under the influence" because, as I read the literature, there are certain drugs for which there are de facto definitions of "under the influence" which have to do with residual blood chemistry and things like that, and which are generally pretty good.

But for lots of other drugs, there aren't such things, and, you know, you're not going to have everybody who is on an antihistamine run through the medical officer on his way to work. And I've seen lots of people under the influence of antihistamines who were a lot worse off than chronic drinkers after their first drink of the day. There are real ambiguities here.

MR. LANGE: People are "under the influence" from fatigue, stress. There's a number of other fitness for duty issues out here, other than just illegal drugs.

MR. LEWIS: Well, antihistamines are legal, of course.

MR. LANGE: Right. The Part 26 program recognizes this.

MR. LEWIS: Yes.

MR. LANGE: And that's where the good programs provide the good training to the supervisors to recognize aberrant behavior patterns or fitness for duty problems, or a person who is walking around that can't keep his eyes open.

MR. LEWIS: I always compare with the FAA regulations for pilots. And the FAA regulations for pilots, in the case of alcohol, specify a blood alcohol content, which is .04 percent, and specify no numbers for any other drug, legal or illegal; but there is a rule that says that the pilot himself has the responsibility to not operate an airplane when his performance would be adversely affected by anything he's taking, legal or illegal.

But then, there is no, if you like, point of sale control. What is done is that, after something bad happens, people are instantly tested to see whether they've misbehaved. And the sense of professionalism that nearly all professional pilots have is really what keeps them, for the most part -- of course there are exceptions -- but keeps them on the straight and narrow. And that's sort of the way it sits.

And they're just as responsible for the public health and safety as reactor operators, or, as Jay says, plant managers.

MR. LANGE: I think we are going to see that same carryover for the licensed operators as you see for the pilots.

MR. LEWIS: The rule is just far more complicated than the comparable FAA rule, which I -- I have just quoted to you almost verbatim and almost completely the FAA rule.

MR. WARD: Hal, recently, some pilots that were criminally prosecuted for flying, is that under the FAA rule, or is that under some other?

MR. LEWIS: No. That was under the FAA rule. They were -- you see, alcohol is the one specific exception to all these things, in that there is a real percentage for which it's illegal to operate an airplane. For all the others, it's a matter of judgement about whether performance has been impaired.

The specific case of alcohol is .04 percent, and those guys were, as I read the newspaper stories, parading their drinking the night before of not only .04 percent but also 8 hours before flying, and they were clearly drinking less than 8 hours before flying.

They didn't do anything wrong. They just drank. But drinking itself is illegal. But if they had been under the influence of cocaine or antihistamines or something like that, then probably they would have come off clean, because there is no evidence that they did anything wrong on that flight.

It's the distinction between alcohol and everything else that I am concerned about.

MR. SHEWMON: In the rule which is under discussion, is it a judgement call of the supervisor whether or not they're under the influence of drinking that they did in the preceding 8 hours? I'm talking now about the operator's rule.

MR. LEWIS: In the case of nuclear cases?

MR. SHEWMON: Yes.

MR. LEWIS: I don't know how to handle the nuclear case.

MR. SHEWMON: It's a question for the speaker.

MR. LEWIS: Oh, forgive me. You were looking toward me but on past me.

MR. SHEWMON: Yes.

MR. LEWIS: I couldn't tell from the line of sight.

MR. LANGE: The supervisory training program that's required under Part 26 is supposed to be kept up.

If there is any question at all, he would remove that person from his job duties. He may have him tested for a substance.

But in either case, the first-line supervisor would be the first one to detect it if it hadn't been -- you know, a gate guard or whatever, if he was on the job.

MR. KERR: But doesn't the proposed 55.53 also make the operator responsible? As I read it, it certainly would.

MR. LANGE: The operator is responsible to -- if he does not feel as though he is fit for duty to operate that plant -- to inform his supervisor.

That falls under the responsibility of employees under the Part 26 program, also.

MR. WILKINS: I see some reference in 55.53, though, to a determination by a medical review officer, which was really the answer to Hal's question.

"Under the influence" means the licensee could be mentally or physically impaired, as determined by a medical review officer, in such a manner as to adversely affect his or her ability to -- and so and so on.

Now, in order to get to the medical review officer, the question is does the supervisor refer him, and is that a mandatory -- if the supervisor refers him, he has to go, or does he refer himself, or is it a combination of both?

MR. LANGE: Could be either one. And what they would do is follow their Part 26 program that's already established.

But the medical review officer is consistent with the medical review officer in Part 26 for a confirmed positive test. That's where the decision would be.

MR. WILKINS: I am not all that familiar with Part 26. Is a medical review officer an MD?

MR. LANGE: I believe he is.

MR. WILKINS: So, this requires -- you're going to get to this later in your slides -- this requires the utility to have an MD on duty, or at least, available or on-call or something.

MR. LANGE: Whatever. They have a designated medical review officer. That's under their Part 26 program.

MR. WARD: Dave, I'm having a little trouble hearing you.

MR. LANGE: I'm going to speak louder.

MR. WARD: Thank you.

MR. LANGE: All right.

I'd like to move on to the third comment, if we have no more questions on this.

[Slide.]

MR. LANGE: We received 20 comments that talk about medical review of legal drugs, and those comments centered around an unnecessary burden to have a medical review officer and have medical personnel be available 24 hours a day to make judgments about prescription and over-the-counter drugs.

That is not the intent of the rulemaking.

[Slide.]

MR. LANGE: If you look on the next page, we continue there.

Our proposed resolution is medical personnel are not required 24 hours a day for prescription and over-the-counter drug evaluation for the Part 26 or the Part 55 program.

The intent is that the operator follow the facility Part 26 program for supervisory notification of fitness-for-duty concerns in the use of legal drugs.

We are going to have to clarify our rulemaking package to make sure that they understand us, and I suspect it will be clarified in a similar way to what Part 26 talks about.

MR. CARROLL: What does Part 26 talk about?

MR. LANGE: It talks about having the medical review officer designated and available, if necessary, but not have to be available 24 hours a day to screen everybody or every licensed operator coming in and out of the plant.

We recognize there could be some confusion in the way the words in the statement of consideration are written right now.

[Slide.]

MR. LANGE: The next comment we got goes back to the basis behind the rule in general. This kind of goes back to the first comments we received on the need for rule change. We don't see -- again, we don't see a change required to the wording of the rule.

You know, we need to stress compliance with the

Part 26 program as a condition of licensing. I think we've done that in the proposed rule. We're going to look to see if we need to clarify that language at all in the background information. I really don't believe we're going to have to.

Again, the reason and basis behind the proposed rule, the Commission directive, from a safety standpoint, yes, we are singling out the operators. We are being very up front in letting them know how serious it is. We don't want to wait until they are randomly tested and found to be positive; we do not want that to happen.

From a safety standpoint, one operator tests positive; that's one too many.

MR. KERR: How many cases of alcohol use on duty or under the influence have been reported over the past ten years?

MR. LANGE: For the past how many years?

MR. KERR: Ten, or five or whatever.

MR. LANGE: I haven't got that information. I know that since Part 26 went into effect, which I guess has been just about a year now, that there have been 14 reported cases of licensed operators testing positive under the Part 26 program.

MR. KERR: While on duty?

MR. LANGE: Either coming on duty or on duty.

MR. WILKINS: Positive for alcohol?

MR. LANGE: Out of the cases that tested positive, I believe that there were 7 of them that were tested for alcohol. The others were tested for some other type of substance that's listed in Part 26.

MR. WYLIE: That is since Part 26 has been implemented.

MR. LANGE: That's since Part 26 has been implemented. That's the last count that I had. That was about a month and a half ago.

MR. SHEWMON: Tested positive for alcohol means it was a blood level comparable to what's required for either operating an airplane or operating a car in some states? It wasn't just detectable, it was a definite level that --

MR. LANGE: Part 26 has a cutoff level of .04 in it.

MR. SHEWMON: Fine.

MR. WARD: Were those tests under Part 26 random testing, or were those tests for cause?

MR. LANGE: It was a combination of cause, random testing and operators being picked up on their annual physicals, which is somewhat disturbing.

MR. WILKINS: Because the man knows he's going to have the annual physical and he shows up drunk or stoned anyway.

MR. LANGE: There was one case of a supervisor sending an operator home without having him tested. That person, after a couple of weeks, voluntarily turned himself into the Employee Assistance Program. To me, if a Part 26 or a fitness for duty program is truly going to work, the two statistics I want to see increase is self-referral and supervisory referral.

MR. KERR: What is the expectation that these 14 cases are likely to go down to 7 with the new rule or zero?

MR. LANGE: I'd like them to go down to zero.

MR. KERR: I mean, I know you'd like to, but there's a reference up there to a need to stress compliance, and presumably that means you have some goal in mind. Do you think that realistically that it will go to zero?

MR. LANGE: For licensed operators? Yes. I really think that with the Part 26 program --

MR. KERR: No, I'm not talking about Part 26; I'm talking about this program.

MR. LANGE: I understand. The Part 26 program is definitely going to influence it. I believe the Part 55 rule change is going to highlight that maybe one percent out there that we still have a problem with, they still have a problem, and reduce it to zero.

MR. KERR: The feeling is that the operators don't know about this, but given 55.53, they will know about it.

MR. LANGE: I believe they know about it right now. We're clearly letting them know how severe we think it is.

MR. WILKINS: You said 14 cases with Part 26, but Part 26 covers more than just operators; does it not?

MR. LANGE: I believe these were reported cases of licensed personnel.

MR. CARROLL: It is a lot more than that if you count contractors and everybody else.

[Slide.]

MR. LANGE: You have to remember that Part 26 has a reporting requirement for all licensed operators and that's a 24-hour red phone notification. That's where we hear about it through the operations officer.

All right, moving on, the fifth comment we got was on the reporting of legal drugs. How will the operators who do not report medicine be treated? This kind of goes back to a couple of comments we've talked about already.

We see a need to clarify the language in the rule right now. We talk about the Part 26 program and the written policies and procedures. We talk about that in the background information of the proposed rule.

We need to clarify more of what expect, I believe, out of the operators to conform to the Part 26 guidelines. We are going to have to clarify that language. That was just one comment we received on that.

MR. WILKINS: I don't understand how you answered the question, though, that occurs at the top of the slide. How do operators that do not report medicine use be treated?

MR. LANGE: Okay.

MR. WILKINS: First of all, how do you detect that you have an operator who has not reported medicine use?

MR. LANGE: It could be a number of ways: it could be after the fact. He should have, under the Part 26 program guidelines -- he could be taking a prescription medication that he is supposed to report his use of. It could be a pain medication, and he does not do that, so something happens and we find out about it.

MR. WILKINS: All right, are your licensed operators told up front as a condition of their license, that whenever they get a prescription from a physician that they are required to advise their supervisor or their personnel department or somebody that they have received this prescription and now I'm taking 40 milligrams per day of Lopid?

MR. LANGE: That would fall under the guidelines of the Part 26 program.

MR. WILKINS: Well, is the answer under Part 26, yes?

MR. LANGE: Under Part 26, yes.

MR. WILKINS: They have such an obligation, a legal obligation to report to competent authority in the utility that they are taking a prescription medication?

MR. LANGE: You'd have to look at the individual facility program, but Part 26 requires that the facility have those procedures and guidelines in place.

MR. WILKINS: So some may and some may not?

MR. LANGE: That's correct.

MR. WILKINS: If a facility has a procedure in place that says an operator must report every time a doctor gives him a prescription and he starts using the prescription and then an operator doesn't do it, then the facility, it would seem to me, would have a clear cause to discharge this operator or take whatever disciplinary action seems appropriate, because he has violated their procedures?

MR. LANGE: That's correct. That would be facility-generated and independent.

MR. WILKINS: Some facilities might not have this particular procedure?

MR. LANGE: They might not have the same program.

MR. WILKINS: The NRC doesn't have an interest in directing the facility to have or not to have such a procedure in place?

MR. LANGE: The NRC has directed the facility to put together those procedures and guidelines. We did not prescribe the details of those. We are inspecting against these facilities.

[Slide.]

MR. LANGE: The last set of comments that we got, number 6, specifically we are concerned with the non-power reactor community or the test, training and research reactor community. That's what TRTR means.

Their major concern was that a formal drug testing program should not be required for non-power reactors. We understood that. Part 26 does not require them to have a formal drug testing program. That was a decision that was made by the Commission when the published Part 26.

The new proposed Part 55 or the final Part 55, when it goes into effect, does not require a formal drug testing program. They are only required to participate in whatever program they have established.

Now, keep in mind, that Part 55 does not segregate non-power reactor operator licenses from power reactor operator licenses. We do change our testing. We are not as aggressive on requalification exams. But, the actual license conditions apply to both. That's why they're included in the revised Part 55. But whatever program they have in place is what they're going to have to live by. If they don't have a program in place, that's what they're going to have to live by.

I don't think you're going to see many facilities not having a program in place, simply because of the fact that under the Federal Drug Workplace Act of 1988, anybody receiving a grant of $25,000 or more, must have a program in place. I believe, if you go from state-to-state, you'll find out that the state has control of the programs they put into place.

So, you might find one facility with a state-controlled program, another facility that put together a program to meet Federal guidelines. You're going to find variances from one facility to another. Whatever program they have, that's what the operators have to follow.

MR. WARD: Does the NRC inspect against requirements of those programs?

MR. LANGE: Not in the Part 26. We don't have a rule or a regulation that would allow us to go out and inspect against that.

MR. WARD: Would a regional inspector, let's say, determine whether or not a test reactor facility had a program under a state regulation or this other Federal regulation in place?

MR. LANGE: Have an adequate program in place? That is correct.

MR. WARD: They would determine that?

MR. LANGE: They may determine it -- they may go out because an incident happens. They may go out, on a routine basis, I don't believe they go out and inspect against this. But if this is something that's --

MR. WARD: If I wanted to find out if such and such reactor at a university had a program in place, could I call the region responsible for that?

MR. LANGE: I don't believe that information would be available through the region.

MR. KERR: I can tell you, from personal experience, that questionnaires have been sent to university research reactors to indicate what sort of program is in existence.

MR. SHEWMON: And that they were sent by the NRC?

MR. KERR: Yes.

[Slide.]

MR. LANGE: Page 2 of these comments addresses some additional concerns, which was a concern about the medical review efforts and not being available at these facilities. We understood that it was not required to be available. The fact that they had not required to even have a program.

Part 55 does not require a medical review officer at the facility, and neither does Part 26.

Again, this comment was, again, related to the prescription medication and over-the-counter medication and the reportability of it. So, it kind of pulls back in with the other comment that we had taken a look at.

So we see no change that's going to be required as a result of the comments from the TRTR community.

Again, 39 comments. Right now, the Operator Licensing Branch had been working on a rulemaking package. I've asked for the assistance of research -- our research group to help, which they are right now. They're going to help put together the responses to the comments and they can clarify any language we need to have clarified.

MR. WILKINS: I notice, in the proposed language, in 55.61, the phrase, "confirmed positive test for drugs" occurs.

MR. LANGE: That's correct.

MR. WILKINS: Those words are not defined in this section. Are they defined elsewhere in the rules and regulations of the NRC, or are there statutes and so on?

MR. LANGE: Yes. They're defined in Part 26.

MR. WILKINS: Have a -- just a basic, fundamental belief that laboratories are totally incapable of confirming anything. Now, starting from that extreme position, let me back off. A positive test is presumably a test that says, on the basis of what we've measured, we infer that this individual is likely to have taken cocaine, for example, all right? But the error in our test is sufficient great and he is sufficiently close to the border and we need to do it again. You do a second test, possibly a more rigorous test. I'm not sure that it has to be a more rigorous test, but possibly more rigorous. If that one confirms it, that's what you call a positive confirmation, or confirmed positive.

MR. LANGE: There is additional clarification on that in Part 26. You would go from there to a review by th medical review officer, which would be followed up with an interview with the individual. Then the determination from that medical review officer if the person has a confirmed test.

MR. WILKINS: I see, so the -- so there's a final step which is a medical judgment?

MR. LANGE: It's a medical judgment after an interview with the individual.

MR. WILKINS: So, the MRO has available the lab tests, as well as his conversation with them and -- it's more than a conversation I assume, but, examination of the patient?

MR. LANGE: Interview, examination.

MR. WILKINS: The sanctions are sufficiently onerous that I really want to be sure that we don't throw the baby out with the bath water. You know this -- even this blood alcohol test of 0.04. You know, you get a guy at 0.041 and the statistical error is 0.005, that 0.041 doesn't mean very much, as compared to 0.039.

That's the kind of thing that bothers me, you know. I go to my own doctor and he says, my cholesterol is 180 and next week it's 160 and the week after that it's 190. I mean, you know, they fluctuate all over the damn place.

MR. LANGE: Maybe I can help out.

If you look at Part 26, you've got to look at Fitness for Duty and the responsibility of operating the plant from a trustworthiness and reliability standpoint. Keep in mind the Health and Human Service guidelines published these levels.

These guidelines established the levels that gave the staff confidence of the presence of drugs, not the impairment state, the presence.

We have a high confidence level that if a person reaches this level and we can assure oursel hat the presence of drug is in the system. That go coo for alcohol. Tie that back to a trustworthiness and reliability standpoint of a person consuming it onsite, or coming into work and taking some type of an illegal drug at work or before work or whatever, from a trustworthiness or reliability standpoint, we do not have confidence in that individual operating in the plant.

MR. KERR: So it is not the impairment that is the goal, it's trustworthiness that is being looked for?

MR. LANGE: That's correct. We use the Part 26 cut-off levels. Those are the ones that have been established and published in the Federal Register by the Health and Human Service Department and those are the only things that we have right now that are quantitative to determine presence of a substance in the person.

Does that help clarify it?

MR. WILKINS: It is what I expected you to say, and you're not a medical doctor, I assume, or a pharmacologist or pathologist or whatever it would be, and neither am I.

I've just had enough dealings with experimentalists, in general, to know that measurements are notoriously unreliable.

MR. LANGE: I understand. That's why they set up the system with a medical review officer interview of the person.

MR. WILKINS: And I must say that gives me a little mora comfort.

MR. LANGE: I believe, right now, based on that interview, if they find out a person has been taken prescription medication, taking the right dose, there's no problem. The person is not going to be immediately entered into a rehab program. It's just going to be something that showed up.

MR. KERR: But you're asking the medical review officers not to pass on presence but on impairment, whereas your goal is not impairment; it's trustworthiness.

So, you aren't really asking the medical review officer to pass on what you consider to be the most important aspect of this test.

MR. LANGE: It's medical judgement, and that's why we used the word "could."

MR. KERR: But it's a medical judgement of impairment, according to the rule, but from what you just told me, what the Commission in interested in not impairment but presence.

MR. LANGE: Correct.

MR. WILKINS: Bill, I think you may be putting words in his mouth that aren't in the rule.

MR. KERR: But he said "correct."

MR. WILKINS: I know, but I'm not reading it here.

The determination of the medical review officer -- let me just read the language.

"The licensee could be mentally or physically impaired, as determined by the medical review officer, in such manner as to adversely affect his or her ability to safety and competently perform the duties."

So, it's not just the impairment. It's the fact that that impairment, in the opinion of the review officer, will or might or could adversely affect his duties, and that's the reliability.

MR. LANGE: We specifically used the word "could" for that reason. We did not want to lock the medical review officer into making a determination, a medical determination, based on a level.

So, again, yes, he'd have to look at the trustworthiness and reliability of the issue, also.

MR. WARD: Dave, could you describe a typical scenario under some utility's program; I mean how the tests and the medical review officer's role actually would come into play?

Let's say an operator comes in, reports for duty. His supervisor observes his or her behavior and concludes that he or she may be under the influence of alcohol, let's say.

Then what happens?

MR. LANGE: Gene, do you want to address this? Do you think you could address it better than I could.

I've got a person with Nuclear Safeguards that's familiar with the fitness-for-duty logistics.

MR. WARD: What I'm interested is, you know, where does a test come into play?

MR. LANGE: My understanding is he would be referred into the employee assistance program, not right away, but immediately be recommended to take a drug test, and the facilities are set up with local hospitals and whatever, or even onsite, to do these tests.

MR. WARD: Okay. Let's say -- okay. A local hospital would make the test, and the test results would be available instantly, then?

MR. WILKINS: You skipped a step.

MR. WARD: Okay.

MR. WILKINS: You left the supervisor at the point where he felt this man might have been under the influence of alcohol.

MR. WARD: Yes. Okay.

MR. WILKINS: You haven't got this man to the hospital yet.

MR. LANGE: The first thing that's done is remove him from licensed duties, if he has a license, or he is taken off his job duties.

He would be driven to the hospital.

MR. CARROLL: Suppose he says I'm not going?

MR. LANGE: Then he is refusing to participate in the program requirements.

He would be tested. Based on the results of that test, they would be forwarded to the medical review officer, who would then make a determination.

MR. WARD: And the test would be made available immediately to the supervisor who is with him there?

MR. LANGE: The test results are kept confidential. At that point, they are handled strictly with the medical department and the medical review officer and the testing laboratories.

So, the supervisor isn't told that the person is positive or not. The person is still undergoing testing under the Part 26 program.

If and when the point comes -- when it's determined by the medical review officer that the person falls into one of two categories, either a habitual user or a recreational user -- or it may turn out that the person is not a user at all -- then he would be -- based on that result, he would be referred to the employee assistance program.

Again, he may choose not to participate in that program.

MR. WARD: And the medical review officer is, let's say, a local physician who is retained by the utility and is available 24 hours?

MR. LANGE: It would have to be somebody designated by the facility that would be available.

MR. WILKINS: Not necessarily the same human being 168 hours a week.

MR. KERR: Is the assumption that these test results are going to be available immediately upon drawing a blood sample?

MR. LANGE: Not necessarily. Not immediately.

MR. KERR: Why does a medical officer need to be available 24 hours a day then?

MR. LANGE: Gene, do you want to answer that?

MR. McPEEK: Gene McPeek from Division of Safeguards.

If the tests were, say, for cause, the first immediate action is to deny the individual access to the site. I'm speaking of Part 26.

Not all the licensees have the capability for onsite testing for drugs. They do have the capability, through breathalyzers, to test for alcohol.

So, depending upon the situation -- if it were alcohol, they could administer the test onsite and get a reading. If it were positive, then they could proceed with that course of action. If it were negative, depending upon the individual's actions, the licensee could permit the person to go back to work.

But in the case of drugs, the test -- say that they had the capability for onsite testing. If it were negative, that would be the end. All right? The individual could be counseled, but he would be permitted access.

MR. WARD: And there is a technician at the site who would determine if the test was negative, and that technician would inform the supervisor? Is that it?

MR. McPEEK: If the test were negative, yes.

If the test were positive, they would have to send that to an HHS-certified lab for confirmation. Then it would come back through the medical doctor.

MR. KERR: So, for that situation, the physician doesn't have to be on-call 24 hours a day.

MR. McPEEK: No.

MR. KERR: Now, in the case of a breathalizer, if that is taken as specific, it still has to be a medical officer determination?

MR. McPEEK: Not for the breathalizer.

If the individual so desires -- and there's two tests administered for the breathalizer. You give him one test. Then, within -- I forget what the timeframe is -- 4 to 12 minutes or something, you give him another test on a separate piece of equipment; the same type, but a separate piece of equipment.

At that time, say that those results are positive. The individual could request that a blood sample be taken. All right?

That would have to be then confirmed by a medical doctor.

MR. KERR: But that test would take a while, wouldn't it?

MR. McPEEK: Yes, it would.

MR. KERR: So, again, I don't see any point in a medical officer being available on a 24-hour basis.

MR. McPEEK: Well, the licensee has to have a medical officer on-call. I mean the primary reason for it is to review the test results coming back from the lab.

MR. KERR: But they are not going to come back within a few hours.

MR. McPEEK: No. I think the regulation speaks to it. The decision has to be made in 10 days. Okay?

But in the interim, the individual would be denied access to the site.

MR. KERR: I'm just trying to get some sense of why the issue of a medical officer being available 24 hours a day has arisen. I see no point in this.

Is that a requirement of the rule, or is it an interpretation of the licensee, the 24-hour-a-day availability?

MR. LANGE: That comment was raised because of the language that we need to clarify.

MR. KERR: Okay.

MR. LANGE: We were talking about over-the-counter and prescription medications.

MR. WARD: I thought the medical officer was supposed to be able to determine something from the interview of the employee.

MR. LANGE: Following the test results.

MR. WARD: But I mean two or three days later, what's a medical officer going to find out from an employee?

MR. KERR: If he is trustworthy.

MR. WILKINS: If he is chronic.

MR. WARD: What qualifications do these medical officers have to make such a determination?

MR. CARROLL: It's one of the big problems in this whole thing, because at least in my experience, it's very hard to find a medical officer who is willing to take the time to figure out what a licensed operator does for a living and, you know, what the physical and mental requirements of the job are.

MR. WARD: I can see a medical officer having an expert opinion on the condition of -- the physical condition of someone when they're faced with them. But five days later, judging his trustworthiness or whatever it is, I don't get any -- you know, why not an attorney or a clergyman or a psychologist?

What's a medical officer got to do with it?

MR. SHEWMON: Don't you trust the medical profession?

MR. WARD: Not anymore than most other

professions, which is --

MR. \ :LKINS: Not very much.

MR. LANGE: Okay. Is there any other questions?

MR. KERR: Did you get any communications from utilities saying that we think this is a good rule?

MR. LANGE: We got communications from some of the contractors saying they thought it was a good rule, and we also got communications from some of the utilities saying they agree that it's an important issue, and they have no problem with the rule.

MR. KERR: I missed that on the slide. There did not appear to be any reference to positive comments.

How many positive comments did you get?

MR. LANGE: In the same letter, where people commented that they saw no need for the rule, they also commented in many places that they didn't have any problem with the rule, other than they didn't see a need for it.

MR. WILKINS: In other words, this is one more useless piece of paper coming out of Washington, and we don't give a damn.

MR. LANGE: Well, it's more than that. They felt as though the operators shouldn't be singled out in some cases. And we feel as though they need to be.

MR. KERR: So you didn't really find any utility that said we need this rule in order to make it less likely that operators will ind'ilge?

MR. LANGE: That is correct.

MR. CARROLL: How does this enforcement policy for the first, second, and third violations relate to fitness for duty in general in terms of non-licensed people?

MR. LANGE: Fitness for duty in general, naturally every utility has their own policy as far as how many test results, positive test results they are going to allow a person before they are going to terminate him.

However, Part 26 does require that a person be removed for a certain period of time of unescorted access after a second and third offense. After the first offense, immediately it's 14 days; second offense, I believe it's three years; and then third offense he is denied unescorted access forever after that.

And our enforcement, the way it's laid out, we put in there that we may take enforcement action even after the first offense, if there is reason to do that; and the second offense, that we will suspend the operator's license; and the third offense, we definitely will revoke it.

MR. CARROLL: The second one is "may."

MR. LANGE: We may suspend it, right. Again, you're going to have to look at the severity of the situation. Was there an accident involved? It would be like a person getting, I guess, arrested for the second time on DWI, only this time there was a fatality involved. The enforcement sanctions would be quite a bit different than if there was no fatality involved.

MR. WYLIE: Where you revoke a license on the third violation, is there any provision in here to reissue that license, or do you speak to that?

MR. LANGE: We don't speak to that specifically in this rule.

MR. WYLIE: Why not?

MR. LANGE: We didn't see a need to.

MR. WILKINS: It's probably covered elsewhere, isn't it?

MR. WYLIE: Is it?

MR. LANGE: Revocation of licenses is covered under Part 55 already. We can revoke a license for a number of reasons. As far as reinstating it, I think the question you have is the shelf life.

MR. WYLIE: Yes, reinstating.

MR. LANGE: Reinstating it, that would be on a case-specific basis, based on a person coming in with an application signed by him in the facility, and he meets all the requirements again. There's nothing stopping him from doing that. There's nothing stopping him from doing that immediately after we revoke the license, if he wanted to go to another facility.

MR. WYLIE: Now, as I unders and t is proposed rule, this is not intended to add additi nal urden on the utility as far as implementation is concerned, that the detection would be through the enforcement of Part 26; is that correct?

MR. LANGE: That is correct.

MR. WYLIE: And you don't envision any additional implementation requirements?

MR. LANGE: If a facility wanted to strengthen its procedures and guidelines to make sure that the operators fully understood their license conditions, that would be up to them.

MR. WYLIE: Okay.

MR. LEWIS: I apologize. I had to be out for a second, so you may have already answered this. But the medical officer we talk about does have to be an M.D. or does not?

MR. LANGE: Yes.

MR. LEWIS: And does i say that in the --

MR. LANGE: In the Part 26 program.

MR. LEWIS: It does. Okay. Any kind of M.D.? An orthopedist is okay?

MR. LANGE: I don't believe so. I think it specifically talks about a person that is familiar with the program.

MR. McPEEK: It doesn't spell out what type of M.D. But we have certain expectations.

MR. LEWIS: You have a list of specialties, but the license has to, but as far as you're concerned, he has to be an M.D.?

MR. McPEEK: Yes.

MR. LEWIS: Okay. Not a chiropractor?

MR. McPEEK: Right.

MR. LEWIS: Okay. And you say that explicitly in the rule?

MR. McPEEK: No.

MR. LEWIS: You don't. How are you going to enforce it, if you don't? No, seriously, how are you going to enforce it if you don't, if you don't say it?

MR. McPEEK: I don't know that a chiropractor is an M.D.

MR. WARD: No, he's not. I chiropractor doesn't hold an M.D.

MR. LEWIS: That's right. But you do say in the rule it has to be an M.D. of some kind. But when I said orthopedist, somebody said no, so that means you have a list in the rule of the kinds of M.D.?

MR. McPEEK: No, we don't have a list.

MR. LEWIS: So it could be an orthopedist?

MR. McPEEK: I doubt if we would find an

orthopedist, but --

MR. WILKINS: That's a separate issue.

MR. LEWIS: That isn't the question. Do you specify that it cannot be?

MR. McPEEK: No.

MR. LEWIS: I'm not picking on orthopedists. You do not.

MR. McPEEK: No.

MR. LEWIS: So it can be an M.D. of any specialty and any type, but must be an M.D.

MR. McPEEK: Knowledgeable in the field, in the area.

MR. LEWIS: Well, again, you can't enforce knowledgeable. We don't even enforce that for membership on ACRS.

MR. WILKINS: The stakes are lower.

MR. LANGE: I believe under the Part 26 program they would go in and inspect against this.

MR. LEWIS: A rule has to be enforceable, and to be enforceable, it must be explicit and clear. And I'm just trying to get at that, because a tremendous amount of responsibility is being vested in this medical officer, especially when you're dealing with good old antihistamines, which are my whipping boy today, and he's got to make judgments about how impaired people are when they're under the influence of -- I don't want to name a drug, because whatever the company is they'll sue me -- but there are certain ones that are extremely variable.

MR. McPEEK: I might mention that NIDA, the National Institutes of Drug Abuse, is looking at that, and the American Medical Association is looking at that.

MR. LEWIS: They've had a lot of trouble pinning down this particular issue. I know that. I've worked with NIDA on a number of things. And that's why other people have tended to be much more vague than NRC is being about both legal and illegal drugs.

MR. WARD: Well, Hal, I think the problem is even a little tougher than that, that the M.D. may not get into the act until a week after the incident.

MR. LEWIS: I understand that. That's right. I'm thinking of a case in which somebody does something wrong.

MR. WARD: So I think an orthopedist might be just as good as anybody.

MR. LEWIS: Well, we could go through osteopaths, for example. I don't want to get into that one. But the point is, he can be brought in during an enforcement action if somebody does something bad, and the question of whether it happened because he was under the influence of a legal drug comes up. And it's going to be a very difficult judgment call. I wonder who is going to be making it.

MR. LANGE: Okay. In the case of the licensed operators, keep in mind that there are medical requirements under a condition of their license. They have a designated physician who specifically knows the job duties of the licensed operator.

MR. CARROLL: Are you sure of that?

MR. LANGE: Yes. That has to be --

MR. WILKINS: You're sure of the rule.

MR. CARROLL: You're sure of the rule.

MR. LANGE: I'm sure of that. They nave to do the physicals for the operators on initial applications and an renewal applications.

MR. CARROLL: That's a real weakness in the program, at least in my experience.

MR. LANGE: In the Part 26 program?

MR. CARROLL: No, in the Part 55 program, is that the doctors really don't really understand what a licensed operator does for a living.

MR. LANGE: Well, let me clarify what happened in 1987.

We published a revision to Part 55 in 1987 which basically we backed out of the medical review business. We used to review all the medical data on an application: blood pressure, hearing test, eye test. And our individual doctor in each one of the regions who used ANS 3.4 as a standard, the 1983 version, would review that data against the standard.

In 1987, we got out of that business and put the responsibility back in the facilities. We did away with NRC Form 396., which had all the little blocks to check for all the little figures and numbers.

MR. CARROLL: Including: "have you ever seriously considered committing suicide."

MR. LANGE: That is correct.

MR. CARROLL: That was always my favorite question on there.

MR. LEWIS: And we came out with a new Form 396 which basically, it has a statement right on it that the physician performed that physical in accordance with the ANS standard, and that a senior company official signs off that that physical has been completed, there's no restrictions that the person needs to have on his license, and that he also meets the safeguards and fitness for duty requirements of that facility.

In the case of licensed operators, medical review officers, in consultation with the designated physician, does the physicals for those operators, as far as determining job duties and responsibilities.

MR. LEWIS: And is that what it says in this rule?

MR. LANGE: Not in this rule, no.

MR. LEWIS: But we're talking of this rule.

MR. LANGE: In Part 55, already in Part 55, there's explanation on the medical requirements for licensed operators. They have to meet those requirements.

MR. LEWIS: But in this case, the Medical Review Officer does not presumably have to consult the physician?

MR. LANGE: That is correct.

MR. WARD: Okay, any other --

MR. MICHELSON: Yes, can I ask a question?

MR. WARD: Yes, Carl?

MR. MICHELSON: In the past, some notoriety has been given to operators sleeping on duty and some heavy fines have been levied and I think, even of late, there's been another possible case. What would be the difference between the fines levied and the disciplinary action taken, if the operator said afterwards, well, I was taking antihistamines and went to sleep on duty? What would be the difference on how you would approach the problem if he made such a claim?

MR. LANGE: We would probably approach the problem differently than if a person had just done it for the sake of fatigue or whatever. That would be handled case-specifically. You've got to remember, we had individual enforcement conferences with every one of these operators to determine just why he was doing what he was doing.

MR. MICHELSON: Yes, but now he says I had a cold and I took antihistamines and, man, it knocked me out more than I thought it would and I went to sleep. Now, that's pretty hart to prove that that wasn't the case afterwards.

MR. LANGE: Then we probably go back to the Part 26 program.

MR. MICHELSON: Well what does the Part 26 program really require of the operator if he takes antihistamines because he's got a cold; it never bothered him before he thought.

MR. LANGE: Again, that would be facility dependent. But each facility has a requirement that they train their supervisors to detect these problems.

MR. MICHELSON: Okay, now, getting back to the case though, I'm going to assume that the operator hadn't taken antihistamines and he went to sleep though. Now, isn't this his excuse to get out of all these penalties and actions? Wouldn't the action and penalty be much less severe if he claimed he was taking antihistamines, even though he might now revert back to a Part 26 penalty, if there is any? It looks to me like he can get out of the sleeping question by just claiming he took antihistamines, contrary to the Part 26 requirement, and get off pretty easy.

MR. SHEWMON: Maybe he could the first time.

MR. MICHELSON: Well, yes, one time only. Of course, I'd assume he wouldn't try this again.

MR. CARROLL: Was that ever used as a defense in any of the sleeping on watch issues?

MR. LANGE: I'm not positive of that. I know there has been a recent case where a person -- an operator had reported that he had a back problem and his back was bothering him and that's why he was sitting in a reclined position with his feet up and his eyes close and his head back.

MR. WILKINS: But he wasn't asleep, he was just --

MR. LANGE: This particular individual said he was not asleep, correct.

MR. MICHELSON: It does look like there's a real problem if operators start saying they took various types of non-prescription drugs for whatever small ailments they had. It would be pretty hard to prove.

MR. WILKINS: Particularly a week later.

MR. MICHELSON: Yes, particularly a week later, yes. If you did the testing immediately they could verify, but they don't require that kind of testing for sleeping cases, as far as I know.

MR. WILKINS: You see, what you say, Carl, suggests to me that we're trying to make rules to take the place of supervisory activity, you see. I don't think you can ever do that. I mean, a supervisor -- if a man goes to sleep, the supervisor ought to know it --

MR. MICHELSON: Yes.

MR. WILKINS: -- very, very shortly after he -- after he goes to sleep.

MR. LANGE: He should wake him up.

MR. CARROLL: There's one celebrated case where the supervisor was asleep.

MR. MICHELSON: That makes it tougher.

MR. WILKINS: Well, that reduces the problem to the preceding case. He has a supervisor, and you know --

MR. LANGE: Well, you're not going to change that with the regulation. Yes, we expect the supervisor to wake him up.

MR. MICHELSON: In the recent case, 2 of the people in the control room, I believe, were sleeping and the resident inspector came in, of course, I don't what their relative positions were, I don't recall, in reading about it, whether either one of them were considered a supervisor, but it looks to me like these cases might get hard to enforce if they start claiming they are taking allowable drugs.

MR. LANGE: They could certainly use that as an excuse.

MR. WILKINS: I don't see anything in 26 that says that that is an excuse or that that serves to mitigate the penalties.

MR. MICHELSON: Yes, but the penalty for sleeping on duty with no excuse might be a whole lot stiffer than the penalty under Part 26, and that was what I was really asking you. What's the difference between the 2 penalties?

MR. WILKINS: If I were a judge, I might be more sympathetic to a guy that says, look I was up all night long, my wife was having pains and bleeding and the baby was yelling and screaming, I didn't get any sleep at all last night, but I came to work anyway because I knew you needed me. I might be more sympathetic to that guy than to the guy who takes the antihistamines.

MR. MICHELSON: Well, I was just asking an academic question.

MR. WARD: Yes, but it's easier to fake the antihistamine excuse.

MR. MICHELSON: Difficult to prove.

MR. WARD: Rather than a pregnant wife.

MR. LEWIS: I have been known to see people sleeping around the table, but only because the subject was boring.

MR. WARD: Any other quick questions or comments for Mr. Lange?

[No response.]

MR. LANGE: Okay, thank you.

MR. WARD: Thank you, Dave.

Rich Enkeboll of NUMARC has asked for a few minutes to comment on this. Mr. Enkeboll is the Senior Project Manager for Operations Management in the Support Services Division.

Rich, how many minutes will you want?

MR. ENKEBOLL: I can take as long or as short as you like.

MR. WARD: Okay. Well, we do want to finish by 10:15, so -- and --

MR. ENKEBOLL: Sure. I can also answer some of your questions about the Medical Review Officer. I have been involved with the Part 26 Rule since it's inception.

MR. WARD: Okay.

MR. ENKEBOLL: So, any specific questions, from the industry's perspective, I can certainly give that to you.

MR. WARD: All right.

[Slide.]

MR. ENKEBOLL: What I have is -- we were thinking that were going to have the opportunity to make some comments when your meeting was cancelled a couple of months ago, so we had prepared a few slides, and I was just going to use those same slides.

MR. WARD: I see. Sure, go ahead.

MR. ENKEBOLL: What these slides are is essentially, an encapsulation of the NUMARC comments to the NRC in reference to Part 55.

We believe -- and I think I could almost stand here and say I rest my case. Every question that you asked about Part 55 the answer was it's covered in Part 26. I think Mr. Lange said that for every single question. Therefore, we say it's already covered, why complicate things by having a second rule?

We like to think that everybody in that utilities protected area has the same requirements on them, as far as fitness for duty is concerned, and we see no reason to single out one group and say we have more requirements for you.

MR. WARD: But that group already has a very important, unique requirement, in that they hold individual licenses.

MR. ENKEBOLL: Yes, sir. I acknowledge that. But there's nothing different that's going to happen to them because of Part 55 than would happen to them just with Part 26. All of the enforcement requirements are currently in being in Part 55. Every single thing that they're saying we need to change ot for is already there. It's already provided by existing regulation.

[Slide.]

MR. ENKEBOLL: The other problem, as you were discussing, terminology changes. What's the terminology in this one, versus the terminology in Part 26? When you have 2 rules being enforced by 2 different groups of people, that really compounds the problem onsite.

We have a strong program for trustworthiness. INPO, the Institute of Nuclear Power Operations, has a very strong trustworthiness, teamwork, professionalism program in progress. This says, hey, we're all members of the team except you guys that are licensees, you're sort of members of the team, but. It just doesn't flow in the atmosphere of supporting professionalism that these are singled out.

If you a licensed operator with all of these added requirements on you and every time a new rule comes out, like Part 26, they say, oh, we got to hit you with it separately, it would probably effect your morale.

For anyone to think that a licensed operator is going to be less concerned about Part 26 because he's a licensed operator, I think is contrary to the trust we've put in those licensed operators. So we should not single them out.

MR. CARROLL: Has NUMARC made this presentation to the Commission directly?

MR. ENKEBOLL: No, sir. We have not. The only thing we've done is we've put these comments in writing which we sent to Secretary Chilk, to reference this rule.

MR. CARROLL: All right.

[Slide.]

MR. ENKEBOLL: Part 26 says if you don't meet all the requirements, you can't have unescorted access. Licensed operators have to have unescorted access in order to do their jobs. So they meet every single requirement of Part 26.

[Slide.]

MR. ENKEBOLL: Enforcement action can be taken currently under the current regulation. It says licenses can be revoked or suspended for failure to observe any rule, regulation, or order of the Commission. So if they don't follow Part 26, they've got it. I don't see why we need a separate rule to do that.

If you violate the fitness-for-duty rule, your license can be revoked. It does require a separate regulation.

[Slide.]

MR. ENKEBOLL: It undercuts our efforts to develop professionalism. Management practices support teamwork; policies encourage professionalism for all personnel; and singling out licensed operators is contrary to those tenets.

MR. SHEWMON: Can you explain that to me? I don't understand it. It seems to me if I say all employees are equal and some are even more equal than others, that they could take that either way, that they're either a cut above, or, you insist, a cut below. And I don't understand the logic.

MR. ENKEBOLL: Every single person that is granted unescorted access to a nuclear power plant has to go through lots of wickets, as you appreciate. We are saying it doesn't make any difference whether you are the Secretary or the licensed operator; when it comes to Part 26 and fitness-for-duty, you must meet all of those same requirements. That's all we're saying.

MR. SHEWMON: If I read that, it says somehow this requirement will decrease their of professionalism and inhibit the development of that.

MR. ENKEBOLL: Well, it says you are a member of the team, except you aren't. We're singling you out. You're different.

MR. CARROLL: More important.

MR. ENKEBOLL: It doesn't say more important. It says, because we don't think you understand Part 26, we're going to put Part 55 on you so you're really going to understand it. That's what I heard said here today. And I think that's the wrong message to be giving. There is no reason for this rule. I think it's an example of regulatory overburden.

If we looked at the situation that was described, there were so many cases of licensed operators that were positive for substances during the last year. Is this Part 55 going to change that? I don't think so. I don't think it's going to make one single difference, other than it might cause some reactor operators to say this is getting too hard; every time I turn around I get another person looking over my shoulder for reasons that are beyond me. I'm already being looked over for that. Maybe I'll go look for a different line of work.

We have to worry about keeping these people doing the jobs that very few people can do. And they are professionals.

MR. WYLIE: Do you envision additional inspections and monitoring?

MR. ENKEBOLL: As always happens when you put a regulation in being, somebody will interpret those words in such a way that there are new requirements implicitly invoked by interpretation.

MR. WYLIE: So you disagree, then, with the staff's intent that it not impose additional burdens on the utility?

MR. ENKEBOLL: I just say from experience that it will impose a burden, yes, sir.

Just to answer some of your questions about the medical review officer, he is toxicologically trained only. That's the only requirement, other than being a medical officer. But his purpose is to make sure that people are not accused of being drug or alcohol users when they are not. He does not pass judgment on whether the person is trustworthy or not. The drug and alcohol programs are very specific in the drugs that are tested and the levels that are used to determine whether they are positive or negative.

What he does is, he determines, takes a positive on some drug and decides, by talking to the individual and getting that person's history, whether he is taking anything else that might have caused this to happen. And what the medical review officer routinely does is say, I can't determine whether eating poppyseed buns caused him to be positive for opiates or not, therefore he's negative and he gets off with it.

So they are there to help prevent abuses of the system, not the other way around.

MR. CARROLL: I've heard a lot in the past several years about poppyseed rolls or buns. How many do you really have to eat to test positive?

MR. ENKEBOLL: You have to eat, nominally, six poppyseed rolls. One teaspoon of poppyseeds will be positive for opiates.

MR. CARROLL: Is that right?

MR. ENKEBOLL: Yes, sir.

MR. SHEWMON: There are candy bars that I know I've gotten in Turkish stores which are poppyseeds and honey together. You might do a better job with that, or see that they aren't sold nearby, or something.

MR. WARD: Now, this is a rather different view of the role of the medical officer than at least what I understood the staff's interpretation of the role. Dave Lange, is this a fair characterization of the role of the medical officer, as you see it?

MR. LANGE: That is one of his roles, that is correct. The other role is to determine if the person has exceeded the cutoff levels and needs to be referred to the employee assistance program.

MR. ENKEBOLL: The medical review officer was established by the Department of Health and Human Services that the NRC used when they set up their rule. That was the purpose in putting it in their rule.

The cutoff levels are cut and dry. The laboratory says you're either positive or negative based on those levels. And granted, there are people that do have problems with testing, but all drugs go through the GCMS process, which is a very, very accurate system, and the levels are well above the graphs, if you will, in those test programs.

For instance, marijuana uses 100 nanograms for a screen and 15 nanograms per milliliter for a GCMS result, and a GCMS machine can detect down in the range of one or two nanograms. They then take seven standard deviations of error and add onto that and get maybe somewhere up around five or six. And to test positive is twice that number. So there is no problem when those numbers come out positive that that material was there.

The medical review officer then says, that material is there because he did something wrong, or it's there because of the interferences or what his doctor did for him.

MR. CARROLL: Then who does make the calls in controversial cases where maybe he was using marijuana, maybe he wasn't, according to the medical review officer; the shift supervisor says, hey, this guy was acting really wierd. Who decides whether we're going to forget the whole thing or we're going to do something in a disciplinary way or do something else?

MR. ENKEBOLL: The supervisor's judgment is taken into consideration, of course, to get him tested in the first place. The medical review officer will then get the specific results from the laboratory and if nothing in that sample is above spec, is positive, then he can say nothing other than maybe, we ought to send them to a psychologist or psychiatrist, maybe that's his problem.

Send him to EAP for an evaluation and when they get all of that data back, that comes back to management, including the supervisor, and they say, we looked at all of these facts and this is what we decided to do with this individual.

MR. CARROLL: So management is --

MR. ENKEBOLL: Management is the end result, but the medical review officer --

MR. CARROLL: Has an input.

MR. ENKEBOLL: -- can call it negative and management can't reverse that.

MR. WYLIE: It was stated earlier that from utility to utility that these programs for the implementation of Part 26, may vary considerably such that some programs would not cover all of the requirements of Part 26; is that correct?

MR. ENKEBOLL: That is not correct. They will cover all of the requirements of Part 26, but many utilities go beyond that and cover more than is required. Part 26 requires testing for five drugs. Some utilities test for as many as 10 drugs. There are differences.

Some utilities have cutoff levels that are less than those required by the NRC, but authorized by the NRC to be less, so there are variances, but no one that we know of

-- and the NRC has inspected about 15 utilities now -- none of them have violated any of those requirements. There have been some things done better or less than others.

MR. LANGE: I have just one question. What prompted those levels and what we've established?

MR. ENKEBOLL: the main reason was because several utilities had drug programs before Part 26 came into being and they were using levels such as 20, 25 and 50. Their lawyers told them that you are much better maintaining what you were doing before, rather than saying we now have a new level and we're going to go to that. Anybody they discharged at the lower level can then come back and say, hey you were wrong before and I want to come back in.

They said, we're going to continue doing what we're doing. One of those utilities determined that 80 percent of the positive marijuana users were less than 100 nanograms between 20 and 100, and they said, these guys are untrustworthy as far as we're concerned. We want to catch them and we want them out of here.

MR. LANGE: I guess it would be fair to say that the lower levels, they felt were necessary to determine trustworthiness and reliability of these individuals?

MR. ENKEBOLL: Yes. As you know, the chairman of the Commission has petitioned DHHS to lower the marijuana cutoff level and they are considering doing that.

MR. WARD: Any other questions for Mr. Enkeboll?

[No response.]

MR. WARD: Thank you very much.

MR. ENKEBOLL: Sure.

MR. WARD: I have one question: do you plan any -- as I guess you heard, the rule is going to be on the -- the staff's plans are to make some clarifications in the rule, but to proceed with it essentially as is and go to the Commission with it over the next couple of months. Do you plan any further attempt to influence the Commission, to get your views to the Commission on this?

MR. ENKEBOLL: I will make a report of this meeting to my management and suggest that we do that very thing. Whether we do or not will depend on them and their relationships with the Commissioners.

MR. WARD: Thank you very much. Any other comments? We are going to see the rule, I guess, in its final form, next month?

MR. KERR: Do you remember if you got any comments from Commonwealth Edison. I simply ask this because they have a large number of plants.

MR. LANGE: I believe we did, yes. I can't recall off the top of my head.

MR. KERR: I didn't see them mentioned, so they must not have been negative.

MR. ENKEBOLL: I think they fell into the categories that we talked about.

MR. KERR: Thank you.

MR. CARROLL: Am I right that I did not find NUMARC's letter in our background material?

MR. WARD: I can get you a copy if you want it.

MR. CARROLL: I'd like a copy.

MR. WARD: Could we get a copy of your slides, too?

MR. ALDERMAN: It is being reproduced now.

MR. WARD: Thank you very much. Okay, thank you again, gentlemen. Let's take a break now until 10:30.

[Brief recess.]

MR. WARD: Our next topic is Item No. 3, proposed resolution of Generic Safety Issue 29, Bolting Degradation. I will turn the meeting over to Dr. Shewmon.

MR. SHEWMON: There have been a variety of bolting problems over the last several years. In a minute here, I'll get my notes and maybe I'll end up talking without them, pardon me.

I think this started originally with regard to the seismic capability of support bolts, but it broadened as people learned about more bolting failures or corrosion from leaking fluids or counterfeit bolts or bolts that were brought to a good spec and had all the right paper on them, but still broke in service under conditions where they shouldn't have and thus, clearly, were out of spec for the spec they had been purchased to and were thought to fit.

So, in '82, was declared an unresolved or generic safety issue and the program started and the program has taken longer than these things often do, partly because the counterfeit bolt question came up after this and other things of that sort.

Now, EPRI and NUMARC have gotten together and put out a program. If any of you are interested, we can provide you with copies of these documents which go over that and this would be an adequate resolution if it was adopted with a few caveats that we'll hear about from the staff. I think the presentation today will aim at a couple of things.

One is to tell you what would be accepted as a resolution by the research people who had the lead on this. Another part of the presentation will be from NRR because the research people don't feel there's enough risk in the remaining problems to require that the applicant commit to complying with this, or they don't see it out of a cost/benefit.

NRR, on the other hand, would like to write a letter which would require a response. One of the things which is open is which way that goes. I don't think we will write a letter at this time, though we may write an intermediate or preliminary one for comments, the reason being that NRR hasn't written this letter which they propose to write and won't decide whether or not the research proposal would be adequate until sometime at mid summer.

We've got sort of half a loaf here that will be presented, as I understand it, and part of the problem will be, do we want to do anything now, or at least what our decision later will be. There has been work done on it. We have at least the start of what everybody agrees would be a solution to the problem and that's what we'll hear about today.

With that introduction, Bob Baer is the lead off.

[Slide.]

MR. BAER: I am Robert Baer of the Engineering Issues Branch in Research, for those of you who don't know me. I'll be making a large portion of the presentation today. I was going to present a little introduction, discuss the industry proposed program that Dr. Shewmon mentioned, the past ongoing NRC efforts on bolting, talk about the proposed resolution that the -- the resolution that Research is proposing and the basis for that.

Then I'm going to turn it over to Jim Davis of NRR who is going to present some additional technical information and the NRR proposed actions or action plan.

[Slide.]

MR. BAER: In the introduction, I'd like to cover, in very brief form, a few things that came up at yesterday's subcommittee meeting that had, I think, left some people confused and maybe we didn't state things very well or didn't anticipate all the questions. That's really what happened.

First of all, the scope of this issue has varied over time. As Dr. Shewmon indicated, it now includes all safety-related bolting or threaded fasteners in commercial nuclear power plants. Bolting failures have occurred in the past, and I will discuss that a little bit and so will Jim. Undoubtedly, they will continue to occur.

As these events have occurred, the NRC has issued a series of generic letters and bulletins that have required licensees to take certain actions. I'll get into that briefly during the presentation. There was a question yesterday of catastrophic failures; that is, a bolted flange or other bolted connection, whether or not these have failed or have the potential for failure.

There have been no such incidents in nuclear power plants that we're aware of, however, the risk analyses that I will discuss in summary form a little bit later, did assume that the occurrence is possible, and, in fact, as I will discuss a little later, the risk analysis ended up estimated catastrophic failure rates that are pretty clearly higher than those that have actually occurred. In terms of risk, they are a fair amount.

The basic decision that we'll be talking about today is the mode of closing out this issue. It really boils down to this: both we and NRR agree that the industry recommended program is a suitable program to resolve this issue. The question is, are licensees implementing it? We don't have any direct feedback on that.

As Dr. Shewmon indicated, we in Research don't feel that we can make a case on risk and cost/benefit analysis that would require licensees or to mandate a specific program. NRR is suggesting that, at a minimum, we go out and have licensees respond to some information gathering type generic letter which, I guess, would lead them to commit to such a program. That's the crux of the differences, really whether just informing industry of this program and suggesting it, as opposed to effectively asking them to commit to such a program.

[Slide.]

MR. BAER: I just want to briefly summarize the industry's recommended program and in some respects describe how it came about.

When this issue was prioritized and assigned to the staff for resolution, industry took an initiative to try and develop a program that would be applicable in nuclear power plants. They had broad participation by many industry groups, with EPRI sort of being in the lead. But there were nuclear owners groups involved, and they in turn involved nuclear steam suppliers and a number of consultants, and pretty much a pretty broad industry participation in developing the recommended program.

Now, I'm going to borrow, use a couple of slides that Mr. Bickford of Raymond Engineering -- I'll come back to this one in a moment -- presented yesterday.

[Slide.]

MR. BAER: And this is sort of where the industry group started from. They look at the events involving bolting degradations and failures that had occurred at the time they started working in the mid-'80s, and categorized them by the type of component. And the histogram reads better this way when you look at it, but if you're like me it's hard to read upside down or sideways. But valves were, there were 40 events in valves and I guess 20-some in anchors and supports, and the rest of the items listed.

MR. CARROLL: What's the definition of an incident?

MR. BAER: I think any case where someone reported degraded bolts or fastener. It wasn't necessarily a major leakage or anything like that.

MR. WILKINS: And it was degradation, not failure.

MR. BAER: It could be failure of individual bolts. Degradation of the joint, I guess, is how I categorize it.

[Slide.]

MR. BAER: The industry group then looked into the reasons for the failures. And as Mr. Bickford pointed out, the sum total of the reasons are greater than the number of incidents because some of the degradations were attributed to more than one cause. And you can see that loose bolts and improper insulation and joint leak, and fastener self-loosened were the major categories. And as Mr. Bickford said yesterday, it wasn't all this clear which, if any, of these were the prime culprit. And they are somewhat interrelated.

MR. KERR: What is the implication of loose bolts? Does that mean that they may never have been tightened or that they had gotten loose, or none of the above?

MR. BAER: That was one of the things that was rather unclear. But as he pointed out, when one is making up a bolted connection, as you tighten one bolt, you effectively reduce the preload on the adjacent bolts. And in many cases, this can later lead to someone finding, quote, "a loosened bolt," and then it becomes a little bit unclear as to whether it wasn't properly torqued originally, which he thinks is a major consideration.

Part of the recommended package includes a couple of bolting manuals and three videotape training films that deal with properly assembling bolted connections.

MR. KERR: Thank you.

MR. WYLIE: Let me ask you, in this slide, where is the counterfeit bolts? Is that improper design or is that miscellaneous?

MR. BAER: At that time, that wasn't an issue.

MR. WYLIE: Oh, okay.

MR. BAER: And it does turn out that NRC has put out a generic, I don't remember if it was a generic letter or bulletin, that required licensees to sampl bolts on hand, both safety-related and non-safety-rel ed. And the results were compiled. And no counterfeit bolts were found. Roughly 10 percent were out of spec, and I think about two, one to two percent were seriously out of spec.

MR. SHEWMON: But they were made in America.

MR. BAER: They weren't counterfeit. I think, Jim, you're going to be discussing that a little bit. Jim Davis will be covering some of that.

MR. WYLIE: What is the definition of bolt here?

MR. BAER: Any threaded fastener.

MR. WYLIE: Any fastener, any threaded fastener. So it could be a machine screw, then?

MR. JOHNSON: Well, a machine screw is not a bolt.

MR. WYLIE: That's what I'm asking. What's your definition of bolt?

MR. JOHNSON: I'm Richard Johnson from the NRC staff.

First of all, the broad generic term is fastener. And when we say fastener, we're talking about bolts, studs, threaded bar, cap screws, you name it. But when the man says "bolt," what we're really talking about is a fastener with a head.

MR. WYLIE: So this group is not bolts, it's everything, then. Is that correct?

MR. JOHNSON: That's the way we understand his presentation.

MR. WYLIE: Okay. I just wanted a definition.

MR. CARROLL: On your first slide -- you don't have to go back to it -- there's a category "reactor." Does that include reactor internals?

MR. BAER: I'm not sure. But I suspect so. I think there were some reactor internal problems at that time, plus certainly by that time some pressure boundary problems.

MR. CARROLL: It's not just the head studs?

MR. BAER: Oh, no. In fact, the program as prepared by EPRI really doesn't encompass the head studs, because those are so thoroughly covered in our existing requirements.

[Slide.]

MR. BAER: Let me continue with the industry program.

The output of the program has three components.

The first is a two-volume EPRI report, which Dr. Shewmon held up at the beginning of the meeting, entitled, amazingly, the same as the generic issue, since that's what they were trying to resolve, "Degradation of Failure of Bolting in Nuclear Power Plants."

In addition to that, they have some good bolting practice manuals; one for large bolts that's been published for a couple of years now, and one for small bolts that has just been published, and we just got a copy of it, but apparently, there were some printing errors, and it's going to be re-published.

And then there are these three video training tapes that I mentioned that are quite good. At least, I've seen excerpts from them, and they're pretty interesting.

MR. WYLIE: Now, in this case, you're talking about larger bolts.

MR. BAER: The video tapes or the manual?

MR. WYLIE: What you're talking about here. I assume they're calling them bolts.

MR. BAER: Well, their good bolting practice manuals cover two size ranges; one from, I think, one inch up and the other one from below one inch, and it was aimed at -- the second one, the one for smaller bolts, machine screws -- Mr. Bickford said yesterday, it was aimed at things like electrical -- things used in electrical cabinets and breakers and items like that, and the reason they -- the two manuals are very similar, if I recall correctly.

But I think he said yesterday they felt that if it was just a -- dealing with large threaded fasteners, the people that work on smaller ones would never get an opportunity see it. So, that's why they decided to have two manuals.

MR. KERR: So, in the course of their study, EPRI concluded that American industry has forgotten how to tighten bolts.

MR. BAER: Or never knew.

MR. SHEWMON: Or never knew. I think they felt that the installation of these things was the cause of many of the problems, or the proper installation, and that the training -- that they would solve their problem most effectively by working on training programs for the people who had this, to convince them it was, indeed, important, as evidenced, partly, by the number that lose bolts.

MR. KERR: That is amazing. I don't dispute it.

MR. CARROLL: Well, I think another thing that probably fits in that category is sometimes you can get stress relaxation in a stressed fastener. I've seen that happen.

I'm still a little confused. When I see "bolt" up there, I read that to mean something -- read that to mean limited to something that has a head on it or it's any fastener with threads, a stud, or whatever.

MR. JOHNSON: May I take a second and do another little job trying to clarify terminology?

"Bolting" does not mean bolts. Bolting is an act of fastening.

One can have a bolting procedure which involves studs or involves cap screws. Bolting materials also gets into this act, and one speaks of bolting materials as those steels and materials which are historically used as fasteners.

But do not read "bolting" as dealing strictly with bolts. It probably is better to use fasteners, except I don't know how to get -- I don't want to use "fastening." "Bolting" is the better terminology.

MR. CARROLL: Better than "nutting," too.

MR. JOHNSON: Well, I didn't want to touch that.

MR. BAER: The EPRI manuals and the good bolting practices and the videotape, they do cover all sorts of threaded fasteners. They cover the studs and the machine screws.

MR. JOHNSON: Yes.

MR. CARROLL: Okay. I got you.

MR. BAER: EPRI recommends development and implementation of a plant-specific bolting integrity program, and the staff, with some qualifications and exceptions, basically agrees with the recommended program.

Yesterday, at the Subcommittee meeting, Dick went through the various exceptions that are in the NUREG document we published, NUREG-1339.

I think, from memory, probably the two more -- most significant ones that I can recall is EPRI talked about this bolting integrity program for structural supports. We believe that it's equally applicable to pressure-boundary bolting.

And they talked about assuring that material that was selected wasn't, basically, too hard, and talked about the specified strength of 150 KSI, but since the material received can exceed specifications, we feel rather strongly that the bolting material ought to be limited to materials with actually strengths, yield strength, of 150 KSI.

I don't recall -- Dick, were there any other real significant exceptions?

MR. JOHNSON: Well, that's the main one.

MR. BAER: Yesterday, during the presentation --

well, let me back up a second.

As part of the EPRI program, they recommended the concept or introduced the concept of leak-before-break in bolted connections, and this was discussed in the Subcommittee yesterday, and I think I ought to clarify a few things that apparently were rather unclear during the presentation.

First of all, I'd like to point out that the concept was mentioned in the staff's regulatory analysis, but the context was apparently unclear.

In our regulatory analysis we were merely trying to say that the core-damage frequency that had been estimated by our contractor -- which, by the way, was in the range of 10 to the minus 6 to 10 to the minus 7 per reactor year -- was probably an over-estimate for several reasons, and one of the reasons was that the connections where this leak-before-break concept can be applied would probably leak and be detected and then repaired, rather than going to a catastrophic failure.

That seemed to introduce some confusion.

We had a markup -- and Al, I don't know if you've passed that out yet or not -- of page 11 of our regulatory analyses, trying to clarify that point; at least, made another crack at trying to write it a little better.

The other thing I want to do is -- we have in the handout, I guess, two-plus pages of sort of a summary of what the industry group proposed and its status and the caveats, and I'd like to go ahead and just hit the highlights of that in this presentation.

[Slide.]

MR. BAER: As I said, in their bolting -- pressure-boundary bolting report, EPRI introduces this concept of leak-before-break. We use "LBB" on these slides here. And they point out that there's similarities in bolted connections and welded connections.

These are safety-grade items in terms of the material selection, the design requirements, the pre-service inspection and in-service inspection requirements and manufacturing and construction controls, and they also point out that bolted closures tend to have implicit redundancy because of the number of bolts.

And they cite -- these page numbers are from their document, to highlight areas where they cite certain considerations and limitations.

They cite some necessary conditions, is that the leakage is safety-acceptable. In other words, the leakage itself can't -- as we understand it, can't be causing an accident, and there has to be, obviously, leak detection with margin to detect leakage before there is any sort of catastrophic failure for this concept to have any technical merit.

Also, we would like to point out that one of the actions that NRR or NRC, in total was Generic Letter 88-05 on boric acid and wastage in the reactor coolant system. This was not limited only to bolting, but to all carbon steel materials.

Licensees were effectively required to develop a program to detect leakage below tech spec limits at places where there could be boric acid wastage and the staff has done an audit of compliance and it appears that licensees all seem to have a fairly effective program in place.

But anyhow, EPRI proposed this leak before break strategy and it was proposed -- they have some acceptance criteria and they've presented or submitted to the ASME Code, Section XI this proposed code case.

The NRC staff is in substantial agreement with the concept, but there are -- there's a long -- there's a ways to go before this is approved, as indicated on the next slide.

[Slide.]

MR. CARROLL: I know, Bob, we all talk about boric acid wastage, but technically, that's not right. Boric acid is a very mild acid, you can put it in babies' eyes for example. It is not the boric acid that is causing the wastage, it is thermodecomposition products of boric acid, like perborates that are the bad stuff. I always hate to blame boric acid for something it isn't doing.

MR. MICHELSON: How hot does it have to be to have that effect?

MR. CARROLL: The chemistry of boron compounds is so complex, I don't think anybody understands it.

MR. MICHELSON: Well, it doesn't -- but you're saying though, if it's a cold water pipe, for instance, you would get no boric acid attack of the carbon steel bolting?

MR. CARROLL: I think you can form perborates slowly at room temperature in the presence of oxygen.

MR. MICHELSON: I've seen it happen at room temperature and that's why I was wondering.

MR. CARROLL: It happens fairly rapidly.

MR. MICHELSON: Yes, it gets worse.

Are you leaving that subject now?

MR. BAER: No, no, I was --

MR. MICHELSON: Excuse me.

MR. BAER: The Code Case is in the fourth revision with Section 11 Subgroup on Evaluation and Standards, and extensive review will proceed before it's incorporated, when and if it's incorporated as a code case, and then there will be NRC review before it's accepted and endorsed in our reg guide and endorsed as acceptable code cases.

So, there is a ways to go before this is an approved concept.

As written, or as proposed by EPRI, the leak before break concept cannot be applied if there is a potential for area loss in any one fastener to be very large or if a number of degraded fasteners can be very large and the total fastener area loss can be large. Large is a function of the size and they ha[illegible] of acceptance standards in their proposed code case.

MR. MICHELSON: Now, how -- do they relate that somehow to leakage then? Because it's a function of how much boric acid is getting on the bolting, isn't it, as to how fast this attack goes and how many bolts is involved?

MR. BAER: If you detect leakage --

MR. MICHELSON: Well, yes, but leakage detection, a gallon a minute, for instance, is kind of the lower limit; isn't it?

MR. BAER: Well, as I said below here on Generic Letter 88-05, the licensees were required to institute a program that would go down below tech spec limits for susceptible locations.

MR. MICHELSON: Aren't the tech spec limits about a gallon a minute?

MR. BAER: Yes.

MR. MICHELSON: Okay. So we're talking about detecting something of the order of a gallon a minute or a tenth of a gallon a minute, or a hundredth of a gallon?

MR. BAER: I'm not that familiar with --

MR. MICHELSON: Well, below tech spec limits, if that's the terminology you're going to use, you have to tell me how far below, so I can tell whether that's a minuscule amount of acid or a lot of acid.

MR. JOHNSON: Sir, a couple of things, if I may?

One of the things that has to be done is that the joint must be made leak tight. Now, the question of where this cut off is going to be, as far as amount -- leakage detection. We're not prepared to tell you what the code is considering right now. As a matter of fact, yesterday we had a conversation with Dr. Cipolla, who's the Chairman of the working group that's putting this into the subgroup in Section XI.

He said that they have prepared a -- I'll call it a white paper, a technical back-up paper to the Code Case. When I mentioned that I hadn't seen it, he said, "consider it in the mail." So, but -- and I'm sure that that will have to be one of the considerations.

As I said to you yesterday, one cannot apply a leak before a break concept without first having established leak detection capabilities.

MR. MICHELSON: But at what level is still the question and you haven't really told me what level yet.

MR. JOHNSON: We, frankly, don't know what the -- what the ASME code is considering.

MR. MICHELSON: Well, is it practical to get much, you know, can you detect a hundredth of a gallon a minute out of a reactor coolant system?

MR. JOHNSON: Well you can always see small amounts, if they just wet the insulation for example.

MR. MICHELSON: But nobody is around to see wet insulation and, first of all, experience indicates that the insulation doesn't get wet.

MR. JOHNSON: You are going back to the assumption that there's no leak detection. When I say that someone's going to see it, that's part of the leak detection.

MR. MICHELSON: We're talking about inside of containment during normal reactor operation now, aren't we?

MR. BAER: Well, I've certainly seen LERs, Carl, where people have reported and shut down the leaks --

MR. MICHELSON: Oh yes, but also there are plenty of reports wherein they removed insulation for other reasons and found enormous amounts of borated crystals on the equipment and didn't even know it until then.

MR. JOHNSON: They've also found --

MR. MICHELSON: 500 pounds of it in one case. So, you're not very convincing if you're telling me that, first of all, they have to be leak-tight. If they're leak-tight there's no problem. If the joint doesn't leak, I'm not worried.

MR. JOHNSON: The Code Case is intended to apply when leakage has occurred. So that's a stipulation. The Code Case only applies -- that is the ASME Code Case will be only applicable to those cases where leakage has occurred. Therefore, there must be, as a precursor, leak detection, by definition.

MR. SHEWMON: You know, we keep arguing about this and it -- I keep trying to come back to saying, what's this going to buy them? We aren't taking out pipe whip restraints like we used to be when we were worried about leak before break and piping. There isn't a code approved inspection program, and presumably, they're going to use this somehow to get relief from this, except they're going to have to take -- partially disassemble, at least take the insulation off to see whether there's boric acid crystals there and it's been leaking. If they find them, they're going to repair it anyway. So, I get confused. Can you help me?

MR. JOHNSON: There are some systems where insulation is not a problem, where there may not be any insulation. If you look at the -- if you look at the ASME Code and the -- in Section XI, as a requirement of complete disassembly when leaks had been detected and what this will do -- you're asking -- your question is "what will it buy the licensee?" The answer is it will buy him a simplified inspection and disassembly procedure and less personal exposure.

MR. SHEWMON: So, if he takes it down -- takes the insulation off and can see no evidence of a leak, then he can forego a more detailed inspection under this code case? Pardon?

MR. JOHNSON: Yes, I'd say, that's what it says to me, yes.

MR. MICHELSON: What does he do presently? Presently there's a requirement to disassemble on a certain periodic basis? I'm not sure --

MR. JOHNSON: Presently, the Code requirement is one of inspection of the bolts themselves --

MR. MICHELSON: Right.

MR. JOHNSON: -- on a routine basis, whether there is leakage or not.

MR. MICHELSON: But that's once every -- third of them every --

MR. JOHNSON: It depends on --

MR. MICHELSON: -- every couple of years.

MR. JOHNSON: -- depends on the system and whether it's Class 1, 2, 3. It's part of the ISI Plan, and that's complicated.

MR. MICHELSON: Thank you.

MR. CHERNY: Frank Cherny from Research. Let me try.

You're supposed to do -- for these Class I bolts as it is currently written for, you're supposed to do, periodically, a volumetric inspection of these bolts if they're larger than 2 inches in diameter.

Now, the Code currently permits you to do that volumetric inspection on a given joint in place without disassembling the joint. You're also supposed to do a periodic visual inspection.

One of the acceptance criteria for a visual inspection is that if you find some kind of leakage, you're supposed to disassemble that thing and take some kind of action to fix whatever it was, okay.

What you're buying with this Code Case, supposedly, is a procedure so that if you have detected some kind of leakage on such an inspection, you won't have to take the joint apart, okay. It gives you a procedure for continued operation without disassembling the whole joint until whatever your next inspection interval might be. That's basically what it's buying you.

MR. SHEWMON: Let me ask a different question here, and Carl may come back with another one. I have great difficulty knowing how one will be able to predict any of those things called A, B, and C, because it seems to me if you've got a gasket which is leaking, there is no way you can assure ahead of time, whether it's going to leak right on one fastener or whether it's going to leak on several of them. Can you show me or tell me why I'm confused or misreading that?

MR. CARROLL: You're talking about 12-A, B, and C?

MR. SHEWMON: 12-A, B, and C, yes.

MR. CHERRY: I'm not sure if we have the latest version here. I think Dick said it was being mailed. I think one of the things he said on the phone the other day was that one of the provisions or qualifications that they've put -- and this thing has gone through several iterations in this committee already -- but one of the things that's in there right [illegible]s, you know that this joint has been leaking because you can physically see some evidence of it.

You are supposed to make that joint leak-tight before you continue to operate the system. The leakage that has been occurring is not supposed to continue. Now, I don't know what they have done in terms of arguing or debating in that committee about how they are going to do that.

We didn't get into that level of detail.

MR. SHEWMON: So they must make it leak-tight and this is whether they have to completely disassemble and replace fasteners?

MR. CHERRY: The leakage is not supposed to continue.

MR. SHEWMON: It's not in force yet, but it may be some day, years in the future?

MR. CHERRY: Right. Right now, it's only for Class I.

MR. CARROLL: Is it possible that a way of doing this would be to pump it with Fermanite?

MR. SHEWMON: The expert here yesterday said that in 20 years at looking at bolted joints in a lot of different industry systems, the only one he had ever seen fail catastrophically was on in the petrochemical industry where they had put Fermanite in it and it did its job and it blew all at once because it quite leaking.

The NRC apparently has not prohibited that, though some of the staff members would like to see it written in as good practice.

MR. CARROLL: All right, then I can't see any way of accomplishing this, short of taking the thing apart, which is what you are presently required to do.

MR. BAER: That may be why it's four iterations in the subcommittee and it hasn't come out yet.

MR. CARROLL: If you've got a bad gasket on the flange or --

MR. CHERRY: One way of handling this might be, depending upon what's causing the leakage or what they think is causing the leakage, might be to tighten the bolts up more. They have to do a system pressure test before they start the plant back up anyway. That could be inspected and they coudl see if it's leaking under the pressure test, without actually taking it apart.

MR. CARROLL: In the real world, though, I know everybody tries to tighten.

MR. CHERRY: You're talking about things that this committee is supposed to be considering while they're writing this thing, okay?

MR. SHEWMON: This committee refers to?

MR. CHERRY: The code committee.

MR. SHEWMON: Okay, go on.

[Slide.]

MR. BAER: Well, the last line was really pretty much what Dick and Frank said. The intended advantage of this would be some sort of reduction in the normal requirements, once a leaky connection has been found and the repair process supposedly would be simplified and personnel exposure decreased.

I'll be honest and tell you that I don't fully understand it either, because the one event that I'm familiar with that I thought got closest to introducing a real problem with threaded fasteners was something that happened at Maine Yankee in '81 or '82 on a steam generator manway on the primary side where they had retightened and Fermanite'd twice and retightened -- I guess, tightened, Fermanite'd, it still leaked later. Sometime later, they retightened, re-Fermanite'd and then finally disassembled it and found a lot of degraded bolts.

That ended up in the action of Bulletin 82-02 which required a continuing program that whenever they pulled something apart in the reactor pressure coolant boundary, the licensees are committed to inspecting the bolts. It was at that time that members of the staff were pushing for banning Fermanite, but we weren't --

MR. CARROLL: No, you couldn't run a power plant without it.

MR. BAER: Those members of the staff that knew enough to have an opinion -- and I won't put myself in that category -- didn't prevail, anyhow. Let me talk a little bit about the NRC actions that have been taken since this issue has been prioritized.

[Slide.]

MR. BAER: As I stated in the introduction, the staff hasn't sat back as bolting problems occurred during this resolution process and done nothing. In total, 7 bulletins and two generic letters and one circular that effectively required certain licensee actions have been issued since about '85 when this issue -- no, '82 when this prioritized.

In addition, there have been 11 information notices to inform licensees of problems. Some of these information notices did later lead to bulletins or generic letters. As a result, -- well, I'll get to that.

The impact of these generic communications certainly were to chip away at the problem and, in our opinion, have reduced the remaining risks to a pretty low level. Most of the bulletins -- most, but not all of the bulletins and generic letters, focused on the reactor coolant system, but not all of them.

In addition, the staff has taken action on USI-A-46, seismic qualification of equipment in operating plants, to require licensees to address the adequacy of equipment anchorages for equipment needed for safe shutdown in the event of an earthquake up to and including the SSE. Many of these anchorages involve threaded fasteners.

Furthermore, the staff is requiring individual plant examinations for external events and this will address adequacy of equipment anchorages for seismic events beyond the SSE as part of that effort.

In conclusion, the staff, or at least the Research portion of the staff -- I guess I ought to really talk about Research -- we judge that action has been taken on bolting events that were judged to be safety-significant and that the residual safety issue appears to be small. To support that last statement, we've been going through LERs. Well, Dick Johnson, since the early 80's, but for the last four years, I have been on the distribution list for LERs and I screen them all and pass them on to people in my branch, depending in the subject.

We haven't seen an LER on bolting that was very significant, in the past four years. Because of some questions that came up yesterday, I took some time late in the afternoon and the evening and looked through the Oak Ridge Precursor Report where they, every year, -- up to '89; they haven't published '90 yet -- look at all the LERs and calculate a conditional probability and then summarize -- list these in order of rank -- well, ranked several ways, and in one table by conditional probability.

I looked through those for the years '85, 6, 7, 8, and 9 for the events that have conditional probabilities of 10 to the minus 6 or greater for core damage and the word "bolting," or "threaded fastener" does not appear in any of those. From our point of view, it does not appear that a very safety significant issue -- partially, or maybe largely because of the actions that have already been taken.

[SLIDE]

MR. BAER: The would like to on to my last slide before I turn this over to Jim Davis.

We'd performed a regulatory analysis, trying to judge whether some additional requirements could be justified.

As I said yesterday to the subcommittee, we started with a prejudice that we ought to be able to find something.

We ended up concluding that the regulatory analyses were essentially pretty inconclusive. That is, that they didn't seem to satisfy both of the backfit requirements of demonstrating a substantial reduction of risk and, of course, beneficial action that we could clearly define.

That's not to say that, uh, we do feel -- I guess this is more gut feeling than PRA -- that licensees ought to have a Bolting Integrity Program and take all the existing requirements and the suggested good practices and put it together in a single program dealing with, for the fasteners.

But we can't conclude that we could justify this based on the data we see. For example, and this is sort of what I promised earlier, to talk a little bit about, the risk analyses and the probability of catastrophic failures.

One of our contractors some years back, about '85, tried to estimate the probability of a LOCA based on fastener degradation within the reactor coolant pressure boundary.

They took the existing events, then applied some factor- `nd tried to estimate the probability of a small LOCA. In other words, if these fasteners fail without having been previously detected and the plant shut down.

A good estimate was such that -- well, it was four times ten to the minus three per reactor year to the bolting failures.

If you think about that with a hundred plants, or 110 operating, you'd expect based on that to see a small LOCA every two years.

Obviously, we haven't seen that in the last five or six years since this happened, where you'd now expect to see two or three small LOCAs.

But, even with that relatively high, apparently high, estimate of the probability of a small LOCA, and certainly there is a probability or a chance that that number is still correct and we've just been very luck.

But, even with that probability of a small LOCA, the core melt probability is only in the ten to the minus six or a ten to the minus seven range.

So, when you start off with assumptions that appear to be, or an estimate, that appears to be conservative and you end up with a risk that is pretty low, it's hard to make a very good case that further action is needed.

MR. CARROLL: Did they define LOCA as with any leakage or leakage beyond normal makeup capability?

MR. BAER: Normal makeup capability.

MR. CARROLL: Beyond that?

MR. BAER: Beyond that, in order to do that risk analysis. I mean, they -- it's an old report and it's not absolutely clear. But it's pretty clear that they postulated LOCAs at a certain frequency and then went through people's PRAs to estimate the core melt probability.

MR. MICHELSON: The probability of catastrophic failure of bolted joints was in the PRA?

MR. BAER: Yeah. In the sense that they were predicting a probability of a small LOCA --

MR. MICHELSON: Well, let me say it differently. The components which could experience such catastrophic failure were identified in the PRA and the probability of, for instance, a flange becoming unzippered was in the PRA?

MR. BAER: Not --

MR. MICHELSON: Pipe break is in the PRA, and not failure of flanges.

So, I think what you have to conclude is --

MR. BAER: Carl, you never give me a chance to answer the question.

MR. MICHELSON: I was going to say --

MR. BAER: They adjusted the pipe break probability to add this other factor due to flange failure, or bolted connection failure.

MR. MICHELSON: That was explicitly done?

MR. BAER: Yes. That was the delta of four times ten to the minus three, or 4.4 times ten to the minus three, was the delta for small LOCAs due to flange failures.

MR. MICHELSON: What was the number they used, then, for probability for catastrophic failure of bolted closures.

MR. BAER: They up'd the estimate of LOCAs, particularly small LOCAs.

MR. MICHELSON: Yeah. Clearly, they up'd the estimate. But what was the number then? What was the probability of the failure of a bolted closure versus the failure of a pipe, which is what I'm really searching for.

MR. SHEWMON: Well, flange joint was four times ten to the minus three, wasn't it? That's it, then.

MR. MICHELSON: Well, that's pipe breaks.

MR. SHEWMON: That was a flange joint.

MR. BAER: No. They took the pipe break number. I don't recall. I don't know if I have a copy of it right here. We looked into that yesterday.

I think the pipe break failure was somewhat -- I think it raised the total probability of a small LOCA from something like two times ten to the minus three, r -- no. I don't want to do it from memory.

MR. SHEWMON: But you said that the number they added failed flange joints was four times ten to the minus three?

MR. BAER: Right. Actually, 4.39. I hate to quote that many quote that many significant digits.

MR. MICHELSON: That was the number -- that was what I was asking. Fine, thank you.

MR. BAER: Okay. Never mind, T.Y. I guess he's got the answer.

MR. MICHELSON: I've got the answer.

MR. BAER: As I said earlier, with some qualifications and exceptions, both Research and NRR endorsed the industry-proposed Bolting Integrity Program as a basis for resolution of GI-29. The question really is, are licensees implementing the program?

The qualifications and exceptions are in NUREG-1339, which if we published an information type generic letter -- which I will talk about in a minute briefly -- would be an attachment to that letter.

I do also want to point out that EPRI program is fairly general. It's essentially good practices, and talks about the Bolting Integrity Program where all the requirements and good practices associated with bolting would be collected into a single program. But it doesn't really represent additional new requirements.

No matter what action is taken response to Generic Issue 29, industry and or licensees would still continue to be committed to the actions that they committed to in response to bulletins and generic letters. Research is also part of a close-out effort and, as recommended to NRR, that they develop a new SRP section for safety related bolting to apply for future plants.

This would be largely codifying existing requirements and making sure that things that have been learned over the years associated with bolting are not lost when all us old guys retire. Old guys like Dick Johnson and T.Y. Chang,

[Laughter.]

MR. BAER: Well, it's a consideration. It's a consideration. The fellow in NRR that followed bolting for since I've been here, I guess, Dave Sellers, just retired recently. We're going to see more of that, that are in-house expertise. A lot of things that are in people's minds may not be written down for future reviewers.

Anyhow, Research proposes issuing a generic letter for information. It would include, as I said before, NUREG-1339 as an attachment that would inform industry of the EPRI program, suggest that they have a Bolting Integrity Program, but would not require a specific action.

On the other hand, NRR is proposing to develop and then issue an 5054(f) request for information type of generic letter. The staff would certainly like to buy some guidance from ACRS, and to point out that the issue is very judgmental as to whether requirements can be mandated or not.

Speaking just for myself, if I put on my regulatory hat, yes, I would like to see licensees committed to such a program. But, if I put on my look at what I'm supposed to bring forth to this Committee and CRGR, to propose such an action I don't think the risk numbers justify it.

MR. CARROLL: Just to better understand the risk numbers, did you say earlier, Bob, that you excluded reactor vessel head studs from this consideration, because it's covered elsewhere?

MR. BAER: Yes.

MR. CARROLL: So when we're talking risk, we're talking risks of all closure failures or bolting failures except for head coming off the reactor?

MR. BAER: As far as the reactor coolant system.

We did a. ,ther quickie study trying to look at threaded fasteners outside the reactor coola.. ,ressure boundary. And the conclusion was that the risk was associated with seismic events, and bolting that might affect the emergency power system -- diesels, electrical cabinets, service water to the diesels. And that showed to be a fairly high risk. But it was quite unclear that fixing threaded fasteners would impact that risk very much. I mean, there's a lot more associated with the seismic risk than just threaded fasteners. And again, the PRA seemed to be rather inconclusive.

MR. SHEWMON: Any questions?

MR. MICHELSON: Yes. You gave us a markup to Page 11 of the regulatory analysis, which ؘems to indicate clearly that the staff is considering leak-before-break only for reactor coolant pressure boundary situations. Is that correct?

MR. BAER: We would have to see what the code case came out. What we were trying to say here, and we did a quick markup. The markup obviously was done, well, it was done this morning, after some discussion yesterday afternoon among ourselves, because we saw that the words were fairly unclear.

What we were really trying to say in the reg. analysis is that we think joint failures and catastrophic failures in the reactor coolant pressure boundary is pretty unlikely in that what was used in the PRA and on the previous page, we talk about the low risk numbers. We go on to say that we think, if anything -- you can see the first couple words -- these are on the high side, and for several reasons, including the fact that these flanges would most likely leak before they would break.

MR. MICHELSON: Let me save you part of your argument, because, as you recall yesterday, the question really wasn't raised about reactor coolant pressure boundary; it was raised about Class 3 piping, for instance, things outside of containment. And it was pointed out, the only place you were clear was in here.

I think the original words were good enough as far as reactor coolant pressure boundary. What was unclear to me is whether the staff also endorses leak-before-break outside of containment.

Now, that hasn't been settled a bit, because you're endorsing Section 3, you're endorsing the entire EPRI document, with certain exceptions listed in 1339, and this is not one of the exceptions. So I have to conclude you're endorsing leak-before-break outside of containment, unless you take exception to it in the generic letter.

MR. SHEWMON: Endorsing it for what, Carl?

MR. MICHELSON: Endorsing the use of the leak-before-break concept for threaded fasteners.

MR. SHEWMON: To do what? Everybody would like to inspect for leaks. It's a very useful way to look at it.

MR. MICHELSON: It has nothing to do with inspecting for leaks. It has only to do with the risk of catastrophic failure of such things as valve bonnets.

MR. SHEWMON: Well, how is it that they're proposing to use this to get relief from some other requirement they now have?

MR. MICHELSON: The staff isn't proposing it, EPRI is proposing it. The staff did not take exception to it.

MR. SHEWMON: To get relief from what?

MR. MICHELSON: To get relief from whether or not you postulate such failures. EPRI tried to argue that you don't have to because they looked at a 16-bolt and a 20-bolt configuration and said it appears to be a nonproblem. And I don't have any problem with that. What I asked them is, have you looked at motor-operated valves.

MR. SHEWMON: So the concern is whether we would have catastrophic failure of bonnets of valves?

MR. MICHELSON: Of motor-operated valves. And that was the whole argument yesterday, and I don't see where you've answered that. Apparently, you're still endorsing leak-before-break outside of containment.

MR. MINNERS: No, sir.

MR. SHEWMON: They're not endorsing leak-before-break for bolted connections anywhere. They're also not endorsing instantaneous failure, though they postulate them, as he said when he starts.

MR. MICHELSON: I'll read Page 6 of your generic letter in which you say that you reviewed 5769 and that you endorse its findings, except for those things listed in Section 3 of 1339. And I read Section 3 of 1339 and I don't find this as an exception. Therefore, you have said you endorse it.

MR. MINNERS: I'm not sure -- I have to go back and read the report -- I'm not sure that leak-before-break is one of the findings in that report. That may be one of the bases for that report they assert, but I'm not sure that's one of the findings.

MR. MICHELSON: Of the EPRI report.

MR. MINNERS: And if that's the case, then we'll change the generic letter, because that's not what we mean.

MR. MICHELSON: Okay. Well, that's all I asked yesterday, was make it real clear you don't intend to apply leak before-break to bolted connections outside of containment. That's all.

MR. MINNERS: Well, now you get imprecise, Carl.

MR. MICHELSON: Not imprecise; outside of containment is a rather precise term.

MR. MINNERS: Let me explain why I don't understand what you're saying.

When you say "apply," that's kind of a vague word, okay? In the regulatory analysis, we give credit for leak-before-break. Do you call that apply?

MR. MICHELSON: Well, for instance, yes.

MR. MINNERS: Well, okay; I don't. Fine. I'll accept your definition. We do give credit for leak-before-break in the regulatory analysis. Now, in the regulatory requirements, the requirements for inspecting bolted connections, we don't give any credit for leak-before-break, yet. There's a code case going through which may change that. And it'll go through the usual code case approval procedure. And until that happens we don't approve it for regulatory use.

But regulatory analyses are supposed to be best estimates. We get criticized by the committee for over-estimating the core melt frequency, so we're trying to make the best estimate. Now, if it's not the best estimate and people think technically we've made not the best estimate, we'll change it. But we think that leak-before-break is a best estimate of what would really happen.

MR. BAER: In fact, we didn't even change the predicted core melt frequency; we really just pointed out we think it's on the high side for several reasons, that being one of them.

MR. MICHELSON: So you've made a regularity analysis of these situations outside of containment, including the motor-operated valves?

MR. MINNERS: No. As we told you yesterday, we've made no explicit calculation of outside of containment.

MR. MICHELSON: So you drew the conclusion without doing a regulatory analysis, then?

MR. MINNERS: I think that's probably --

MR. MICHELSON: And I find that unacceptable, myself. I'd like to read the regulatory analysis that draws the conclusion that this is okay, and then I'd look at the analysis and be happy.

MR. MINNERS: I'd agree with you there, Carl. I think we omitted something from the regulatory analysis. I tell my staff never to leave blank spaces, and here's an example of where we left a blank space, and I think we can get criticized for that. We should have had some basis for saying you don't have to worry about outside of containment.

MR. MICHELSON: That's all I asked for.

MR. MINNERS: I think people do. But it's certainly not written down.

MR. SHEWMON: Let me interject also, for the rest of the committee at least, that Carl has this concern, but that Bickford says in 20 years of paying a lot of attention to bolted joints, he had never seen a catastrophic fa lure of the kind that Carl is postulating and is concerne about in his experience, except for this one that somebody pumped full of Fermanite, which did go.

And so I think one can conclude that the odds of this are extremely low. Whether or not anybody does an analysis to come to that conclusion I personally find less comforting than what people have found from experience.

MR. MICHELSON: Well, experience is generally not reported unless people got killed. In that case, somebody got killed so it became a court case, and then he became aware of it.

MR. SHEWMON: It would be certainly reported in a nuclear power plant, even if you didn't kill somebody.

MR. MICHELSON: Oh, in a nuclear power plant, yes. I'm not saying this happened in a nuclear power plant.

MR. SHEWMON: But there's been a lot of motor-operated valves that go up and down fairly regularly.

MR. MICHELSON: We're beginning to learn more and more about what the margins are.

MR. SHEWMON: Can we move on to Mr. Davis now?

MR. BAER: I would like to make one other point. And I realize, Carl, you're worried about changes that would be made to certain valves as a result of generic letter 89-10. But we did do an LER search yesterday and this morning, and we could find no evidence that a valve bonnet has ever failed.

MR. MICHELSON: Oh, I don't think anybody's ever claimed that. No.

MR. SHEWMON: Good, we all agree. Now, was there another comment over here, or question? Hal?

MR. LEWIS: I just have one question. I think Warren said that in the regulatory analysis, I think you said that in the regulatory analysis, credit was taken for leak-before-break. I wonder how? Was it done by reducing the probability of core melt for every sequence that begins? How was it done?

MR. MINNERS: The contractor did a calculation and got some numbers and we said we thought that those numbers were a high estimate of the core damage frequency for a number of reasons, one of which is we thought that leak before break would reduce that frequency.

MR. LEWIS: So you took it into account by essentially influencing your contractor to reduce some numbers that you thought were too high?

MR. MINNERS: No. We didn't reduce the numbers. In our regulatory analysis we commented on the numbers and I asked my staff all the time to try to make an assessment of the bias in any core damage frequency estimates.

MR. LEWIS: Okay, so it is roughly the way I thought. That is to say that the probability of core melt given the event was simply reduced by --

MR. MINNERS: No, he thought it was conservative.

MR. LEWIS: By what?

MR. MINNERS: All we said that we thought, pardon the expression, it was conservative.

MR. LEWIS: Okay, so that's what you mean by taking it into account.

MR. MINNERS: Yes.

MR. LEWIS: I am trying to find out what you mean by taking credit for it.

MR. MINNERS: Taking it into account -- it's a very vague thing, that's right.

The numbers are calculated strictly, directly so when you look at the value-impact ratio, that was based on the contractor's numbers.

MR. SHEWMON: Can we now move on to Mr. Davis?

MR. LEWIS: I was just trying to understand what he meant by saying credit. I found out.

MR. SHEWMON: Good.

[Slide.]

MR. DAVIS: I am going to present the NRR position on Generic Issue 29. I am going to talk about safety significance, give you the NRR proposal and the NRR Action Plan.

MR. CARROLL: We would also note for the record that NRR, unlike Research, gives us a page with the presenter's name and phone number and all that good stuff.

MR. MICHELSON: They also staple their slides in the upper right hand corner.

MR. SHEWMON: Please proceed!

[Slide.]

MR. DAVIS: Bolting in structural applications is highly loaded under faulted and accident conditions, degraded, loose or missing bolts may result in a system failure.

Bolting with manufacturing defects may cause system failure.

There's a recent case where we had a large number of U-bolts that had quench cracks in them in the condenser ice basket system.

If there was a steam accident, these ice baskets could be ejected and be a missile coming out.

MR. SHEWMON: Did that show up in an LER? How did you learn about that?

MR. DAVIS: Well, I am directly involved in it. I am the lead engineer on that project.

MR. SHEWMON: But it was an LER?

MR. DAVIS: There was an LER.

MR. SHEWMON: Fine, thank you.

MR. DAVIS: Then, counterfeit bolts.

From a small sample, no counterfeit bolts were found.

Ten percent were out of spec and one percent of the overall population were seriously out of spec.

MR. WILKINS: How small is small in your small sample?

MR. DAVIS: I don't know exactly how small it was but it was not a large sample.

MR. BAER: Each licensee had a --

THE REPORTER: I'm sorry. Mr. Baer, could you use the mike, please?

MR. BAER: I believe each licensee had to test the sample of ten safety related and ten non-safety related fasteners on hand and so it would be about a thousand of each for all the plants -- each plant, I guess, had to do that.

MR. WILKINS: And that is the fraction that is perceptibly less than 1 percent?

MR. BAER: I am sure far less.

[Slide.]

MR. DAVIS: A given type of bolting may be used on a number of components.

This would be like 410 stainless steel on the internals of Anchor Darling check valves that were heat treated at too low a temperature and were suffering stress corrosion cracking.

Then this one I think has been covered.

If you did have wastage of a large number of bolts you could get unzippering but it's very unlikely that it would occur.

MR. MICHELSON: When you say "very unlikely," do you have some kind of a probability number?

MR. DAVIS: Well, it just has never occurred before in the nucl plants, so --

MR. MICHELSON: I know. What's the probability of it becoming unzippered?

You say it is not zero. It is a finite number. Do you have some feeling?

MR. SHEWMON: There's a thousand reactor years and there's how many bolts and multiply them out.

MR. MICHELSON: I just asked him for the bottom line.

MR. SHEWMON: He doesn't have one.

MR. DAVIS: I don't know what the probability number is.

MR. SHEWMON: You just think it's low?

MR. DAVIS: It's very low, based on experience.

[Slide.]

MR. DAVIS: What NRR would like to do is issue a

50.54-f Generic Letter.

Are he licensees implementing a plant for bolting similar to those suggested in the EPRI manuals, NP-5067, Volumes 1 and 2 and these are the titles for them.

MR. CARROLL: That would be the essence of the Generic Letter?

MR. DAVIS: Yes, just information gathering. Are they implementing the program?

MR. KERR: And what would you do with the information?

MR. DAVIS: We would write a report on summarizing the --

MR. KERR: And the report would increase reactor safety significantly?

MR. DAVIS: I don't know exactly how to answer that but we would find out if people are implementing the plans.

MR. SHEWMON: If you look at his last slide, Bill, you'll find that indeed once he had the responses they would know what their future action was with regard to this, whether or not this generic issue is closed.

MR. KERR: So we would permit them to close to not to close a generic issue?

MR. MINNERS: Well, Jim's a novice here and he's not used to these arguments we go through but I don't want to let it pass that --

MR. WILKINS: Lucky guy!

MR. MICHELSON: -- that only Generic Letters that actually improve safety should be sent out.

The Commission I believe has a mission to not only keep safety good but also to provide assurance to the public that it is good, so a letter that improves our assurance of safety but doesn't do a thing about safety I think is part of our mission.

[Slide.]

MR. DAVIS: The Action Plan that we have come up with is to do an LER search and this has been completed.

Then there is an issue of a receiving inspection to certify that the bolting material is what it is supposed to be and this is being handled by the Vendor Inspection Branch of NRR.

Then the Generic Letter to assess the industry implementation of the EPRI manuals, and then assess the need for future action.

MR. KERR: What would indicate a need for future action?

MR. DAVIS: If there is widespread lack of implementation of any type of program for bolting.

MR. KERR: What sort of future action would you foresee?

MR. DAVIS: It could be a requirement that they put a program in, which we would like to avoid, as Bob said.

If they refused to put in a plan, then we have to insist that they do.

[Slide.]

MR. DAVIS: The LER search was conducted from '84 until the present, which included LERs up through September of 1990. 349 incidents were reported, although not reported as bolting failures, they're normally reported as a leak or some other type of failure, and the root cause then comes down to be bolting failures. So, you may not capture every bolting failure looking at the LERs in this manner.

The common incidents were: stress corrosion cracking; boric acid corrosion; vibration loosening, this is primarily set screws inside of valves, that then led to damage to the valves, sometimes significant damage.

Loose nuts, and this was due to improper or no torqueing instructions; missing bolts, and this was improper, no installation or inspection requirements for the bolts. In some cases, for seismic safety, all the bolts were left out, none of them were installed and they weren't discovered until sometime later.

Improper design or material and then counterfeit bolts. If you look at the --

MR. WILKINS: I find it interesting that this group is called "common incidents." Yet you didn't find any counterfeit bolts.

MR. DAVIS: Well, counterfeit bolts has been an issue and we know that they have existed. It's just that when you sample 10 bolts, 20 bolts out of each plant --

MR. WILKINS: That is suggested on some other time you did some sampling or you did some looking and you did find some counterfeit.

MR. DAVIS: Yes, I believe they have been found in the past.

MR. CATTON: What is a counterfeit bolt?

MR. DAVIS: It's a -- a counterfeit bolt is a bolt that does not meet specification and there's a definite intent not to meet specification.

MR. SHEWMON: It has a stamp on it that says it meets this code, but it does not.

MR. DAVIS: It says Rolls Royce on the front, but you'd swear it was an Escort.

[Laughter.]

[Slide.]

MR. DAVIS: The reported incidents, by year, '84 being the first year, I may have missed some of those, but -- and this only three-quarters of the year, so you see it's probably going to end up about here, so there's really been no change in the number of reported incidents since '84 in bolting failures.

That's why we would like to see what they're doing to improve this performance.

MR. CARROLL: Now, you use the term "failure," but you really mean incidents?

MR. DAVIS: Incidents, really. Yes, you're right. A missing bolt I consider a failure, but it's probably more like an incident.

MR. KERR: What would be an acceptable number?

MR. DAVIS: Zero would be acceptable, but they'll never reach that.

I would just like to see the trend going down rather than staying level.

MR. CARROLL: Forever?

MR. KERR: You can't expect it to go down forever. I just wondered what you would feel comfortable with?

MR. DAVIS: I don't know, I would feel comfortable if it showed an improvement. I would even take a step improvement and then level.

MR. KERR: But if 40, for example, or 50 is as low as you can expect to achieve without some outrageous expenditure, maybe you're already there. I just wondered how you would judge when enough had been done?

MR. DAVIS: The type of incidents bother me though, that you can have missing bolts on support equipment but no inspection.

MR. KERR: I agree, in an ideal world or maybe in heaven, you wouldn't have this happening. But, we aren't in this situation and we have not -- where is it when one stops worrying about this and worries about something else.

MR. SHEWMON: Can't he say he would like to improve from what he feels is an unsatisfactory situation and why do you have to have an end point 10 years from now?

MR. KERR: He didn't say it was an unsatisfactory situation. He said, "I would like to see it improve." And I wondered why he would like to see it improved?

MR. DAVIS: We have had a big effort by EPRI to tell them -- give them guidelines. They are treating their manuals as a maintenance document. I would like to see those implemented. Maybe this is all the better we can do, but --

MR. JOHNSON: May I address this question for a moment? I'm Richard Johnson.

One of the things that I do from time to time, is scan the reports on the 10-year in-service inspections that are sent in by licensees. They're documents that sometimes stand oh, 6 to 12 inches high in terms of paper. So, when I say scan, I mean that literally, flipping through very quickly.

Usually within those documents there are a group of papers that are forms which have to do with repair and replacement. I noticed that, as my -- using my mind as a computer, that it looks like, from time to time, somewhere between 15 to 30 percent of the repair and replacement items have to do with fasteners: nuts, bolts and things like that.

Now, you ask, what would be an acceptable thing on these incidents? I, personally, would like to see those problems with threaded fasteners that result in licensee event reports, reduced to almost zero, but that still means that we're going to be seeing things turning up as a result of the inspection -- in-service inspections, and I think that will continue. That -- that I doubt that will be reduced to zero.

I think that a properly implemented bolting integrity program would, indeed, result in near zero LERs and probably continue at a sizable fraction of repair and replacement items on the 10-year ISI programs.

MR. BAER: I would like to add something to what Dick Johnson said, is that as USI-A46 program gets implemented and people are required to do the walk-downs and look at the anchorages, you are going to see, as far as the missing bolts, which is I think a problem on that equipment, more LERs. Because those are the sort of things that would show up in LERs.

So, I wouldn't be surprised to see a -- an increase in LERs for a period of time as USI-A46 were implemented. But then, yes, I think the goal ought to be that there should be relatively few LERs associated with holting.

MR. WARD: Has your question been answered, Bill?

MR. KERR: It must be in there somewhere?

[Laughter.]

MR. WARD: I didn't hear it. I was just wondering.

[Slide.]

MR. DAVIS: The action plan proposed by NRR is to issue the draft generic letter on February 1st. Go through a NRR management review by March 1st and meet with GRCR in April and issue the letter in May, review the responses in September and then determine future action in the middle of September.

MR. MICHELSON: It isn't clear where we are at. We have a proposed generic letter and an actual generic letter from two different offices. Where do we go from here? What's going to happen next?

MR. MINNERS: We're going to go to CRGR.

MR. MICHELSON: With your version?

MR. MINNERS: Well, with both.

MR. MICHELSON: With your generic letter?

MR. MINNERS: With both.

MR. MICHELSON: With both generic letters?

MR. MINNERS: Yes, I think they're going to stand up and say what they want to do, and we're going to stand up and say this is what we want to do.

MR. MICHELSON: You'll take two generic letters and go to --

MR. SHEWMON: That will be in a couple of months after NRR has written a generic letter?

MR. MINNERS: No, we're going to go right now.

MR. MICHELSON: You won't have two generic letters, unless they change the schedule.

MR. MINNERS: The concept of the generic letter is there; the actual words won't be there, no. We're going to propose that our generic letter be sent out. NRR, I guess, is going to propose, no, wait and we'll have a different generic letter that gets sent out.

MR. MICHELSON: Then CRGR is going to mediate this thing, arbitrate it or whatever?

MR. MINNERS: You'll have to ask CRGR what they're going to do.

MR. WYLIE: Who has the authority to make the decision as to which path to take? The EDO?

MR. MINNERS: Yes.

MR. WYLIE: The EDO will accept advice from the CRGR?

MR. MINNERS: Correct. That's who they advise, right. I think the EDO would also take your advice.

MR. SHEWMON: Under consideration at least. I have two questions with regard to the NRR position. First, with regard to what committment anybody in industry or what you know anybody in industry has done, first, NUMARC has not put this out in the form that would make it a requirement for all plants; is that right?

MR. DAVIS: That's right.

MR. SHEWMON: Sec›nd, INPO --

MR. MINNERS: I think commitment would be a better word.

MR. CARROLL: Let me follow up on that for a second. Have you talked to them? Do they have any intent of doing that?

MR. DAVIS: T.Y. Change went down and saw the letter.

MR. CHANG: There was a slide yesterday. I talked about what the industry has done to follow up on their program. NUMARC has issued a letter last year that encouraged their members to refer to the EPRI documents as a basis to resolve this issue. INPO has issued an SOER in '84.

In that SOER, there are four recommendations and recommended actions for the utilities to take. Those recommendations are basically from the EPRI program. They did some followup audits on those.

MR. SHEWMON: So INPO puts it out as good practice and then will audit against it when they go out and do their periodic inspections of the plant?

MR. CHANG: That is correct.

MR. MICHELSON: Can you tell us roughly what those good practices are, these four things that they require, since I have never seen the SOER?

MR. CHANG: Well, wastage, SCC --

MR. MICHELSON: Wait a minute. Tell me a little bit more than a word.

MR. CHANG: They want them to have programs to address those concerns. Basically, it's what's mentioned in 82-02 Bulletin.

MR. MICHELSON: Now, what --

MR. CHANG: They said they recommend to use the -- what's in the EPRI program. I think that at that time, it's a draft copy, okay?

MR. MICHELSON: Which EPRI program are you referring to?

MR. CHANG: Those two volumes.

MR. MICHELSON: These are 88.

MR. CHANG: Those were drafts already.

MR. CARROLL: If I remember correctly, when I used to wear another hat, an INPO SOER is a pretty important thing. The utility has to respond to INPO and INPO has to say, if they are at all smart, at least, I'm going to do everything you say, guys, because they do follow up on those at every evaluation. They tend to make a big thing out of the fact that you have pending SOERs.

MR. CHANG: I think it depends on whether it's a yellow ticket or red ticket. On the red ones, the recommendations were being followed up continuously, but on this one, I think it's a yellow ticket, so it's audited only once.

MR. SHEWMON: The other had to do with the NRR position with regard to risk. They don't feel that they have to have a risk basis for the letters that they put out? You're speaking for NRR now?

MR. CHENG: Cheng for NRR staff: I think right now we are thinking without the risk analysis, but eventually, they might change their mind to do the risk analysis. We are going to send out the generic letter at the moment.

MR. SHEWMON: When do you expect to go to CRGR with that generic letter?

MR. CHENG: April, '91, yes.

MR. SHEWMON: Okay.

MR. CARROLL: Now, CRGR, of late, at somebody's instigation, has been asking the question, how does this comport with the safety goals on these issues. How are you going to answer that question?

MR. CHENG: That's the reason that the management might change their minds, is, for instance, if they decide not to send out the generic letter, it goes to the risk consideration, yes.

At the moment, the management has instructed me to say to send out the generic letter, yes.

MR. SHEWMON: Fine, any other questions?

[No response.]

MR. SHEWMON: I think then we're finished.

MR. WARD: Thank you very much, gentlemen. Before we break -- we're going to have an extended lunch break until 1:30, and I remind you that Mr. Shewmon has some entertainment for you at 12:30.

[Whereupon, at 12:05 p.m., the committee was recessed for luncheon, to be reconvened this same date at 1:30 p.m.]

AFTERNOON SESSION

[1:33 p.m.]

MR. WARD: Let's reconvene. The next item on our agenda is Item Number 4, which is a meeting with the Director of the Office of Research. And we'll want to close a portion of this meeting. And Ivan, I understand from what Eric said that he would like to give the budget presentation first. So why don't we go ahead and close the meeting now, and probably open back up in 15 minutes or so.

[Whereupon, at 1:34 O'clock p.m., the committee proceeded in closed session.]

OPEN SESSION

[2:]

MR. WARD: The meeting is now open.

[Slide.]

MR. WILKINS: Eric, do you get any sense that cuts in the advanced reactor program -- before I ask that question, were the cuts in the advanced reactor program your response to some larger total number of dollars that the Commission told you to cut or were these dictated at OMB?

MR. BECKJORD: In advanced reactors?

MR. WILKINS: Yes?

MR. BECKJORD: No, we -- this is our response to the reduction.

MR. WILKINS: I don't need to ask my other question.

MR. CATTON: I think you can go ahead.

MR. BECKJORD: Well, I wanted to say more about the advanced reactor work because, as I said before, the next time you see a budget write-up for us, there will be a new category which will include all of the advanced reactor work and research in it.

There are some organizational changes as a result of Tom Murley's taking over the -- the evaluation part for all of the advanced reactors, getting it underway for light water as well as for gas and liquid metal.

What we are doing, in effect, is establishing the normal relationship between research and NRR on -- we're going to be pursuing advanced reactor work on the basis of user need, that is the research part.

We -- the branch that is involved in this is the Advanced Reactor and Generic Issue Branch. We have made some changes there and that branch is being reformed and redefined and its responsibilities will be to coordinate -- provide a coordination point for our research on advanced reactors and to -- I'll say some more about that.

If you consider how we operate now on light water in the Engineering Division and in the Systems Division of System Research, I think that on light water reactors, the systems aspects are well understood on both sides, NRR and Research, and the relationships between NRR and the research divisions on that are well established and we don't really have to do anything about developing a -- or expanding a systems engineering capability.

I don't think that's true in the non light water reactors. For example, CANDU, we don't have a group here that is really highly knowledgeable on how CANDU reactors respond to transient events, for example. We have some knowledge, by virtue of our work on the gas reactor and on the liquid metal.

But as a result of this, we're going to include, within this newly-defined branch, some systems engineering responsibility on the non light water reactors, in order to provide a -- a point where we can develop knowledge on the important characteristics of those.

As the research comes along, it will be either systems research to be carried out at contractors or at laboratories and likewise, for components, pressure vessels and so forth.

We expect the research on those 2 categories will be done in the divisions that now do that research. So, in effect, what we're doing is setting up a small systems engineering responsibility to help define what needs to be done on the advanced non light water reactors.

The other assignment for that branch will be the review and updating of rules and reg guides for the advanced reactors. So that branch will have 2 main functions.

As I say in the third bullet down, the next write-ups you'll see on advanced reactors will have a specific category and we intend to work very closely with the new division in NRR responsible for licensing advanced reactors and responding to their needs and getting the research underway.

Finally, we intend to assure that we will have a comprehensive research program for the advanced reactors whether they be water or whether they be other types. As I said, I think it is likely they'll be water first.

MR. CATTON: On some of the advanced reactors with the passive cooling, that can lead to some kind of complicated fluid mechanics.

Do you have any plans for experimental work?

MR. BECKJORD: Yes. These are examples of planned activity, which I think your question leads into it.

[Slide.]

MR. BECKJORD: There is one thing I'll include which doesn't appear on this chart.

At the top are PRA matters. There has been a lot of discussion on the effectiveness of passive designs and what they can and can't do. I think our feeling is that these passive designs have a lot of promises for very reliable safety systems but it is one thing to offer the systems. It's quite another thing to show in concrete terms that they are in fact reliable.

What's happened, what is happening is that the reactor manufacturers or reactor designers are trading off redundancy that you have with active systems. I mean for example three systems in parallel for a high pressure core cooling. They are going to in some cases one system which is passive and not active and with the argument that this passive system because it doesn't require an active, doesn't require power, will be very reliable.

Well, that's fine but now they will have to prove that and we think that we've looked at it from a PRA point of view and it's not immediately obvious how you develop a convincing argument on that point. It is going to mean more inspection of passive components.

I think it is going to be analogous to the case of the failure probability of a reactor pressure vessel. You are going to be depending now on inspections, continuing inspections, to assure that the pipes maintain their integrity and that type of thing.

The first task here is to look at it from a PRA point of view and now try to reformulate the PRA in terms of systems that do not have active components.

Having done that, then we will proceed to access what the reliability of these passive systems are.

The one thing that isn't listed down here is related to that -- integral systems testing. I think that we have had a lot of discussion on that and we feel that there is a need for both testing integral systems and for testing of special effects and that type of thing.

There is one referred to here, steam binding in gravity feedlines. That is an example of something that could be done as a separate test but probably it would also be incorporated in an integral systems test.

We talked for a couple of years now about how and where to do these integral systems tests. We are looking for a university as a means of something analogous to the setup that we have at the University of Maryland for the B&W system that we may be able to get this work done at very good prices by doing it that way.

Dr. Sheron's been -- we are working, we have been looking carefully at the facility at North Carolina State.

Do you want to say anything about that or is it premature?

If it is premature, don't say it.

MR. SHERON: No, I think last May I went down to North Carolina State to find out what they had. They have a one-ninth scale loop of the Prairie Island Westinghouse reactor. It's a two loop mock-up, fairly accurate. It uses freon as a coolant. That's a lower pressure.

It was funded by Carolina Power & Light and Duke Power. It cost about half a million dollars to build.

The only thing they want out of it is to be able to let their operators go in and fool around with it occasionally and actually see what boiling looks like and so forth.

I think it has a lot of potential. It's got a computer hooked up to the control system so they actually have a -- it uses a kinetics equation to drive the power so it actually behaves like a reactor.

We put out a sole source contract or a sole source request last June, which has finally just finished up and we are in the process now of waiting for North Carolina State to submit their proposal to us for the work that they want to do, which we put in our statement of work that went out.

It looks promising. It is something that we can buy into very, very cheaply and we don't have to spend a lot of money for the capital expenditure of building it.

MR. KERR: Do you look on that as a facility to do work on advanced reactors. I thought it was more narrowly conventional.

MR. SHERON: Not right now, because it's not configured to advanced reactors.

MR. BECKJORD: But that might be an example leading to another facility or a couple other facilities kind of following that as a model.

It would be designed specifically for an advanced reactor investigation.

MR. SHERON: We are in the process right now of developing an RFP to go out for a small scale integral loop, the AP-600 reactor.

We are looking at the scaling and the like and will be developing that over the next couple weeks, couple months and trying to get that out.

That was one area where we have reached agreement with NRR on what is needed in terms of experiments.

MR. BECKJORD: Okay, I'll go on.

MR. CARROLL: Let me ask a philosophical question here.

Why should the NRC be doing this? Why shouldn't Westinghouse be putting together --

MR. BECKJORD: We had very interesting discussions on that. The discussions went something like this. We discussed it with Westinghouse and they don't feel that any integral system test is necessary.

We have discussed it with the research advisory committee and they have rather strong feelings not only that an integral systems test is necessary, and that is where we stand, but furthermore their view is, the research advisory committee's view is that the NRC should do it.

MR. CARROLL: Does the FAA do that kind of work in the development of the new Boeing-777?

MR. BECKJORD: Well, I don't think this whole question has been settled. I'm sure there is going to be some hard negotiations with the vendors on this point.

Given the difficulty of funding, I am certainly going to be pushing hard to get them to pick up some of this work, at least a share of it, but on the other hand I don't say that we won't be doing any either.

I think what -- generally the experience, if you look back over the past eight or ten years of this, there are a lot of things you can get the industry to get interested in if you get into it first and get interested and build something and then often you can get a cooperative program together that both parties are interested in and that they fund part and we fund part.

This was certainly true in the case of MIST.

I don't think it would have happened otherwise than a cooperative venture like that. I think that happened before I came here but I think the feeling is one of general satisfaction with the success of that program.

Is that a fair statement?

MR. SHERON: Let me just add if I could real quickly the MIST program was one where we asked the industry to provide us data. We told them that they had the obligation to provide data.

In this case we wanted to get data on our own above and beyond what the minimum that the industry would provide and so in that case a cooperative seemed to be the most beneficial way to go because we had our own desire to get data and the industry had their own desire to get data so in that case we shared.

MR. CARROLL: Why should the required amount of data, Brian, depend on whether it is the NRC or industry? Shouldn't there be something that reasonable people agree is needed?

"Reasonable" people is probably the problem.

MR. SHERON: Yes, that is the biggest problem.

MR. BECKJORD: Well, there are a lot of problems right now. One is a customer and an order and a cashflow stream that is going to pay from that from industry's point of view.

From our point of view we are not, we haven't seen the design specificity yet that is really needed to use and define in an experiment so some further thinking needs to be done on both sides.

MR. CATTON: Are you sure that you need more data?

MR. BECKJORD: Yes -- on systems, on the systems aspect.

MR. SHERON: Ivan, what we have agreed to do is we have met with NRR, with Thadani's people and we have agreed to the following.

Number one is that regardless of what the industry is doing or will be required to do either experimentally or analytically, we concluded that the NRC, it would be desirable for the NRC, (a) to have its own analytical capability to analyze these reactors, and (b) we would like to have our own experimental capability to look at the performance of these reactors on an integral basis and we felt that a loop of the scale of the University of Maryland, namely about a one-ninth linear scaled representation, would be appropriate.

Now the second thing we agreed to do was we would go and review the Westinghouse experimental program that they are proposing to support the AP-600 design.

We will look at that experimental program.

We will look at what they are intending to do and based on our own understanding and our own experiments, our own analyses we will come up with conclusions regarding whether we think the program is complete, whether there are experimental programs that still need to be done, whether additional data should be gotten.

We will provide those recommendations to the NRR people in terms of what additional things we think are needed, okay, in terms of reducing uncertainties in the performance of the AP-600.

NRR will then have to decide if they wish to go forward and to demand Westinghouse or whoever to produce that experimental information, whether they can perhaps live without it because there is a conservative way to bound it, or whether they decide it is really not needed in order to certify the plant but, gee, we would like to have it anyway and it is something that perhaps the NRC should do itself.

They would have to come back to us with that logic and ask us to do it. We're going to start process for both the thermal hydraulics and for the severe accidents. We're starting it for severe accidents.

There's a meeting scheduled at Westinghouse on the 23rd and the 24th of this month, to go through their containment tests. They have a one ninth-scale containment which they are going to use to test the performance of their containment.

We will be going up and asking them a lot of questions about the scope of the tests, how they're going to be conducted, the scaling rationale, and the like.

One of the things that should come out of this meeting, then, is some conclusions regarding the adequacy of the testing to address the issues as we know them. Then we'll forward that to NRR.

MR. BECKJORD: One other example. They have a passive heat exchanger which is in that annular well of water inside the containment for decay heat removal, which I don't think there's any experience which tells you now exactly how that's going to function. It looks like a good idea. But I think that needs some confirmation.

Let me move on, then.

MR. CARROLL: Just one final observation, or reflection.

You know, this is very similar to what happened when EPRI came into business.

MR. BECKJORD: Yeah.

MR. CARROLL: They got out of the research business and got into the product development business for the vendors, and the utilities were paying the bill in that case. The taxpayers are paying the bill in this case.

But it just seems to me --

MS. BELL: The rate payers, finally.

MR. CARROLL: All right. It just seems to me that the vendors in this country have shirked a lot of responsibility for their own product development and being able to stand behind it and say, yes, I can demonstrate this is a good system or this is a good plan.

I think you guys are giving them the opportunity to continue the game.

MR. BECKJORD: Well, I don't think this question is finally settled, now. I certainly understand your point.

I think we should put a lot of burdens on the manufacturers for doing this work. But, at the same time, I don't think we can stand completely clear. But simply because, if there are not people here who are not involved in the work in some depth, they are not going to understand the work that is presented to the Commission.

I mean, there has to be involvement. We just haven't worked out the details of that.

MR. CARROLL: If you could work out something where you could get your people involved directly in this, it's a lot cheaper than duplicating the facility.

MR. BECKJORD: I agree with that. But, there is also -- and this example I think is very informative. Because finally, the final stages of that work, it was a cooperative program. I think it was very productive.

I think there's a justification there in which it was laid out in that National Academy of Science report on research five years ago which talks about whether our common interest is a justification for joint expenditures.

MR. CATTON: On the other hand, the -- and this program certainly was productive.

MR. BECKJORD: Yes.

MR. CATTON: But there are some who question the cost effectiveness, and how useful the data was, and questions like that.

I think you need to come into something, if you're going to build a new facility, with some of those things in mind.

MR. BECKJORD: Well, I agree. But, with the budgets we're getting, we have to be cost effective. There's no question about that.

MR. CATTON: I know a lot of people like the idea that MIST was where it was, but a lot of money got spent, and that money is all gone. All you've got left is the data.

MR. BECKJORD: Yeah.

MR. CATTON: Where, if you would have put that facility in at a national lab, you'd still have it. You'd have the instrumentation, the computer systems that drove it, all sorts of things that you don't have no .

MR. BECKJORD: Yep. And it would have been expensive, too.

MR. CATTON: If I add up -- and I did at one time -- the amount of money that was left behind from facilities that were done like the MIST was done, you'd have one Cadillac system. It's just something to think about.

MR. BECKJORD: Yep. Let me get on because I don't want to --

MR. CATTON: This is a story that has feedback to the taxpayer through graduate students.

MR. BECKJORD: Well, I think what I'd suggest --

MR. WARD: Alleged feedback.

MR. CATTON: Alleged feedback, right.

MR. BECKJORD: This is going to take some time to evolve. We'll keep you advised of what's going on and who is proposing what.

MR. CATTON: Well, I certainly would be interested when you start to consider one-ninth scale for a passive system. Because most passive systems it goes like the scale of cubed. That becomes the difficult thing to deal with.

MR. BECKJORD: Right. Okay, let me move on then.

MR. WARD: We've got about fifteen minutes left in our budget here, the time budget.

MR. BECKJORD: Okay. I'm going to go through the rest of this slide quickly.

I've already commented on the leak-before-break. If you want, Larry Shao is here if you have any question on that.

Research work on materials. Looking ahead to the expectation of a 60 year life rather than a 40 year life. That bring some new research questions up to the table.

MR. MICHELSON: Excuse me. Could I ask just a brief question on leak-before-break? Is some of that effort going to be directed towards possibly redefining a LOCA, the size of a LOCA?

MR. BECKJORD: The size?

MR. MICHELSON: Yes. Because that's what -- you know, right now we use an arbitrary size for a LOCA, even though we do take leak-before-break for certain pipes.

MR. BECKJORD: I think Larry has --

MR. MICHELSON: If you can reduce the break size that you have to deal with for LOCAs, you'd be in good shape. You could save an awful lot of money.

MR. SHAO: I don't think we're going to have any work on the size of LOCAs. That would be quite a difficult task.

MR. MICHELSON: There will still be the arbitrary double ended of the biggest pipe?

MR. SHAO: Right.

MR. MICHELSON: Don't think it would be worth spending a little money to think about it?

MR. SHAO: Mainly, the size of a LOCA, meaning how big a LOCA is, is it geared to a break. The question is how big a break is a LOCA.

We did a lot of research and we found we had leak-before-break, but we don't know how big would be the break. All we know is it would leak before break. All we know is, with leak-before-break it wold be about ten to the minus eight.

But how big would be the break would depend upon the material.

MR. MICHELSON: I've heard a lot of convincing arguments about how small it really is. So, I was wondering if you're going to use that to change the size of the ECCS.

MR. SHEWMON: If you indeed have a leak-before-break situation, the argument is that the leak is there for so long that you have time to take action on it, and the break is ultimately an irrelevant question.

MR. SHAO: Yes. Because you have a leak detection system to find out the leak, so you don't really need to know the size of the break.

MR. BECKJORD: I haven't looked into this myself. I do know that, in the case of reactor coolant piping, there are very big sums of money involved, both in the supports for pipes and the costs, and the radiation exposure of crews. I don't know whether to what extend those considerations apply for other types of piping.

MR. SHAO: A leak-before-break is not applicable. So far, our position is that the leak-before-break is not applicable for ECCS systems or sizing the containment.

MR. CATTON: Yeah, but why not?

MR. SHAO: Because it is a very difficult task.

THE WARD: Well, that won't solve that problem, though. You know, it's not just the size of the leak, but it's the rate. I mean, I think you've got to

MR. SHEWMON: You've got a clean sheet now.

MR. MICHELSON: I think it should be the subject of a small research expenditure to look into the realities of our ECCS design.

MR. CATTON: Westinghouse would probably be delighted to help them.

MR. MICHELSON: Oh, everybody would be delighted.

MR. WARD: Well, I haven't noticed any real initiatives from the vendors on this. You'd think they might have --

MR. CATTON: I'll remember Hocrider, in his presentation on the Westinghouse best estimate model.

MR. MINNERS: I don't think there would be any change, much change in the ECCS equipment if you got rid of the big break.

As I remember it, at least in the G.E. plants that I'm most familiar with, small breaks and medium breaks are the limiting conditions.

MR. MICHELSON: But, from the viewpoint of the repetitive, the timing of all of this, you don't have to have that fast response equipment.

MR. WARD: Yeah. How much do those big accumulators cost? Eric, do you know?

MR. BECKJORD: I know what they to cost. They cost more now. We'll take a look at it. I think it's a good suggestion.

The only other thing I would mention here is the new instrumentation will be digital, with digital displays. There will be computers and software. We are expending a considerable amount of effort now on developing the technical basis for the regulatory guidance on the new instrumentation and control systems. That's a big effort.

MR. CARROLL: Have you in-house or have you hired people who are smart in these arcane areas?

MR. BECKJORD: Yes. I hired John Gallagher from Westinghouse, but he went to work for NRR.

[Laughter.]

MR. BECKJORD: But maybe he will change his mind a few months down the road.

We are able -- as a result of the restructuring which is taking place now, there are experienced people coming available, and I'm sure we'll be able to -- we intend -- we have a program to go out and hire that kind of experience because we don't have it.

[Slide.]

MR. BECKJORD: I wanted to say something about the Research Review Committee. I referred to it already. I think you're aware of the history on this, but there was a suggestion in one of your letters this Spring for a review of research, and Mr. Taylor, in a letter, I think in a response, asked me to see if the Research Review Committee would take a look at the content of the essential research.

They agreed to do that at their June meeting, and they submitted to me their report on December 21st, and I think you all have copies of that report.

MR. CATTON: We do have copies of that.

MR. BECKJORD: Okay.

MR. CATTON: Unless somebody's really interested, maybe we could just go over it quickly. We're running out of time.

MR. BECKJORD: Yes. Oh, not go over it.

MR. CATTON: Not go over it.

MR. BECKJORD: Yes. Fine.

MR. CATTON: Unless somebody has specific interest. We have a copy of the report.

MR. BECKJORD: Yes. There are more than 60 recommendations in there and some very interesting ones. The strongest of the recommendations was on the matter of the research for advanced reactors. So we certainly agree with their recommendation on that.

In fact, I don't take exception to any of their recommendations. They even agree with us on the question of the Mark-I liner resolution. Herb Isbin has been very active in that and has attended all the meetings.

[Slide.]

MR. BECKJORD: The scope of aging research is shown here. Just a few notes in the declining minutes of this.

[Slide.]

MR. BECKJORD: We are working very hard on both aspects of this matter now to be ready to bring a rule to the Commission on license extension in June. That's indicated here in the work on the draft regulatory guide for reviewing and renewing plant licenses, the technical basis for the license renewal rule.

[Slide.]

MR. BECKJORD: We've been working on a revised thermal shock rule. Issues of current importance are shown there. There are four people from the NRC going to the Soviet Union a little bit later this month to be present during the annealing of the third Unit No. 3 at Novo Voronezh. There are also EPRI people going and a number of utility people. I think the total is -- Larry, how many?

MR. SHAO: About ten.

MR. BECKJORD: Ten people will be there over a period of about three weeks to witness the annealing.

MR. KERR: This doesn't have anything to do with what you're talking about, but can somebody remind me, what is the annealing temperature that they use on those vessels? Do you know?

MR. BECKJORD: Larry knows.

MR. SHAO: It's 450 degrees centigrade.

MR. KERR: Thank you.

MR. BECKJORD: We're putting a lot of effort on the annealing now because of the expectation that this is going to be important in a number of the license renewals, perhaps as many as 17 of them, that are coming up.

Yankee Rowe will be the first, of course, because it's a -- not only because of the time of expiration of license, but also it's a lead plant. We know that -- I think you've had a presentation on the Yankee Rowe vessel, so I don't need to say more about that.

MR. SHEWMON: At least one. Actually, one of the things which is down in your domain someplace is a document which would define what the NRC would accept as a satisfactory anneal. I believe that it would be nice to see come out some day. I don't know whether it will come out before or after Yankee Rowe has to anneal the first time, but --

MR. BECKJORD: That would be a good idea.

MR. SHAO: Dr. Shewmon, right in the bullet, third from the last, developing reg guide on thermal annealing, that's the one you're thinking about.

MR. SHEWMON: Oh, good. Thank you.

[Slide.]

MR. BECKJORD: I did want to say something about severe accidents. That's the scope of current emphasis on these matters.

[Slide.]

MR. BECKJORD: We could talk at some length -- in fact, you might be interested in the work on the Three Mile Island lower vessel head.

My understanding is that they now have a good temperature estimate for four of the nozzles, and that it appears now that there was an area of the vessel which reached 1100 degrees centigrade temperature.

We also have analysis underway out at Idaho on some temperature calculations, and there is a discrepancy there between the value of temperature that comes from metallurgical examination and from the heat transfer calculation. So I think that in the process of establishing some hypotheses and testing them, by the time we get a little further into the year, we'll have a better idea of what actually happened in that accident.

The work on the TMI samples will be completed -- the present scope of work will be completed about the end of this year. There is an extension of that program to look at other samples that we collected in the course of the work of removing samples at TMI, and so there's an extension -- we're certainly interested and the partners are interested in extending the work, and probably that will continue for another year.

MR. SHEWMON: Eric, you did get several samples from half a dozen locations from the bottom of that vessel.

MR. BECKJORD: Yes.

MR. SHEWMON: Have those all been evaluated or looked at in the first state?

MR. BECKJORD: No. There were 15, and I think we have the temperature from four. Is that right, Ralph?

MR. MEYER: Right.

MR. BECKJORD: Ralph Meyer.

MR. MEYER: Ralph Meyer from the Research Office. I talked to Dwight Dirckes this morning, and initially, you'll probably remember that there was one nozzle location that had some very visible cracks or tears in the stainless steel liner, and so you suspect that that's a hot spot in the vessel.

MR. BECKJORD: Yes.

MR. MEYER: Well, there are three other nozzles, the nearest ones to that, in an area, an elliptical area roughly a meter across, where they have also found the phase transition, and therefore the high temperatures, and now, having looked more closely, also see the cracks in the liner. So there is a hot spot in the vessel --

MR. SHEWMON: But you have evidence that on the other side of the vessel bottom, it was not hot. Is that right?

MR. MEYER: We don't have evidence, but it didn't rupture, so you suspect that --

MR. SHEWMON: No, let me come back. This came down and went over, and this was the hot spot on that side.

MR. MEYER: Yes.

MR. SHEWMON: But over here, have you looked at these samples, even though there wasn't cracking in the cladding?

MR. MEYER: I can't say for sure, but I believe those have been looked at and they are not hot.

MR. SHEWMON: That was my impression, and I've been told that.

MR. MEYER: Right. Yes.

MR. SHEWMON: But I wanted to make sure that you, indeed --

MR. MEYER: Yes.

MR. SHEWMON: Okay.

MR. MEYER: I'm not sure that they're all finished. I can tell you what the current thinking is, and that is something like jet impingement, the pour impact probably impacted in this hot region, and the physical process of impact has created good heat transfer for a little bit. So it probably got hot locally for a very short period of time, cooled off quickly, quenched in the microstructure, and probably didn't heat up through the whole wall thickness, and that's how you got locally high temperatures without any --

MR. SHEWMON: That means it got hot for five or ten minutes and cooled down?

MR. MEYER: Oh, no, I don't think for five or ten minutes; I think for probably the duration of the pour -- maybe tens of seconds.

MR. SHEWMON: Go do a heat transfer and see how many inches you can diffuse that kind of a temperature into steel, and I don't think you'll find it's tens of seconds.

MR. MEYER: We will look at that.

MR. SHEWMON: I don't think it's tens of seconds, either.

MR. BECKJORD: I think that's right. This is part of the work that they're doing out at Idaho on this, the heat transfer calculations on the vessel. I think that a little later -- in fact, I think there's a meeting coming up on this. We will certainly keep you advised. I want to go back to the slide before on the core melt progression.

[Slide.]

MR. BECKJORD: We're taking a careful look at that now, getting some people on the outside to help us assess the needs at this point. We want to define some options for the next experiment or set of experiments that would tell us about the later part of core melt progression that would lead to vessel failure.

I hope that we will have some more on that by mid year.

[Slide.]

MR. BECKJORD: The SURTSEY experiment, we have two sets -- two experiments, on at SURTSEY on DCH and a smaller scale one at Argonne and we have been waiting to conduct the

SURTSEY experiment until we had completed the scaling work for that experiment. We now have Sandia' report on the scaling methodology and we expect to get their specific recommendation for that experiment which is planned to be run in March.

I think the next time we have a severe accident meeting, it would be good if we did it when the results of that experiment are available to us. I guess we've run out of time.

[Slide.]

MR. BECKJORD: Human Factors, that's the scope of human factors research. We're still carrying out the plan which you've seen, the research plan on human factors. Some recent accomplishments here:

[Slide.]

MR. BECKJORD: The scope associated with the use of advanced control systems, all relating to what I referred to earlier, the expectation that advanced reactors are going to be using these systems. We are working on the organizational research.

We're looking for another plant now that would be interested in having an evaluation. I hope we'll be able to get another nuclear plant to do that. There's a lot of effort going into the integration of human reliability data into the PRAs. That, you will recall, is a user need given to us by Tom Murley. That would be another thing to have a discussion on later this year.

I think it's past my time. If you've got questions on the program for me, either I will answer or one of the division directors, Dr. Speis?

MR. CATTON: I do not see a question.

MR. MICHELSON: Back on your slide where you discuss the need to look at the advanced control systems and so forth, is any of the work on advanced control systems going to include possible environmental susceptibility of such systems? Elevated temperature and that sort of thing?

MR. BECKJORD: I got a new user need the other day from NRR. It was a verbal user need relating to a fire at Brunswick in the drywell, a cable fire in which there was a lot of smoke produced and NRR has asked us to take a look at that in connection with equipment qualification.

I think that's an interesting time to -- as a result of that, --

MR. CARROLL: Because of chloride?

MR. MICHELSON: I'm interested in just the elevated room temperature alone. What does this equipment start doing when the room warms up?

MR. SHAO: To answer your question, we intend to work on it. We want to qualify these events systems for temperature, pressure, radiation, seismic and also electromagnetic conditions.

MR. MICHELSON: That will be a part of this program?

MR. SHAO: It will be a part of the program.

MR. MICHELSON: Thank you.

MR. WILKINS: This is a smaller question, Eric. Howard Lewis is really the one who should ask it, but he's not here. Harold, from time to time, gets very upset, and I have joined him, because the Commission appears not to be doing its statistical work properly.

I'm not sure whether you're aware of his concerns or not, but I wonder if you have any comment on the issue? It would seem to me that your office is probably the most likely place to have competent statisticians in the Commission and that to the extent --

MR. BECKJORD: We have at least two competent statisticians.

MR. WILKINS: Of course, on Harold's behalf, let me say that maybe they don't get called on for their professional advice and assistance in a number of areas where it would be useful to the Commission to have them called on.

MR. BECKJORD: Are you thinking of diesel generator reliability?

MR. WILKINS: For example.

MR. BECKJORD: I don't have a difference with Harold on the points raised in his letter. We're doing -- our own people are working on that. We did have a contractor working on it, but there's been some problem in a delay of getting that work underway to answer the questions.

We wanted the people who did the work on it originally to answer the question, but meanwhile, we've got our own people. I don't think there's any disagreement on the basic point. There are some things which have to be looked at more carefully because it's not a simple case of 1 in 20, because it's kind of a process where there are three steps.

There's one in the last 20 and it's no longer a simple problem when you have a sequential series to look at. I don't think there's any difference on the basic conclusion. We will -- when that work is ready, we'll present it -- we'll give you a letter on it and then a presentation, if you like.

MR. CARROLL: I thought I heard you say that safety research review committee report agreed with the position you are taking on liner melt-through. Why can't I find that in here?

MR. CATTON: I can show you where it is.

MR. MICHELSON: I have one small question. Could you tell me roughly where you're at now on your -- what research, if any, is proceeding on fire and fire protection and fire effects and so forth, other than the one you mentioned, just getting a user need. Before that, what did you have going?

MR. SHOTKIN: I spent the morning at the National Institute of Science and Technology talking to the people in what is now the Bureau of Fire. This used to be the Center for Fire Research.

We were going over the software that they are developing on the government support, Navy support and some private industry. We were discussing what software changes are needed to accommodate that for a nuclear power plant so that we can have it ready by June to interact and provide a resolution to Generic Issue 57.

Beyond that, the software work that they are doing; they have about five or six people work ng on the software and it looks like we're just going to y into that program.

MR. MICHELSON: Well, that's one piece of work that's related to the inadvertent actuation of fire protection?

MR. SHOTKIN: Yes, that's Generic Issue 57.

MR. MICHELSON: What else? Is there anything else going on at all?

MR. MINNERS: There are three issues being prioritized.

MR. CATTON: There is some interest at NTIS on what a three hour barrier means or the time associated with a given fire barrier means. There is some disagreement among the people who are there.

MR. MINNERS: I think that's one of the generic issues on the effectiveness of fire plans.

MR. BECKJORD: Can you say which the three are?

MR. MINNERS: One of them, I think, is effectiveness, one is on the manual fire fighting and I can't recall the third.

MR. BECKJORD: We will find out.

MR. MICHELSON: Thank you.

MR. BECKJORD: I have just a comment on the Mark I liner which is also the one on page 13.

MR. CARROLL: I misunderstood. Is it the resolution?

MR. BECKJORD: No, the approach.

MR. WARD: Eric, thank you very much for coming down, and all of your staff. We appreciate the interaction very much. Let's break now until 3:[illegible].

[Brief recess.]

MR. WARD: Our next topic is a discussion of operating experience in events at nuclear power plants. Mr. Carroll.

MR. CARROLL: Before we begin that, I would like to take note of a letter Ernie Rossi received from Mr. Babbin, which was passed on to the committee by Commissioner Remick.

For those who didn't see it, Mr. Babbin is a practicing 66-year-old professional engineer who in recent years has become a very critical reader.

MR. KERR: You can't fool me. That's a pseudonym for somebody who works there.

MR. CARROLL: I thought it might be his brother-in-law, but it's hard to tell.

But anyway, he does comment that he, over the last several years, has read at least 100 of the information notices coming out of Ernie's shop.

MR. WARD: Can we believe anything else he says?

MR. CARROLL: And he thinks they're consistently, they deserve special recognition for the consistent detail, and excellence of the information notices.

So I congratulate you, Ernie.

MR. ROSSI: It took a lot of review and effort.

MR. CARROLL: I guess the only other comment I would make is that it's quite obvious that he doesn't receive ACRS letters to read.

[Laughter.]

MR. WARD: Put them on the list.

MR. CATTON: We have his address.

Anyway, today's topics for review of operating experience are two events, one at Quad Cities and one at Ginna, that have in common the fact that the plants were in an abnormal operating mode, and a bunch of strange and wonderful things happened. You'll find the background material in Tab 5. And with that, I will turn it over to Al Chaffee.

[Slide.]

MR. CHAFFEE: The two events that we've been asked to talk about, the first one is at Quad Cities, and Barry Kaufer will make a presentation on that.

Barry was part of a team that AEOD sent up to Quad Cities to look into the human factors aspects of this particular event. This particular event occurred when the licensee was changing the plant conditions to get out of doing finishing aspects of a test, on a torsional test on the turbine, and in the process of doing that, they ended up getting an unexpected trip when the operator lost track of where he was relative to being critical.

Then a second event at Ginna --

MR. CARROLL: Did something like that happen at Chernobyl?

MR. CHAFFEE: Yes, somewhat.

And the second event is at Ginna. And in this case, Nick Fields, from the Events Assessment Branch, he will make a presentation on an event that occurred there, where the operators, in trying to do some corrective maintenance on an under voltage relay, put the plant in a condition where they had the automatic and manual system actuation of the engineering safety features inoperable for about 20 minutes.

So we'll start off with Barry Kaufer from AEOD.

[Slide.]

MR. KAUFER: Sorry for the delay. Obviously, as Al said, I'm here to present the report from our human factors study on Quad Cities' IRM scram from hot shutdown.

This event happened in October, on the 27th. And this is the results of our study from an AEOD human factors study.

[Slide.]

MR. KAUFER: What I plan to do, as you can see on your slides, is run through a brief introduction of what our human factors studies are about, and give you some basic background information on event, a little review of the sequence of events that happened during the three shifts of this torsional test that they were running, present the results of our study, and just a brief conclusion following that.

[Slide.]

MR. KAUFER: If you look at our slide, the AEOD program was set up to review human factors aspects of operating plants, operating events, and the way plant personnel perform during these events.

In this regard, this is the sixth study we've done. And a team, including myself, one other AEOD person, and two people from INEL, and one person from Region 3, went out to Quad Cities on the 31st.

We obtained data from discussions, plant logs, strip chart recordings we looked at later on that we retained during the visit, and our basic information, our most important information, comes from the plant operators who we talked to during the trip. They would get the best story we can get of what's going on during these events. That's probably our most useful piece of information.

MR. CARROLL: Now, of these five people that were involved in this plant visitation, what were their general backgrounds? Were some of them human factors people?

MR. KAUFER: Varied backgrounds. Some were human factors people. I myself had previous plant experience, doing a lot of modification work, and mechanical work, and working in modification of systems startup. Just varied discipline work.

MR. CARROLL: The human factors people were the consultants from INEL?

MR. KAUFER: Yes. They were consultants.

[Slide.]

MR. KAUFER: Just to give you a brief background of what was going on there, the circumstances involved is, Quad Cities was running a turbine torsional test. The purpose of this test, being run by, I think GE, through numerous plants around the country. I don't know the entire background of these tests. But the purpose of the test was to find the location of torsional resonance vibrations on the main turbine, based on a need to, or a want to improve turbine reliability.

The test was performed at power, but with the turbine generator off the system grid.

Going further, Quad Cities had attempted this test back in September, on the 28th. They never got to run it because they had problems with, electrical problems with their EHC circuit, so they aborted at that time. This was the second attempt that they started on the night of the 26th.

The night of the 26th, they started dropping load to run this test. At approximately 4:00 O'clock on the 27th is when they had the reactor scram on a high-high IRM scram signal. This occurred when the operator was withdrawing control rods to increase reactor pressure without recognizing the need to follow normal procedures for re-establishing reactor criticality.

MR. KERR: This was 4:00 a.m.?

MR. KAUFER: 4:00 p.m. on the 27th is when the scram occurred. I'll get into the sequence in a little while. That will probably give you a better perspective on the event itself.

Just as a note, our safety significance review of this was that it was a low safety significance, based on the fact that all the automatic scram features of the reactor were available and operable at the time, and there was no chance of later things happening.

The primary cause that was determined from this event was that it was an operator error, because he had focused on controlling reactor pressure with the control rods rather than on the reactivity of the reactor itself.

They were also able, through their analysis, to determine that there were several contributing factors relating to this event. These were low-level task awareness, poor communications, poor command and control, inefficient procedures, incomplete training, and an ineffective utilization of operational experience.

[Slide.]

MR. KAUFER: Just to lay out the sequence. They said the event happened basically on the 27th -- the first shift came in at 11:00 p.m. on the 26th, and they were already reducing power.

Just to give an overview, power was reduced during the first shift, they set up -- making -- putting their test equipment on EHC system and they were fairly well set for running the test by the end of the first shift.

The second shift, they were setting up and finishing preparations and began to run the test. By the end of the second shift they ran into problems with the test, itself, because of turbine problems.

The third shift was when they decided to abort the test and come back down, take the equipment off EHC and that's approximately the time when the scram occurred, about one our into the third shift.

[Slide.]

MR. KAUFER: To give you a little bit better idea, we included this little -- what we're calling a "W" chart. If everything went well, and the power levels here are not at 100 percent, but we're figuring 10 go 1 percent, in this range here.

The idea was to come down and hook up your test equipment, come back up, run your test, complete your test, come back down, take off the equipment and come back up to normal operation.

MR. CARROLL: They had to be off the line to put the equipment on?

MR. KAUFER: Right. They had to have all the turbine valves closed so they can shut down the EHC pumps, and hook up their equipment to the EHC system for monitoring purposes.

Basically, to just give you, and I'll try and make this brief. There's a lot that happened during this period, and I'll be glad to answer any questions if I missed stuff.

About 11:45 they had -- during the load reduction they had found that they had an IRM detector that wasn' working so they made a drywell entry to insert this IRM and they had one IRM now that was without remote drive because the remote drive was inoperable.

The reason why I mention this is you put them in an LCO to re-inert within 24 hours or shut down. That was the basis of that.

By about 1:00 o'clock in the morning on the 27th, they had reduced power and were going to hot standby. They reached hot standby by about 2:30, 2:40 in the morning.

About 3:40 in the morning, while they were working still withdrawing -- inserting core control rods, they had a half scram on IRM 14. This was a -- there was a near miss memo written on this and a caution tag put on this detector.

MR. CARROLL: What's a near miss memo?

MR. KAUFER: That's what they call, I guess, when you have a half scram or come close to a scram. That was their technology. I'm just taking this from their -- from our interviews.

MR. SHEWMON: A half scram means that there was a signal, but it wasn't confirmed, so it didn't go in?

MR. KAUFER: Right.

MR. SHEWMON: Okay.

MR. CARROLL: No, I believe that's wrong.

MR. CHAFFEE: Yes, I think -- I believe what it means is that they got a signal that caused the equivalent of half of what it takes to get a scram, so half the circuitry went through. It takes another half to finish the process I believe.

MR. SHEWMON: They can some how catch it?

MR. CHAFFEE: It is 2 out of 4 taken.

MR. KAUFER: During this period, they had also realized a problem -- not a problem, but they noticed that they had, moving these control rods, some high rod worth.

During -- being that was the midnight shift, there wasn't a lot of people, they had enough control room operators that weren't too busy. The other unit -- I think the other unit was on -- but there weren't a lot of problems going on, so they had enough people to control everything. They were doing this process very slowly to get down, because they knew of the criticalities, the high rods were involved. So, they -- just a slow process.

By about 4:20 in the morning, they were at 830 pounds pressure and the EHC pumps had been turned off and the test circuitry was being installed.

At the 7:00 o'clock turnover to the second shift they had -- the operators mentioned this high rod worth problem to the oncoming shift. This was never entered into any logs, but they orally told the second shift coming on about it.

Also, at that point, obviously, one IRM was remote drive inoperable and an IRM on the other channel was inop.

MR. CARROLL: Was there something, at that point, they could have done about the high rod worth problem; gone to a more benign rod pattern?

MR. KAUFER: There was a nuclear engineer onsite watching this and the way they were controlling it, and it was just, you know, your normal operations I would presume. They were watching criticalities and the reactivity of the reactor at this point.

MR. CHAFFEE: I think one of the keys is that they recognize they hit a high rod worth there, but later on when they actually had the trip, the operator who was doing the activity, he wasn't aware that there was a high rod worth situation that existed.

So one of the things they could have done is pass that information on to that individual. Then that would have helped facilitate his ability to recognize it later on when he talks about pulling rods. He might have been better able to prevent the scram.

MR. KAUFER: Anyway, continuing on. The second shift came on. They started preparing for the test about -- took, I guess about -- my notes say about 12:00 o'clock in the afternoon, they were getting ready to run the test.

By about 1:30 in the afternoon, they determined that determined speed was less than the minimum required for the test. I don't know, at this point -- I don't recall what the exact problem was with the turbine, but they just couldn't get the speed up.

At that time, they started a conference in the control room around the SCRE's desk, shift control room engineer's desk, to discuss what was going on with the test and what they were going to do.

At about 10 to 3:00, the other shift -- the third shift had been coming on, because they were scheduled to start at 3:00. Shift turnover was getting ready to begin. There was so much commotion around this desk, with all these people conferring on this test, that the SCRE basically kicked these people out of the room and said, we've got to do it now with our shift turnover.

At the turnover, what was given to the third shift -- they had approximately 12 hours left on the drywell to re-inert it or shutdown. They've been told abut the IRM problems, but they were never told about the high rod work, that wasn't passed on at that point.

About 10 minutes after 3:00, the people who were conferring outside the control room now decided to abort the turbine torsional test. At that point, the shift engineer, who was outside, called up the SCRE inside and told him to abort the test, start bringing down pressure, to unhook the test equipment, get the drywell re-inerted and --

MR. CARROLL: And bringing down pressure?

MR. KAUFER: Right. On the reactor.

After they hooked up the test equipment, they brought the pressure back up and power level back up so they can run the turbine and do the test. So, now they had to come back the other way to get the pressure back down, close it, turn off the EHC pumps and get the TBVs so they won't have a problem with the EHC system so they can take off the test equipment.

MR. CARROLL: My way of saying it would be get the power down, you know, so you could take the unit off the line, which results in pressure going down.

MR. KAUFER: Well, the one point I -- maybe I missed it by just saying this is that the other instruction was they were going back to power that night. So, they weren't coming offline.

At that point the SCRE directed the NSO at the desk, control room cperator, to reduce reactor pressure to 800 pounds in order to ensure that TBVs would close prior to removing the test equipment and do his thing.

At that --

MR. MICHELSON: What do you close?

MR. KAUFER: The turbine bypass valves, I'm sorry, so they can unhook the test equipment, turn off the EHC pumps.

At the point the operator started inserting rods to reduce the reactor pressure. By about 20 to 4:00, about 30 or 40 minutes later, he had completed inserting 14 rod groups, about 84 steps in this procedure, following the rod procedure.

Between the next 10 minute -- 10/15 minutes or so, the following things were happening. The pressure was still decreasing, it was down to about 805 pounds. All the turbine valves were closed, EHC pumps had been secured. Reactor power had, at that point, decreased to an IRM range of 1 and the SRM count rate was less than 100 CPM.

At this point, the NSO, seeing that the pressure was still dropping, he wanted to keep it at 800, that's what he was told, decided he better start withdrawing some rods. He went to do this and he, of course, had an SRM rod block because he was down to range one.

He quickly inserted the SRMs, got the rod block cleared, withdrew 1 group of 4 rods 1 notch, withdrew 1 rod another notch and that's when he got the IRM high scram.

MR. CARROLL: He clearly recognized he was subcritical at that time?

MR. KAUFER: Probably at about that time, yes. But, during the whole other process, what we've been looking at, and what you'll see in our assumptions -- or results, is that he was focusing all on reactor pressure; he wasn't watching the activity, because he didn't know he had a rod block, which he should have known when he passed range 4.

MR. CARROLL: But the fact that he did ultimately have to put them in to clear the rod block --

MR. KAUFER: It should have clued him in. And then he was also unaware of the high worth rods that he started pulling which quickly made him critical.

MR. CARROLL: Did you talk to this guy? Did he acknowledge that he did not really think that the reactor was critical or not as he was pulling rods?

MR. KAUFER: He expressed to us that he was concentrating on pressure at all times, and when he was looking at that pressure gage and he saw it going down, he said he'd better start withdrawing rods and get that pressure back up.

MR. CARROLL: Was he asked the direct question, though, "Did you realize the reactor was sub-critical at this point?"?

MR. KAUFER: I believe we probably asked him that, myself or somebody else, and, to be honest with you, I don't recall the answer at this time. I'd have to look in my notes to find out.

MR. CARROLL: Okay.

MR. KAUFER: I don't know if Gene would recall at this point. Anyway, that was the basic sequence of events that occurred.

MR. CARROLL: Was this operator an old-timer or a fairly --

MR. KAUFER: This operator was one of their most senior operators at the plant. I think he had been a control room operator at the desk for at least nine years, I think, if I recall.

MR. CHAFFEE: But wasn't this a particular activity that was done very infrequently, and he hadn't done it very often?

MR. KAUFER: Yes. Going down and putting a plant in a hot stand-by condition, I think he said the last time he had performed that was about in the early '80s on the plant.

MR. CARROLL: Do they get any training on this on their simulator?

MR. KAUFER: That will show up in my analysis, but the answer is no -- prior to this event.

MR. CARROLL: Yes.

[Slide.]

MR. KAUFER: To further go on and show you our analysis, as I said earlier in the little bullets I described, the main cause of this was operator error. The event occurred because the NSO was monitoring pressure and not paying attention to reactor reactivity at all.

MR. WILKINS: I infer from your remark that he could have had, had he just turned his head, seen a meter or a gage or something which would have given him a clue.

MR. KAUFER: If he was watching his ranges on his IRMs coming down, along with everything else going on, he would have noticed it. That should have been a hit on the head.

MR. CHAFFEE: He not only had to down range, I think he had to also insert scurce range instruments? Isn't that correct? So he had two things that he had to actually do that should have clued him in that it was going on.

MR. KAUFER: So I don't think there's any question that that was the main cause of this event. If you look at our contributing factors, there was definitely what we found to be a low level of task awareness.

The way I describe this is that the dominating contributing factor in this event was that the plant staff was not aware of the reactor conditions required for performance of this test and the reactivity changes that would evolve with the reactor at this level.

Maintaining the reactor critical with the turbine bypass valves is not a frequent operation; that's stand-by. It's difficult to maintain the reactor pressure level, especially using control rods to do it with. Pressure response is very slow when you compare it to reactivity changes going on in the reactor. Changes in the moderator temperatures affect reactivity that weren't even considered.

One note that I probably missed and should have mentioned when I was going through the sequence is that after the test was aborted a little bit after three, the test engineer and the nuclear engineer on site left site. They weren't present when this occurred. They had left site because they weren't expecting any major changes to evolve during this period.

MR. MICHELSON: Question: The turbine bypass valves apparently won't close at high pressures. They had to reduce the pressure in order to close them?

MR. KAUFER: Correct.

MR. MICHELSON: Not a pressure set point. Those are manually operable turbine bypass -- those are manually operable valves. What was the problem? Won't they close at above 800 pounds?

MR. KAUFER: They close below 920, I believe.

MR. MICHELSON: That might be --

MR. CHAFFEE: My understanding is that these valves that we're talking about, the point is that they control their position based on the pressure of the steam.

MR. MICHELSON: Yes.

MR. CHAFFEE: So the idea was to reduce the pressure of the steam so the control system for the valves would cause the valves to go shut. By causing the valves to go shut, they do that by removing oil pressure to opening the valves. Once the oil pressure is removed, that then allowed them to secure these pumps, and they had to secure the pumps to hook up this test circuity or take the test circuitry out.

MR. MICHELSON: But what happens if I have an accident at that plant at a thousand pounds pressure and I want to maintain isolation, because turbine bypass allows it to go onto the condenser? Those are isolation valves of sorts. This is the boiler, isn't it?

MR. KAUFER: Yes, it is.

MR. MICHELSON: These turbine bypasses are downstream of the MSIVs; so apparently, they -- I thought they could close at a full reactor pressure.

MR. CARROLL: I did, too.

MR. MICHELSON: Is this right? The reason that they -- they apparently wanted to get hydraulic pressure on them.

MR. CARROLL: That may make some difference in what pressure it takes to close them, I don't know, because they wanted to shut the --

MR. MICHELSON: They're hydraulically operated.

MR. CARROLL: Yes, and they wanted to shut the pump down.

MR. MICHELSON: But that's the force that allows them to close. But they didn't want as high a hydraulic pressure for some reason as they might -- I thought they close at full reactor pressure, but maybe not.

MR. CARROLL: I think if the hydraulic system is on, you can adjust the set point of them.

MR. MICHELSON: That's how you control pressure to keep about a thousand pounds even on hot standby.

MR. KAUFER: Right, but they were going down below [illegible] so they'd stay shut, and they wanted to get far enough below 920 -- they didn't want to come back. If it went over 920, they'd start opening up again.

MR. MICHELSON: Oh, I hope not. During normal operation, they're not open and they're over 920.

MR. CARROLL: But they have the H pump on.

MR. WARD: I think we have an answer here.

MR. LANIK: When the turbine is off line, that's the way they relieve steam to the condenser, and they normally want to dump steam to the condenser rather than have the safety relief valves come open to relieve pressure. So that's why they wanted to reduce the pressure down below. So they were low enough so that there was no chance that a minor pressure increase would cause a discharge to the --

MR. MICHELSON: They were afraid the perturbation from opening and closing the valves would --

MR. LANIK: No, no. What they didn't want to have happen was they didn't want to have -- first of all, they wanted to remove the motivating power to the bypass valves while they were closed. They didn't want to have them open while they were removing oil pressure.

Second of all, at that point, they no longer can dump steam to the condenser. So they wanted to have any -- they wanted to have basically no net increase in energy in the reactor, because if they had an increase in energy in the reactor, they would dump steam to the torus. The safety relief valves would eventually come open, and they didn't want that to happen, either. So they reduced the pressure down to about 800 pounds so they have some margin.

MR. MICHELSON: Margin to what? If they were at low power, they're still generating steam. I guess they thought they were at low power. It turned out they weren't.

MR. LANIK: They were decreasing in pressure. They were losing more energy to ambient losses --

MR. MICHELSON: What was the power when they were at 800 pounds?

MR. LANIK: Well, they were basically on decay heat.

MR. MICHELSON: But I thought they thought they were higher than that. Even decay heat's still, at that short a time after shutdown, is still a percent or so.

MR. LANIK: They probably had steam loads like steam generator injector, and they did not isolate -- they did not close the MSIVs. So they had all the normal steam loads that you'd have except for the turbine being closed.

MR. MICHELSON: They were still feeding all the heaters and so forth off the same steam line, then?

MR. CARROLL: Yes.

MR. MICHELSON: Okay. That probably balanced them out with what power they had.

MR. WARD: The individual involved here, was it NSO, is that what you said?

MR. KAUFER: Yes.

MR. WARD: A licensed operator, not the shift supervisor --

MR. KAUFER: Right. Correct. I will right down the road show you a chart.

MR. WARD: That's all right.

Why wasn't somebody looking over his shoulder? I mean this went on, this miscomprehension of the situation went on for a long time.

I guess I'm -- isn't there any redundancy there?

MR. KAUFER: What they have is they have the shift engineer. Just let me pull that slide and I'll show you what their setup was and that might explain it a little better.

MR. MICHELSON: While you are doing that, could you tell me whether there was a procedure, a test procedure for this?

MR. KAUFER: There was a temporary procedure written to handle this. Our work, our analysis and our results showed that they basically were not following the procedures.

MR. MICHELSON: Oh, okay, but there was a procedure that, if followed, everything would have been all right?

There was a good procedure?

MR. KAUFER: It would have been difficult to say that it would have been all right.

MR. WILKINS: I find some language in this report that Trager and the contractors did. The procedure gave no instructions for reactor operation during installation and removal of test circuits.

MR. KERR: It seems clear to me from what I read and what I hear that this test was not carefully and thoroughly analyzed, not nearly as much as it should have been.

MR. MICHELSON: A Chernobyl problem.

[Slide.]

MR. KAUFER: Just to give you an outline, you have a shift engineer who has the overall responsibility for operations.

Below him you have your SCRE, Shift Control Room Engineer. He is an SRO and he acts as the STA in emergencies.

He directs the control room operators and activities for both units at this plant.

Under him you have the Nuclear Station Operators, the NSO's who are the licensed control room operators.

MR. WARD: And they are licensed as RO's, is that right?

MR. KAUFER: Right. Right. That is the man who is doing the control rod manipulations.

You also have the shift foremen who reports to the shift engineer and he basically does in-plant activities, directs the other operators on the in-plant activities.

MR. WARD: So are those auxiliary NSO's in the control room too?

MR. KAUFER: Yes. I think there's one in each control room, control desk, and I think there is one extra in the control room.

MR. CHAFFEE: Yes, I think in this event didn't they have one of the auxiliary NSO involved in the inerting activity?

MR. KAUFER: He was involved in the inerting activity.

MR. CHAFFEE: And then the other one on the unit in question was involved in actually manipulating the rods to control pressure?

MR. KAUFER: Right. On Unit 2 he was manipulating the rods and I think the Unit 1 they were doing a test on that unit.

MR. ROSSI: I think at the time that this trip occurred, the operator was trying to control the pressure and the reactor, he thought, was at a very, very low power level and just critical and in fact it was somewhat subcritical. I think that is the key.

I would imagine that it is not a question so much of having a lot of procedures to describe exactly how you control things at this point. I think it is more a matter of having had training and an explanation of how the reactor might behave and then it would have been up to the operator to control the pressure while still carefully watching the instrumentation to be sure that he didn't come up to the point where he tripped.

Is that the situation?

MR. KAUFER: Yes, there's a few factors that further amplify it.

The midnight shift went through the same sequence and had no problems. One of the reasons they had no problems, they weren't under any time -- let me take that back because the third shift wasn't on any time constraints either but there was a lot less noise and confusion in the control room with the midnight shift obviously.

Also, the guys or first shift had been there as auxiliaries when they tried to test the first time, so they were more familiar with the reactivity of the vessel -- I'm sorry -- reactivity of the reactor at this time.

To answer your preliminary question which you first started with, SCRE got involved with the de-inerting, changes being made to the AC system and conferences going on and other phone calls that were coming into the control room.

He gave the NSO his directions at 3:10, like I said earlier, and the next time he was at the control desk with the NSO was probably about 30 seconds before the SCRAM occurred.

MR. WARD: Which was 50 minutes later?

MR. KAUFER: Right.

MR. CARROLL: How long do you think they were subcritical and didn't know?

MR. KAUFER: The charts we looked at and everything were not enough information to really give us that.

MR. CARROLL: Was it minutes or hours?

MR. CHAFFEE: I think one thing that existed that makes it kind of cloudy is over this 50 minute or an hour period of time as pressure was going down and temperature was changing and xenon concentration was changing, also in this period I suspect he was periodically moving rods in, so he may have been, you know, going subcritical, going critical.

It's unclear exactly what happened is my impression. It was about an hour in total length, 50 minutes.

MR. KAUFER: They started the rod manipulations at 3:10 and this occurred at 3:59, I think.

MR. CARROLL: -- building in as a result of lowering power level or going subcritical so they would have had a pull rod to stay critical.

MR. KAUFER: My knowledge of reactor physics is a little low.

MR. MICHELSON: Aren't there operating curves because of the power oscillation problems of boiling water reactors or certain conditions you've got to maintain?

MR. KAUFER: Yes.

MR. MICHELSON: Where were they relative to their operating?

MR. LANIK: Well, they had the recirculation pumps running during this event so they weren't in any danger of going unstable.

MR. MICHELSON: No danger of that one.

MR. LANIK: And the other point on the xenon is that they had been operating at, if you remember from that W-curve, they have been operating at a fairly high power some 12 hours before, so really they were on the downside of the xenon curve and reactivity was increasing due to both cooldown and the natural decay of the xenon.

MR. KERR: I must say that I am puzzled that you attribute the principal contributor, you attribute operator error as being the principal contributor to this.

I would say organizational error was the principal contributor. I think the operator doesn't -- I mean the operator obviously was not properly instructed and the test was not thoroughly analyzed and maybe he could have done better under the circumstances.

This is such a chilling analogy to the Chernobyl accident that I really think Commonwealth Edison ought to rethink how they run tests.

I mean look at what happened.

In the first place you have a test involving unusual operating conditions which clearly was not thoroughly analyzed. For example, that xenon condition could have been anticipated and a number of other things could have been anticipated if they really analyzed it carefully.

In the second place, it was started one day, aborted, and tried again later. It was precisely what happened at Chernobyl and this sort of thing, since you failed the test once puts pressure on people to get it right the second time.

Third, it was started on the back shift, just as the Chernobyl accident was.

Fourth, the test was unsuccessful and an unanalyzed recovery was attempted.

Finally, some normally available equipment was unavailable.

MR. WARD: And there was an inadequate procedure.

MR. KERR: Yes.

MR. WARD: Essentially no procedure.

MR. KAUFER: We have looked a little bit at the Chernobyl event as well as this particular event and there are some differences. There are the similarities you talked about but --

MR. MICHELSON: I hope there were some differences!

MR. CHAFFEE: Well, in this case they didn't override the safety systems that existed like they did a Chernobyl.

MR. KERR: I didn't say they overrode them --

MR. ROSSI: The key safety system to protect against this reactivity insertion was operable.

MR. KERR: That may be luck.

MR. ROSSI: That is a very important difference.

MR. KERR: It may be luck because they had some other equipment that should have been operable which was not operable.

MR. ROSSI: I would call it more than luck, I think. The key safety system is the scram system that did indeed potentially trip.

MR. KERR: I don't mean it as a one-for-one parallel.

MR. KAUFER: I don't quite understand what you're saying, that there were some systems shut down?

MR. KERR: Well, you pointed out that one of the systems, the rod control monitor, was not operable.

MR. KAUFER: No, it was operable. That's why he couldn't withdraw rods.

MR. KERR: But another one was not.

MR. KAUFER: No, I was talking about IRM detection.

MR. CHAFFEE: One of the biggest differences here is in this particular case they didn't override any of this equipment and the equipment kept telling them, hey, things are going on here -- you have got put your source range instruments in, you have got a down range of instruments, and then it finally said, okay, the plant is going to trip.

MR. KERR: I'll grant you there are some differences. The big difference was that we didn't have an accident!

MR. KAUFER: What I was pointing out is there was a few detectors that weren't working.

MR. KERR: The principal contributor I would say is that they tried to run a test which nobody analyzed.

MR. KAUFER: I think if you look at our analysis and our contributing factors --

MR. KERR: I don't call that operator error.

MR. LANIK: If you recall, Barry, if you put up that previous slide, we didn't call that the main cause. Our identification of what the operator did is we called that the immediate cause.

In other words, what happened at the time of 3:598

was that the operator was focusing on pressure rather than reactivity. All the contributing causes we agree were factors within the organization and the blame is spread around throughout that organization.

The operator really is, you know, incidental to the incident.

MR. WARD: If the operator had been alert and caught this and you hadn't had the scram, nobody would be aware of all these real problems that are there --

MR. LANIK: That's right.

MR. WARD: -- which are organizational problems.

MR. LANIK: All what we are calling the contributing causes are the ones that we think are what you might call the basic, more basic than --

MR. WARD: Oh, is that right? So we should turn that slide around?

MR. LANIK: We are calling what the operator did the immediate cause, which means that was what happened at that time but his background was influenced --

MR. WARD: If you had a million dollars to spend on fixing this, what would you do?

MR. LANIK: You wouldn't slap the operator on the hand. I mean you would focus on these other issues, right.

MR. CHAFFEE: You would address those contributing factors.

MR. MICHELSON: This procedure was reviewed by the plant operating committee?

MR. KAUFER: Yes, it was reviewed by the plant, reviewed for their administrative procedures.

MR. MICHELSON: Okay. Which is generally a PORC, or something equivalent for a test procedure. And it was reviewed?

MR. BARRETT: Like George was saying -- excuse me. I'm Richard Barrett, I'm the Project Director at NRR.

The procedure was reviewed by the plant oversight committee. In fact, the plant set up a special group to oversee the entire operation of this test, from start to finish.

In retrospect, we don't feel as if the oversight was sufficient. But it was reviewed in advance, and by the PORC, by the equivalent of the PORC.

MR. MICHELSON: But the oversight committee wasn't obligated to be there when the test was being conducted?

MR. BARRETT: The oversight committee was not there throughout the test.

MR. CHAFFEE: The other thing I was told was that they also, in developing the procedure, they relied upon, as I understand it, the fact that they expected the operator to understand I guess the core physics associated with being at a low power level, although I'm not sure that they fully appreciated this hotrod situation, I guess that's the term that they had.

Apparently that was detected by the earlier shift and, unfortunately, it was not, as one of the contributing factors show, properly communicated.

MR. SHEWMON: Are you saying that if there hadn't been the hotrod then what he had done when he pulled out this and watched on the pressure would not have gotten him in trouble?

MR. CHAFFEE: I think that the potential for it to have gotten him in trouble would have been reduced. My understanding was that --

MR. SHEWMON: I'm sure that's true. But then, the question is whether it would be reduced significantly.

MR. ROSSI: I think what you're discussing is how much each of the contributing factors contributed to the problem.

It is clear that all of those items under contributing factors up there were the key to what happened. It's a little difficult to tell which one of them was the most important.

I mean, clearly, the training of the operator and his understanding of the physics was very important. The fact that he was looking at the wrong parameter was very important. Exactly which one of those was the major one is a little bit difficult to say. But I think everything you're discussing is a question of the contributing factors, what caused the operator to make the mistake.

MR. SHEWMON: Is the high level of activity rod on that list up there?

MR. CHAFFEE: It's there in the form of the poor communications that wasn't --

Let me tell you about the hot rod meant. As I understand it, when he went to pull the rods out, he pulled out one group, one step and then he pulled out I think it was one other rod one step. So, the implication of the hot rod is with very minimal rod motion. You have to up-range your, the ranges on your scales to prevent the trip, so the operator has to pay very, very close attention as a result of that situation.

If they hadn't had that situation, he would have had more time when he pulled rods out, so it was something unexpected, as I understand it.

MR. KAUFER: That definitely does fall into poor communications. If they had known and logged in on the first shift and passed it on --

MR. KERR: But if they had really analyzed this first carefully they would have anticipated it.

MR. KAUFER: Any one of these could have prevented it. All of them would have been helpful.

MR. KERR: A careful analysis of what they were doing would have anticipated it.

MR. KAUFER: Better training before hand.

MR. CARROLL: What period were they on when they tripped?

MR. BARRETT: They were on a 20 second period.

MR. CARROLL: That's the trip point, or was the period faster than that?

MR. CHAFFEE: I don't believe it was the rate, because the trip, I believe it was a hi-hi trip and it's based on the scale that they used, that they're monitoring on.

So when the power went up they got to the top of the range they were monitoring and caused a trip. That's why the ranging has to be changed.

The problem is, when you have a hot rod with very small rod movement, it goes up very quickly, so the operator hadn't expected that he was going to have the high trip that quickly are the implications I'm getting. That's why the hot rod had such an integral role in this thing.

MR. CARROLL: They got rid of vacuum trips a long time ago.

[SLIDE]

MR. KAUFER: I think what would key everybody in would be our conclusion, which probably encompasses what everybody is saying.

This event, running a reactor, a special test at unusual conditions that are not your normal mode, you need careful planning, obviously increased awareness, good training, proper review and use of procedures. Good communications and everything. It's a total ball putting it all together. There was definitely a low level of this at the plant.

MR. CARROLL: What is the level now? What's Commonwealth done about this system or situation? What lessons did they learn? How did they deal with them?

MR. KAUFER: I'd have to turn to the NRR people and let them answer that, since I don't deal in the --

MR. CARROLL: Why don't you do that, then?

MR. KAUFER: Under a different branch.

MR. CARROLL: No. I mean, ask them.

MR. OLSHAN: I can answer the corrective actions that the licensee has taken since this event.

My name is Lenny Olshan. I'm the Project Manager for Quad Cities. I have a slide here.

[SLIDE]]

MR. OLSHAN: These are the corrective actions that have already been taken by the licensee. Needless to say, right after the event, the plant senior management briefed the operating crew as to the event, and shortly after that brief, told the plant personnel.

In addition, one thing Barry neglected to mention, or maybe did mention. At the time they had an SRO assigned to both units. I mean, one SRO in the control room for both units. They have since decided to add an additional SRO, so now they have two SROs.

MR. CHAFFEE: So the significance of that is, now they have an SRO in the control room who is responsible for one unit and focuses on that unit.

MR. OLSHAN: Right. I'm sorry. That's right.

MR. CHAFFEE: Whereas, before the SRO in the control room was focusing on two units.

MR. WARD: He is also the STA, right? Who is the STA?

MR. KAUFER: Yes. He would be the STA.

MR. CHAFFEE: No.

MR. KAUFER: I think the STA is what they call the SCRE.

MR. CHAFFEE: He is the senior person on shift as well as the STA, and he is degreed. Is that right?

MR. OLSHAN: He's the SCRE. The SCRE is. The SCRE is their equivalent to the STA.

MR. KAUFER: What is a SCRE?

MR. OLSHAN: A Station Control Room Engineer. He's an STA with an RO license.

MR. WARD: And he's in charge of both units?

MR. OLSHAN: Yes. Now, the one SRO met tech specs. But again, they felt that they weren't --

MR. KERR: Did Commonwealth communicate information about this event to the other plant people?

MR. OLSHAN: Yes. The other plant personnel.

MR. KERR: Other plants, is what --

MR. OLSHAN: Oh, I'm sorry. Did you say the other plants?

MR. KERR: Yes. Some other plants other than Quad Cities?

MR. OLSHAN: The other plants that they have?

MR. KERR: Yes.

MR. OLSHAN: Yes, they have. In fact, one of the things we're doing is sending out an information notice to the entire industry on this event. That's in the process of being developed right now.

MR. CARROLL: Can it read well?

MR. OLSHAN: Who's writing it? You know it will read well.

MR. WARD: Wait a minute. I'm confused now. Where is the second SRO? Okay, well that is at the STA level, then. I mean, you said they've added another --

MR. KAUFER: They've added another one in here.

MR. WARD: But that is the STA, then.

MR. KAUFER: Correct.

MR. WARD: I mean, are they both STAs now?

MR. OLSHAN: I knew the STA was the SCRE and had an RO, but I didn't know he had a senior RO. Okay. If that's correct, then that's where they're adding him.

MR. CARROLL: So, there will be a SCRE for Unit 1 and a SCRE for Unit 2.

MR. OLSHAN: No.

MR. BARRETT: No, that's not our understanding. Our understanding is that they've added an additional licensed operator at the SRO level to the shift.

He's not -- I don't believe he's assigned to either unit specifically. He's just available there for the SCRE.

MR. WARD: Oh. He's just a guy off to the side there. Responsible for both units, or what?

MR. BARRETT: In a situation like this, he would have been assigned. If he had been available, he would have been assigned to the unit, say, that was manipulating the rods.

MR. SHEWMON: Is this diagram supposed to -- that was what it was before, or what it is now?

MR. BARRETT: That's before. This is the before.

MR. SHEWMON: Okay. So, there's at least three SROs on there. There would be a fourth one now?

MR. CARROLL: Floating around someplace.

MR. BARRETT: Yes. The Shift Engineer is outside of the control room. He is, on the back shift, he is the top level of operations department management on site.

The SCRE is at a center desk between the two units, and he is the manager of the entire control room. He is an SRO, and he is the STA.

The old situation was that they had an NSO who operated each of the units, as you see up here. And they had what they called a center desk NSO who supported the SCRE at the center desk, and they had an NSO who could be assigned to either unit as needed.

They now have an SRO who can be assigned to either unit as needed.

MR. WARD: All right. So, really, in addition to, or instead of those auxiliary NSOs, they've got another SRO.

MR. BARRETT: I believe in addition to.

MR. WARD: In addition. Okay.

[Slide.]

MR. OLSHAN: The other remedial actions taken by the licensee. I think there was a question earlier about whether the people have received training on this event. Well, obviously, since the event, the crew has received complete training, and the training, this type of event or this type of operation has been included in their normal training. So, by May of '91, all their operating personnel will have received training in a similar type situation.

The other things they have done are, they have already completed an independent in-depth investigation, and they have made a commitment to never again deliberately operate in hot standby.

MR. CARROLL: Why?

MR. OLSHAN: Well, because it is a sensitive mode of operation.

MR. CARROLL: Yes, but if there's a good reason to do it, you do it. You do it right.

MR. OLSHAN: I think even if you -- if you do it right, that's right. But I think even if you know what you're doing, you still have a potential for a trip or something.

MR. CARROLL: Yes. I mean, it isn't something you do capriciously. But if there's a reason for it, you do it right.

MR. ROSSI: Recognize this is what they've decided to do, not what we think --

MR. CARROLL: I know. I'm just questioning their wisdom.

MR. WARD: They've made a commitment; does that become part of their license?

MR. OLSHAN: No, no, no. That's not part of the license. That's an internal order. We in no way imposed it upon them and they haven't made any license recommendations or anything along that nature.

MR. KERR: Is that just for BWRs or PWRs, or just for this plant?

MR. OLSHAN: I believe it's just for this plant, for Quad Cities.

MR. CARROLL: When are they going to do the torsional tests at Dresden?

MR. OLSHAN: Well, they never even completed it at Quad Cities, they have to do it again at Quad Cities.

MR. CARROLL: It was the first one they were doing.

MR. OLSHAN: I think they completed it on one of the units already. I think it had been completed on one of their plants already. And I think they intend to do it again on Quad Cities.

MR. SHEWMON: They have to do this same test on all of their plants, PWRs and BWRs?

MR. KAUFER: This is, from our understanding, it's a test being run by GE on GE turbines. So it would just concern those plants with GE turbines. I don't know if Commonwealth has all GE turbines or not.

MR. SHEWMON: Okay. But you know that Braidwood is, presumably?

MR. KAUFER: I'm not sure.

MR. CARROLL: I think it is Westinghouse.

MR. KAUFER: It was one of their other plants, but I'm not sure which plant it was.

MR. OLSHAN: Yes, I don't remember, either. But I think they had completed it successfully on another plant.

Okay. That's the items that are completed. They still have several items that are in progress.

[Slide.]

MR. OLSHAN: I guess I hinted at that before. The lessons learned from this activity, from this event, will be included in their operator training, and the nuclear engineers will be required to attend that training.

The procedures are being revised.

The nuclear fuel services, which is a corporate function, is performing a self-assessment of the reactivity management training.

They brought in an experienced shift supervisor from LaSalle, and he's giving an independent review of shift activities, of such a shift turnover, the noise in the control room, that kind of thing, that may have contributed to the event.

And last but not least, they are surveying all their people to see if they do really have a good appreciation of how to apply reactor theory in the case of these low-power situations.

MR. KERR: How about impractical low-power situations?

MR. OLSHAN: Okay. Practical may not be a good word there.

MR. KERR: Yes.

MR. OLSHAN: But the word practical meant -- you know what it means -- it means the practical application of the theory, not practical low-power situations.

MR. CARROLL: And all of this is focused on Quad Cities, or are they looking at their other boilers at least?

MR. OLSHAN: Well, I'm primarily concerned with Quad Cities. Most of this is focused on Quad Cities. But the other boilers I'm sure are aware of what's going on.

MR. KERR: Tell me why you are primarily --

MR. OLSHAN: An independent overview by LaSalle, I mean, that man from LaSalle, LaSalle is a boiler, and he is familiar with the way they operate the control room.

MR. KERR: Tell me why you are primarily interested in Quad Cities.

MR. CARROLL: That's his job.

MR. OLSHAN: Oh, yes. I'm sorry. I'm the Quad Cities Project Manager.

MR. KERR: Oh. Okay. Is there somebody else interested in the other boilers?

MR. BARRETT: I am interested.

MR. ROSSI: We are in the process of preparing an information notice to let the entire industry know about this event, and share the lessons that are learned, which are the ones that we've discussed with you here. So we intend to go out with an information notice that tells all reactors about it.

MR. KERR: I doubt if this will happen again in Quad Cities, but it might happen somewhere else.

MR. BARRETT: Some of these lessons that have been learned here are specific to Quad Cities. Some of them are more generic. As Ernie pointed out, we will put out an information notice for the entire industry. Some of them are generic to the Commonwealth system. And basically, the reaction of the utilitie is keyed to the level that they perceive that the --

MR. KERR: But the one that is generic, it seems to me, is that if we are going to do an unusual reactor manipulation, you analyze it much more thoroughly than was the case here, apparently.

MR. BARRETT: That is correct.

MR. OLSHAN: Well, I think those are words that will be in the information notice, that type of warning.

MR. CARROLL: I guess the thing Bill and I are getting at is how did Commonwealth, as an organization, respond to it? Are they going through the same witch-hunt in their other boilers? I guess you guys don't know.

MR. BARRETT: I think that you are correct in your assessment that this entire evolution should have been more carefully managed, more carefully controlled, and analyzed, and planned, with better attention to procedures, and to training and to overseeing all of these evolutions.

But when you get to the cause, the specific cause, some of those causes are specific to the plant itself, to the way in which the plant itself is managed.

MR. OLSHAN: To elaborate a little bit, shift turnover has been a concern for several years at Quad Cities. They have a very close-knit organization, and the shift turnover tends to be informal. We've pointed this out in the past SALPs. That's the kind of thing Rich is talking about that may be unique to Quad Cities, an informal shift turnover.

MR. BARRETT: I'd like to suggest that we take a second. We have Ed Greenman here, who is the Director of Reactor Projects for Region III. And I think that it would be interesting to get a perspective from him on how this fits into the entire picture for Commonwealth Edison.

MR. WARD: While he's walking up, Jay, I'd like to remind you, you've used up your hour. It's up to the committee what it wants to do.

MR. CARRO! .: I was hoping we could close this one of: fairly quickly. And it doesn't appear that we'll get Ginna in today.

MR. WARD: Perhaps that would be more useful to the committee to hear the Ginna. We do have time for writing letters this we.k.

MR. CHAFFEE: Also, we do have some people from Region I here for Ginna.

MR. WARD: Yes. Well, why don't we just take the time and go through the Ginna review, too?

MR. CARROLL: All right.

MR. GREENMAN: Okay. Thank you, Mr. Chairman, members. I beg your indulgence for just a moment.

I'm here on a special assignment in Washington for a period of months. But I can explain how the Commonwealth system does in fact, and did address this particular event.

Their corporate oversight organization, headed by a corporate vice president, has the responsibility under the Quality Assurance Group, to formally incorporate lessons learned from any operating event at any one of the plants, any one of the stations within that system, across the entire station. You meet not only with the Nuclear Group of the Board of Directors, but monthly with the senior vice presidents on both the boiling water reactor side of the house and the pressurized water reactor side of the house.

In addition to that, the day after the event occurred, while they were developing the lessons learned, that went out under their own network to all Commonwealth plants, to all plant managers, and that resulted in the decision to terminate that particular type of test at their plants, at least in the short term. So the mechanism does exist and does in fact get translated in lessons learned to improve operations at all the Commonwealth stations.

MR. CARROLL: Thank you. Unless there are some more serious questions, let's move on to Ginna.

MR. CHAFFEE: Okay. Nick Fields is here to talk to us about the Ginna event. Nick's in the Events Assessment Branch.

[Slide.]

MR. FIELDS: This is an event that occurred at the Ginna plant on December 12th, 1989, and it involves a loss of the automatic and manual ESFAS actuation capability at the plant while it was at power.

The DC power supply for the A and B ESFAS logic trains was interrupted while the unit was at three percent power. The cause of this event, the immediate cause was the inadequate maintenance procedure, which had undergone formal plant review and was incorrectly approved for use in all modes of operation.

MR. CARROLL: What were they doing at three percent power? They were coming back up or --

MR. FIELDS: They were starting up. I'll get to that.

MR. CARROLL: Okay.

MR. FIELDS: They were restarting from a December 11th reactor trip, and they had an under-voltage signal on one of their safeguards buses, the no. 14 safeguards bus, and that signal caused the emergency diesel generator A to start. The diesel didn't load because the signal was spurious. It resulted from a failed relay card.

In order to replace and test the new relay card, it was necessary that they de-energize the under-voltage cabinet, and this evolution was accomplished by -- would be accomplished by transferring the power supply for the safeguards bus from its normal off site source to the operating diesel generator.

A work order indicating the steps required to accomplish the task was prepared by the plant electrical planner. The work order included a reference to a maintenance procedure M48.14, which was an infrequently conducted procedure. The work order, however, received varying levels of review by the electrical planner, the plant scheduler, and the shift supervisor.

After their reviews were conducted, the work order was then provided to the control room foreman for implementation. He questioned the appropriateness of the steps in the maintenance procedure which was a part of this work order which is required the opening of two DC switches and the distribution panel on the back of the back of the main control board. However, the electrical planner assured him that the procedure was proper and that it had been performed before, and that the switches was proper.

He then reverificd for himself, by going back through the maintenance procedure, that the procedure was okay to perform in all modes of operation, after which he opened the switches. They received the control room alarm when the switches were opened, and that alarm enunciated a safeguard DC failure.

The control room foreman then opened the normal supply breakers to the safeguards bus, which caused momentary de-energization of the bus, and as a result of the de-energizing this bus, they received the reactor trip because they had de-energized the intermediate instrumentation channel, and that completed the required one out of two trip logic to initiate a trip at three percent power.

The oncoming shift supervisor who was in the control room at the time noticed the DC failure alarm; however, because of control room activity associated with addressing the reactor trip, he delayed his pursuit of the cause of the alarm.

Following the reactor trip and unit stabilization, the maintenance procedure was completed, which allowed the DC switches to be reclosed. The oncoming shift supervisor then consulted with various plant personnel regarding his concerns with respect to the alarm and confirmed that during the period that the switches were open, in the open position, the automatic and manual single -- when I say manual, I mean a single pushbutton ESFAS initiation sequence was disabled.

The maintenance procedure that was a part of this work order had been reviewed and approved for all modes of operation by the Plant Operating Review Committee, the PORC. The infrequently implemented procedure should have been specifically limited to use during cold shutdown, and the purpose of the repositioning of the DC switches is to prevent spurious ESFAS actuations while that's shut down.

So it had undergone the required review and had been approved for all modes of operation when it rightfully should have been approved for only cold shutdown. This maintenance procedure unnecessarily challenged operating personnel and significantly contributed to this event.

They relied on the electrical planner, who had a good reputation at the plant, had a lot of experience, and also the three levels of review that took place just prior to implementing the work package also, I suspect, gave them some confidence that the procedure was accurate and adequate.

As follow-up, prior to start-up of the unit, the licensee briefed the region and NRR on its proposed corrective actions with respect to this event.

[Slide.]

MR. FIELDS: They intend to make plant personnel aware of the need for questioning attitude with adequate follow-up.

They see as a problem the fact that the control room foremen and others who had a gut feeling that the procedure was improper to implement but didn't follow up on it and they want to assure that --

MR. WILKINS: What more could the foreman have done? Quit his job? I mean I don't know what else he could have done.

MR. FIELDS: Well, he could have stopped at that point and then maybe taken, you know, requested additional review.

MR. WILKINS: But he asked the guy in charge and the guy says it's okay, do it, and then he went and read the procedure and it said it was okay under all circumstances.

MR. FIELDS: Well, I am just saying that is one of the problems that we are identifying.

MR. CARROLL: Yes, but it's his responsibility. The planner can tell him whatever he wants. He is the Captain of the ship.

MR. WILKINS: So what you are saying is he has the authority on his own to say I don't care what you say, I am not going to do it.

MR. FIELDS: I think that is correct.

MR. CARROLL: Absolutely.

MR. KERR: Well, in his earlier discussion though I thought you said that he did question it. He then went back and re-reviewed it and convinced himself it was probably okay.

Did I miss --

MR. FIELDS: No. I said the control room foreman re-read the maintenance procedure to see that it was okay.

The shift supervisor had approved the work package and the control room foreman could have consulted with the shift supervisor and I am sure the shift supervisor could have halted the procedure until they got clarification on it.

MR. CARROLL: Do you think there is an element of too many people in a review chain in this, where to the point that nobody feels responsible?

MR. WILKINS: Well, hell, Joe signed off on this.

MR. CARROLL: It must be okay, Joe usually does good work.

MR. FIELDS: Beyond that, there was a problem in the original review of the maintenance procedure.

I don't know how many levels of review that entails but the procedure was approved by the plant operating review committee.

MR. CARROLL: I have seen things like that happen but then when you are really going to try to use it in a practical situation, that is when you oftentimes find a flaw.

MR. FIELDS: It was an infrequently performed procedure. That's for certain. They didn't have very much experience performing this procedure.

The licensee is conducting a human factors enhancement system evaluation of all aspects of plant, staff and crew performance leading to this event.

MR. KERR: He is performing a human enhancement --

MR. FIELDS: What they called it is a human performance enhancement system evaluation.

MR. KERR: We need to find out how to do that, you know!

MR. CARROLL: HPES.

MR. KERR: I think we could use one of those.

MR. FIELDS: HPES, that's right.

MR. CARROLL: That's the INPO technique for [illegible]ng for root cause of things.

MR. FIELDS: They are going to evaluate the procedure development and approval process at the site, at the plant and implement enhancements.

They expect to conduct personal training on lessons learned and then they are going to monitor the effectiveness of their corrective actions.

MR. CARROLL: Had they had an HPES program in effect before this event?

MR. FIELDS: I am not sure of that.

VOICE FROM THE FLOOR: Yes.

MR. FIELDS: The region has conducted a special inspection and they intend to issue an inspection report shortly on this event.

That concludes my presentation.

MR. CARROLL: Does anyone have questions?

[No response.]

MR. CARROLL: Okay. I thank all the presenters today. It has been very informative. I will turn it back to Dave.

MR. WARD: Thank you very much.

Why don't we just take a five minute break while we clear the room.

We are going to go on to report writing session next.

[Whereupon, at 4:25 p.m., the meeting was adjourned.]

REPORTER'S CERTIFICATE

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

in the matter of:

NAME OF PROCEEDING: 369th ACRS Meeting

DOCKET NUMBER:

PLACE OF PROCEEDING: Bethesda, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Marilynn Estep

Official Reporter
Ann Riley & Associates, Ltd.

10 CFR 55
OPERATORS' LICENSES
PROPOSED RULE CHANGE

FITNESS FOR DUTY (FFD)
REQUIREMENTS
LICENSE CONDITION

PUBLIC COMMENTS

COMMENTS RECEIVED

- 1 - NUMARC
- 25 - Utilities and Contractors
- 7 - Individual Licensed Operators
- 4 - Employee Organizations
- 2 - Universities

ISSUES AND DRAFT PROPOSED RESOLUTIONS

I. RULE UNNECESSARY
(REGULATIONS EXIST)

- 30 Comments

- Proposed Resolution:
  The Commission directed rulemaking that emphasized and clearly informed operators that it is a condition of their license that they must comply with the Facility Part 26 Program for FFD.

- No change required to proposed rulemaking

II. OPERATOR MORALE

- Proposed rule singles out operators to the detriment of their morale
- 28 Comments
- Proposed Resolution:
  Proposed rulemaking stresses to licensed operators that their license is a privilege (not a right) and that refusal to participate in Part 26 requirements can lead to enforcement action and/or licensing action
- No change required to proposed rulemaking

III. MEDICAL REVIEW
(LEGAL DRUGS)

- It is an unnecessary burden that the proposed rule requires medical personnel be available 24 hrs/day to make judgements about prescription and over-the-counter (OTC) drugs
- 20 Comments

III. MEDICAL REVIEW (CONTINUED)

- <u>Proposed Resolution:</u>
- Medical personnel are not required 24 hrs/day for prescription and OTC drug evaluation per Part 26 or proposed Part 55
- The intent is that operators follow the facility Part 26 Program for supervisory notification of FFD concerns about the use of legal drugs
- Proposed rulemaking wording will be clarified to more fully explain the intent

IV. BASIS

- What is the basis or need for the rule change ? Is it an industry-wide problem ?
- 2 comments
- <u>Proposed Resolution:</u> Need to stress compliance with Part 26 as condition of license.
- Issue # I. addressed need for the rule change.
- No change required to proposed rulemaking

V. REPORTING
(LEGAL DRUGS)

- How will operators who do not report medicine use be treated ?

- 1 comment

- <u>Proposed Resolution:</u>
  As per the facility Part 26 program, written policies and procedures designed to meet the general performance objectives and specific requirements of Part 26 will be adhered to

- Proposed rulemaking wording will be clarified to more fully explain the intent

VI. SPECIFIC TRTR COMMENTS
(ISSUE # 1 of 2)

- Formal drug testing programs should not be required for non-power reactors (NPR).

- 1 comment

- Proposed Resolution:
  They are not required per Part 26 or proposed Part 55.

- NPR licensees are only required to participate in whatever program that they have established.

- No change required to proposed rulemaking

VI. SPECIFIC TRTR COMMENTS
(ISSUE # 2 OF 2)

- Medical Review Officers (MRO) do not exist at NPR facilities (in relation to OTC and prescription medication).
- 2 Comments
- <u>Proposed Resolution:</u>
  True. There are no requirements in either Part 26 or the proposed Part 55 that they do.
- No change required to proposed rulemaking

OPERATOR'S LICENSES

MODIFICATION FOR

FITNESS-FOR-DUTY

THE INDUSTRY BELIEVES THE PROPOSED RULE IS UNNECESSARY BECAUSE:

- PART 26 APPLIES TO ALL PLANT PERSONNEL WITH UNESCORTED ACCESS, INCLUDING LICENSED OPERATORS.

- THE STATED PURPOSED, I.E., TO "...PROVIDE A BASIS FOR TAKING ENFORCEMENT ACTIONS AGAINST LICENSED OPERATORS..." IN REGARD TO FITNESS-FOR-DUTY IS ALREADY PROVIDED BY EXISTING REGULATION.

OPERATOR'S LICENSES

MODIFICATION FOR

FITNESS-FOR-DUTY (CONT'D)

- IT UNDERCUTS INDUSTRY EFFORTS TO ACHIEVE AN ATMOSPHERE OF TRUST THAT SUPPORTS PROFESSIONALISM.

- THE MORALE OF THIS VERY IMPORTANT GROUP OF EMPLOYEES MAY BE ADVERSELY AFFECTED BY BEING SINGLED OUT FOR SPECIAL TREATMENT.

PART 26 APPLIES

§ 26.2 SCOPE

"THE PROVISIONS OF THE FITNESS-FOR-DUTY PROGRAM MUST APPLY TO ALL PERSONS GRANTED UNESCORTED ACCESS TO PROTECTED AREAS, ..."

- LICENSED OPERATORS MUST HAVE UNESCORTED ACCESS IN ORDER TO PERFORM THEIR DUTIES.

ENFORCEMENT ACTION

CAN BE TAKEN NOW

§ 55.61(B)(3) & (4)

- THE CURRENT REGULATION PROVIDES FOR ENFORCEMENT ACTION
- LICENSES CAN BE REVOKED OR SUSPENDED FOR WILLFUL VIOLATION OR FAILURE TO OBSERVE ANY RULE, REGULATION OR ORDER OF THE COMMISSION
- VIOLATIONS OF THE FITNESS-FOR-DUTY RULE CAN NOW RESULT IN REVOCATION OR SUSPENSION OF LICENSE

UNDERCUTS EFFORTS TO

DEVELOP PROFESSIONALISM

- INPO DOCUMENT, PRINCIPLES FOR ENHANCING PROFESSIONALISM OF NUCLEAR PERSONNEL, RELEASED IN 1989

- MANAGEMENT PRACTICES AND POLICIES SUPPORT TEAMWORK AND TRUST AT ALL LEVELS

- PRACTICES AND POLICIES ENCOURAGE PROFESSIONALISM FROM ALL PERSONNEL

- SINGLING OUT LICENSED OPERATORS FOR SPECIAL TREATMENT UNDERCUTS THIS EFFORT

GI-29, BOLTING DEGRADATION OR FAILURE IN NUCLEAR POWER PLANTS

PRESENTATION TO THE ACRS - JANUARY 9, 1991

- o INTRODUCTION
- o INDUSTRY PROGRAM
- o PAST AND ONGOING NRC EFFORTS ON BOLTING
- o RES PROPOSED RESOLUTION
- o NRR PRESENTATION AND PROPOSED ACTIONS

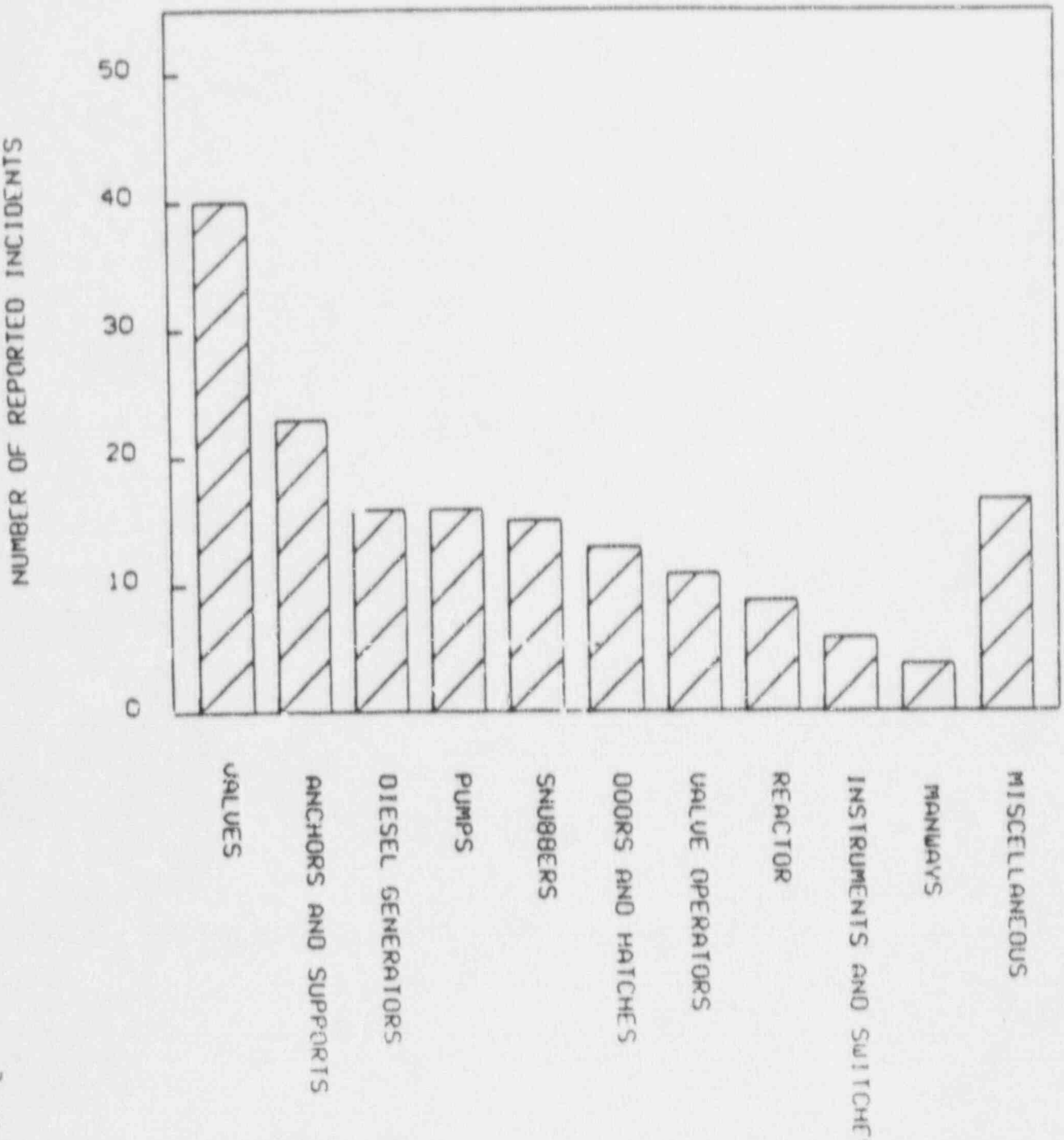
INTRODUCTION

- o SCOPE INCLUDES ALL SAFETY RELATED BOLTING
- o BOLTING FAILURES HAVE OCCURRED AND UNDOUBTEDLY WILL CONTINUE TO OCCUR
- o NRC HAS REQUIRED ACTIONS BY LICENSEES ON BOLTING EVENTS JUDGED TO BE SIGNIFICANT
- o CATASTROPHIC FAILURES
  - NONE HAVE OCCURRED IN NUCLEAR PLANTS
  - RISK ANALYSIS ASSUMED THAT OCCURRANCE IS POSSIBLE
- o DECISION PENDING IS WHETHER TO CLOSE ISSUE WITH "INFO ONLY" GENERIC LETTER, THAT SUGGESTS A BOLTING INTEGRITY PROGRAM, OR TO REQUIRE SUCH A PROGRAM

SUMMARY OF INDUSTRY RECOMMENDED PROGRAM

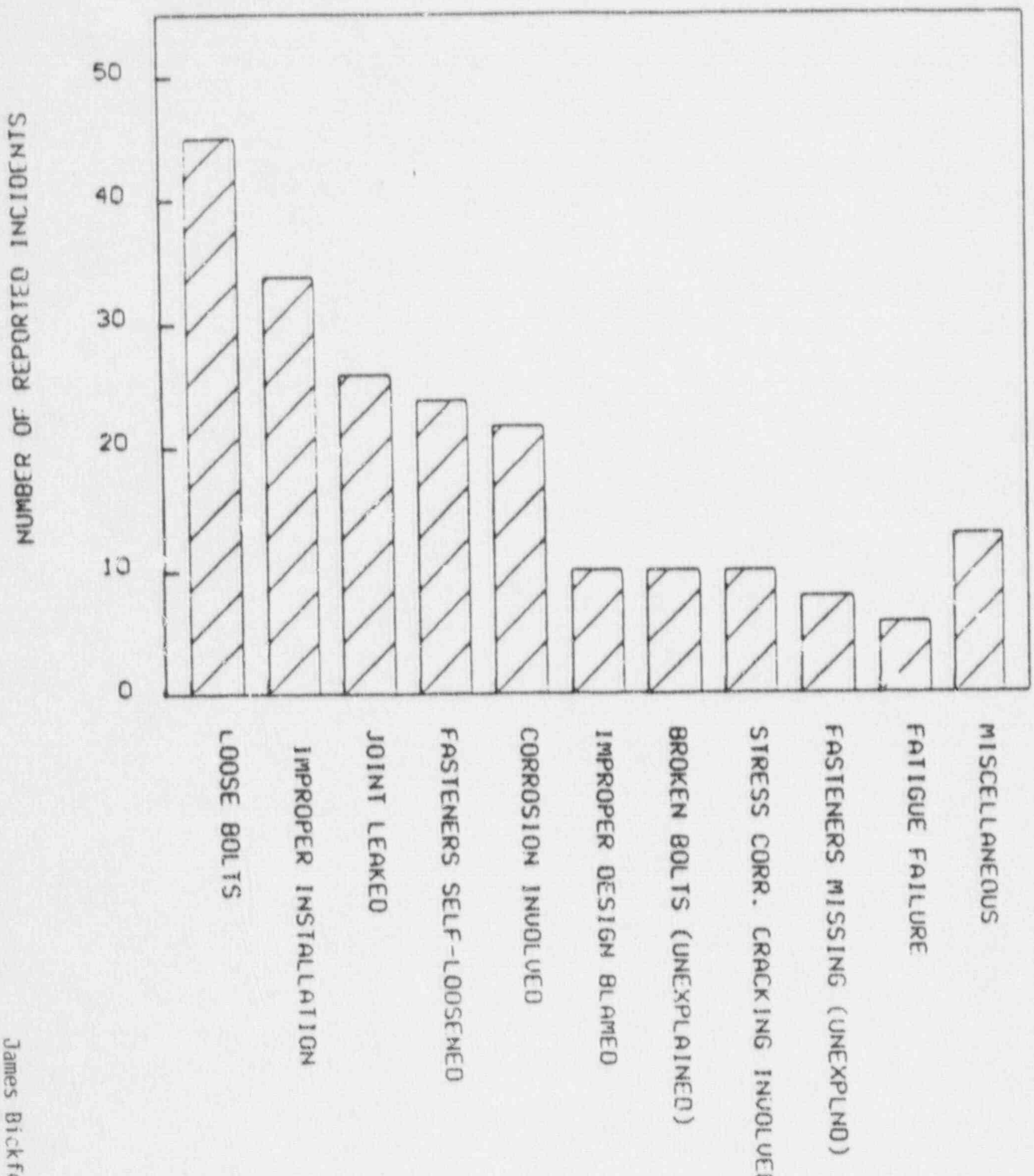
- o EPRI ORGANIZED THE DEVELOPMENT OF A GENERIC PROGRAM
- o BROAD PARTICIPATION BY MANY INDUSTRY GROUPS
- o LOCATION OF BOLTING PROBLEMS
- o REASONS OF BOLTING FAILURES
- o OUTPUT
  - EPRI NP-5769, VOLS 1&2
  - EPRI GOOD BOLTING PRACTICES MANUALS
  - VIDEO TAPES (PARTS I, II, & III)
- o EPRI RECOMMENDS DEVELOPMENT AND IMPLEMENTATION OF A PLANT-SPECIFIC BOLTING INTEGRITY PROGRAM
  - STAFF HAS SOME QUALIFICATIONS AND EXCEPTIONS, BUT BASICALLY AGREES WITH THE RECOMMENDED PROGRAM

LOCATION OF PROBLEMS



James Bickford
Raymond Engineering

REASONS FOR FAILURES



James Bickford
Raymond Engineering

LEAK - BEFORE - BREAK PROPOSAL

1. IN NP-[illegible]769, VOL. 1, SEC. 3, "PRESSURE BOUNDARY BOLTING," EPRI PROPOSED LBB TO ENSURE CLOSURE INTEGRITY.

2. BOLTED CLOSURE/WELDED JOINT SIMILARITIES:
   MAT'L. SELECTION; DESIGN, PSI AND ISI REQUIREMENTS;
   MANUFACTURING/CONSTRUCTION CONTROLS.

3. BOLTED CLOSURES FEATURE REDUNDANCY.

4. NECESSARY CONDITIONS CITED (P. 3-2)
   - LEAKAGE IS SAFETY-ACCEPTABLE
   - MARGIN (LEAK DETECTION TO BREAK) IS SUFFICIENT

5. NOTE: G. L. 88-05 (BORIC ACID/WASTAGE) SET LEAKAGE BELOW T. S. ALLOWABLES.

6. EPRI PROPOSED A LBB STRATEGY (P. 3-15)

7. EPRI PROPOSED ACCEPTANCE CRITERIA (P. 6-3)

8. CODE CASE PREPARED AND SUBMITTED TO ASME CODE, SEC. XI; UNDER STUDY BY COMMITTEE WITH NRC PARTICIPATION.

9. NRC STAFF IN SUBSTANTIAL AGREEMENT.

L. B. B., (CONTINUED)

10. ASME CODE CASE IN 4TH REVISION IN SG - E+S

11. EXTENSIVE REVIEW WILL PRECEED INCORPORATION; NRC ACCEPTANCE.

12. AS WRITTEN: LBB CAN NOT BE APPLIED WHEN:

    a. AREA LOSS IN ANY ONE FASTENER MAY BE LARGE;
    b. NUMBER OF DEGRADED FASTENERS MAY BE LARGE;
    c. TOTAL FASTENER AREA LOSS MAY BE LARGE.

    NOTE "LARGE" - FUNCTION OF SIZE (CLOSURE OPENING OR NUMBER OF FASTENERS) PER CODE CASE ACCEPTANCE STANDARDS.

13. AS WRITTEN: CODE CASE APPLIES TO ASME CLASS 1, PRIMARY PRESSURE BOUNDARY; WHERE PERCEIVED NEED IS GREATEST.
    (IN PRINCIPAL - CAN APPLY TO CLASSES 2 AND 3)

14. OTHER CODE CASE LIMITATIONS:

    a. LOW ALLOY OR Q/T STEELS OF YS < 150 KSI
    b. NOMINAL SIZE ≥ 1 IN.
    c. OPENING DIAMETER ≥ 6 IN.
    d. 8 OR MORE FASTENERS

L. B. B., (CONTINUED)

e. NDE MUST DETECT AND SIZE PER ACCEPTANCE STANDARDS
f. LEAKAGE MUST BE STOPPED
g. PRELOAD MUST BE CONFIRMED

15. IF CODE CASE PASSED AND ENDORSED, REQUIRED REPAIR WOULD BE SIMPLIFIED; PERSONNEL EXPOSURE DECREASED

SUMMARY OF NRC ACTIVITIES ON BOLTING

- o RELATED GENERIC COMMUNICATIONS

  - 7 BULLETINS, 2 GENERIC LETTERS, 1 CIRCULAR, AND 11 INFORMATION NOTICES

  - GENERIC LETTERS AND BULLETINS REQUIRED CONTINUING ACTIONS

- o USI - A46

  - ADDRESSES ADEQUACY OF EQUIPMENT ANCHORAGES
  - SAFE SHUTDOWN REQUIRED FOR SSE

- o INDIVIDUAL PLANT EXAMINATION FOR EXTERNAL EVENTS

  - WILL ADDRESS ADEQUACY OF EQUIPMENT ANCHORAGES
  - SEISMIC EVENTS BEYOND SSE TO BE CONSIDERED

- o CONCLUSIONS

  - STAFF HAS TAKEN ACTION ON BOLTING EVENTS JUDGED TO BE SAFETY SIGNIFICANT

  - RESIDUAL SAFETY ISSUE APPEARS SMALL

PROPOSED RESOLUTION OF GSI-29

- REGULATORY ANALYSIS RESULTS PROVED TO BE INCONCLUSIVE REGARDING A MANDATORY PROGRAM ON SAFETY-RELATED BOLTING FOR OPERATING PLANTS

- WITH SOME EXCEPTIONS AND QUALIFICATIONS, RES AND NRR BOTH ENDORSE THE INDUSTRY PROPOSED BOLTING INTEGRITY PROGRAM AS BASIS FOR RESOLUTION OF GSI-29
  - QUALIFICATIONS AND EXCEPTIONS IN NUREG 1339
  - EPRI PROGRAM IS GENERAL

- INDUSTRY TO CONTINUE COMMITTED ACTIONS IN RESPONSE TO NRC BULLETINS AND GLs

- A NEW SRP SECTION OF "SAFETY-RELATED BOLTING" TO BE DEVELOPED BY NRR FOR FUTURE PLANTS

- RES PROPOSES ISSUING GL FOR INFORMATION (INCLUDING NUREG-1339)
  - INFORMS INDUSTRY
  - MAKES SUGGESTIONS
  - DOES NOT REQUIRE SPECIFIC ACTION

- NRR PROPOSES ISSUING 50.54(f) TYPE GL

- STAFF SEEKS ACRS ADVICE

NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: GENERIC ISSUE 29
BOLTING ISSUES AND PROBLEMS

DATE: JANUARY 10, 1991

PRESENTER: JAMES A. DAVIS, Ph.D.

PRESENTER'S TITLE/ BRANCH/DIVISION:

MATERIALS ENGINEER
NRR/DET/EMCB

DIVISION PRESENTER'S NRC TEL. NO:

(301) 492-0713

SUBCOMMITTEE: MAIN COMMITTEE

OUTLINE

- Safety Significance
- NRR Proposal
- NRR Action Plan

GENERIC ISSUE 29
SAFETY SIGNIFICANCE

- Bolting in Structural Applications-Highly Loaded Under Faulted and Accident Conditions. Degraded, Loose, or Missing Bolts May Result in System Failure.

- Bolting with Manufacturing Defects May Cause System Failure. (Broken Ice Condenser U-Bolts Could Result in Ejection of Ice Basket)

- Counterfeit Bolts- From a Small Sample, No Counterfeit Bolts were Found, but 10% Were out of Spec., 1% Seriously out of Spec.

GENERIC ISSUE 29
SAFETY SIGNIFICANCE

- A Given Type of Bolting May be used in a Number of Components: i.e., Over-Hardened 410 SS in Anchor Darling Check Valves.
- Severe General Corrosion of Bolts Caused by a Leak Could Result in "Unzippering."

GENERIC ISSUE 29
NRR PROPOSAL

- Issue a 50.54f Generic Letter
- Are the Licensees Implementing a Plan for Bolting Similar to Those Suggested in EPRI Manuals NP-5067 Volume 1 and Volume 2.
- "GOOD BOLTING PRACTICES, A Reference Manual Power Plant Maintenance Personnel,"
  Volume 1: Large Bolt Manual
  Volume 2: Small Bolt Manual

GENERIC ISSUE 29
NRR ACTION PLAN

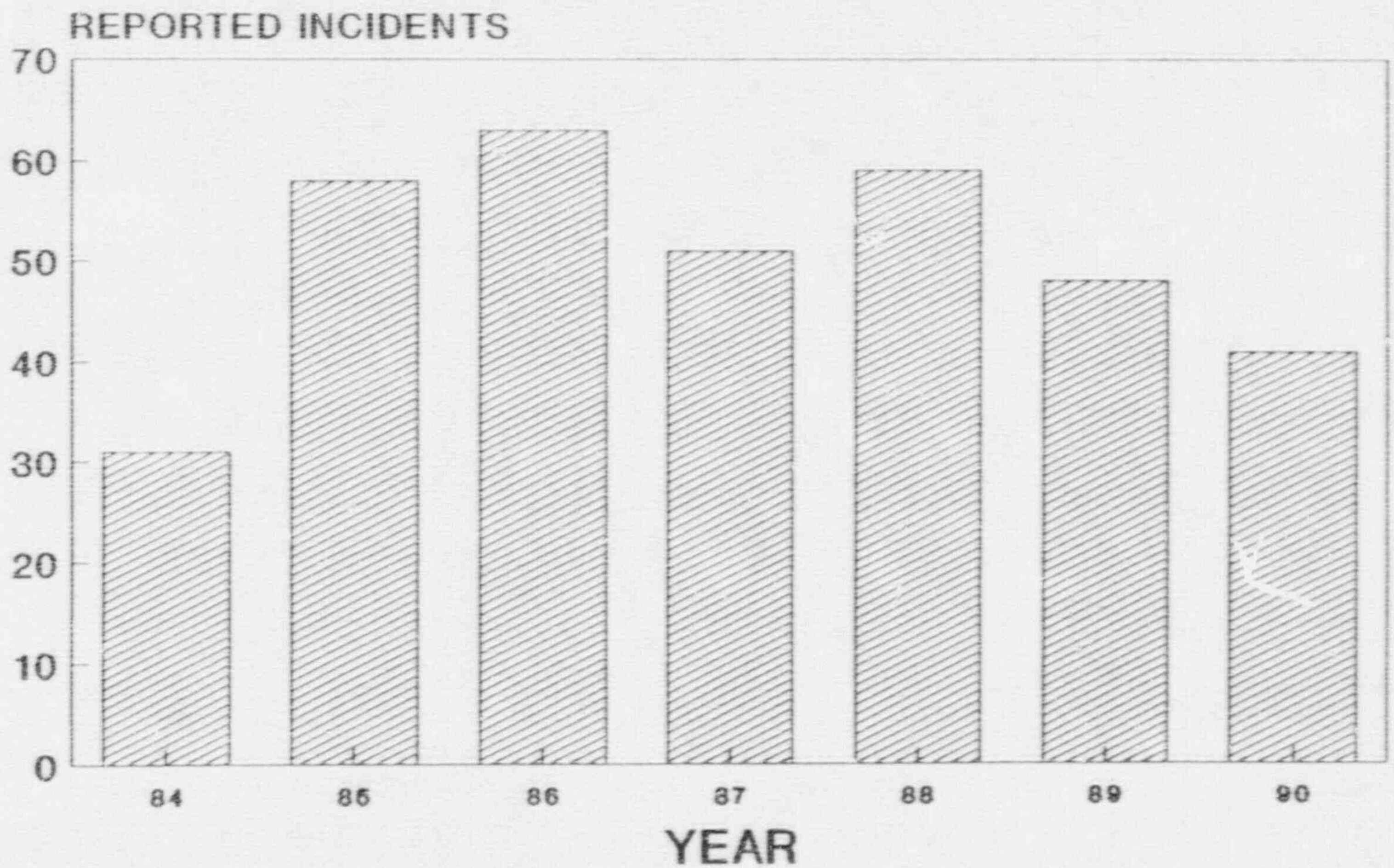
ACTION	CONTACT
LER Search	M. Poore ORNL
Receiving Inspections	R. McIntyre RVIB
Generic Letter to Assess Industry Implementation of EPRI Bolting Manuals	
Assess Need for Future Action	

GENERIC ISSUE 29
LER SEARCH

- Oak Ridge Searched LER's - 1984 to Sept., 1990
  349 Incidents Reported.

- Common Incidents
  - ✓ Stress Corrosion Cracking
  - ✓ Boric Acid Corrosion
  - ✓ Vibration Loosening
  - ✓ Loose Nuts-Improper or no Torquing Instructions
  - ✓ Missing Bolts-Improper or No Installation or Inspection Requirements
  - ✓ Improper Design or Material
  - ✓ Counterfeit Bolts

BOLT/FASTNER FAILURES
1984 TO SEPT 1990



GENERIC ISSUE 29
NRR PROPOSED SCHEDULE

Action	DUE DATE
Prepare Draft Generic Letter	02/01/91
Management Review	03/01/91
Meet With CRGR	04/01/91
Issue Generic Letter	05/01/91
Review Responses	09/01/91
Determine Future Action	09/15/91

Report to ACRS
on
NRC Research Programs

Presentation to the Advisory Committee on Reactor Safeguards
January 10, 1991

Eric S. Beckjord, Director
Office of Nuclear Regulatory Research

BUDGET

RES FY 1991 BUDGET

PROGRAM CATEGORY	OMB MARK	REVISED	DELTA
Integrity of Reactor Components	27,780	27,230	(550)
Preventing Damage to Reactor Cores	22,550	21,675	(875)
Reactor Containment Performance	17,875	17,330	(545)
Confirming Safety of Low Level Waste Disposal	3,431	3,301	(130)
Resolving Safety Issues & Developing Regs	18,364	18,364	---
Confirming Safety of High Level Waste Disposal	4,000	4,000	---
Totals	94,000	91,900	(2,100)

ADVANCED REACTOR INITIATIVES

- Form a New Advanced Reactors Branch
- Coordinate All RES Advanced Reactors Activities in new ARB
- Create New Advanced Reactors Program Area in FYP Budget
- Work Closely with New Advanced Reactors Division in NRR
- Assure Comprehensive Research Program for Advanced Reactors Activities

NSRRC REPORT

- EDO Requested Review to Consider Research Strategy and Content of Research Program.
- Report Submitted December 21, 1990.
- NSRRC Finds the Research Program to be Consistent with the NRC Mission, Responsive to the Needs of the User Offices, and Consistent with Stated Requirements.
- NSRRC Points out that the FYP does not address Specific Research for Advanced Reactors and Recommends that RES give Prompt Attention to this.
- NSRRC Concludes that it would be Difficult to Sustain a Viable Research Program if Budgets are Decreased.
- NSRRC States that Budget Increases will be needed to Address Requirements for New Technologies.

AGING

SCOPE OF AGING RESEARCH

- Primary System Pressure Boundary
- Safety Systems and Support Systems
- Electrical and Mechanical Components
- Concrete Structures
- Special Studies
- Program Integration

SEVERE ACCIDENTS

CURRENT EMPHASIS IN SEVERE ACCIDENT RESEARCH

- Core Melt
- Lower Head Failure
- Revised Source Term
- Direct Containment Heating
- Issues Specific to Various Containment Types (e.g., Mark-I Liner Integrity, FCIs in Mark-II Cavities & Downcomers)

HUMAN FACTORS

SCOPE OF HUMAN FACTORS RESEARCH

- Human-System Interfaces (Including Advanced Controls and Displays).
- Influence of Organizational Factors on Plant Risk.
- Incorporation of Human and Hardware Reliability into Risk Assessment.
- Personnel Performance Measurement.

ACRS PRESENTATION
ON
REACTOR OPERATING EVENTS
JANUARY 10, 1991

3:00 P.M. -- 4:00 P.M.

INTRODUCTION	ALFRED CHAFFEE	
QUAD CITIES 2	HUMAN FACTORS STUDY REPORT HI - HI SCRAM FROM HOT SHUTDOWN	BARRY KAUFER
GINNA 1	LOSS OF AUTOMATIC AND MANUAL ACTUATION OF ENGINEER SAFETY FEATURES SYSTEM WHILE AT POWER	NICK FIELDS

NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: LOSS OF AUTOMATIC AND MANUAL ACTUATION OF ENGINEER SAFETY FEATURES SYSTEM WHILE AT POWER

DATE: JANUARY 10, 1991

PRESENTER: NICK FIELDS

PRESENTER'S TITLE/BRANCH/DIV:

REACTOR SYSTEMS ENGINEER, EVENTS ASSESSMENT BRANCH, DIVISION OF OPERATIONAL EVENTS ASSESSMENT, NRR

PRESENTER'S NRC TEL. NO.:

492-1173

SUBCOMMITTEE:

GINNA UNIT 1
LOSS OF AUTOMATIC AND MANUAL ESFAS ACTUATION
CAPABILITY WHILE AT POWER
DECEMBER 12, 1990

PROBLEM:
THE DC POWER SUPPLY FOR BOTH ESFAS LOGIC TRAINS WAS INTERRUPTED DISABLING AUTOMATIC AND MANUAL (SINGLE PUSH-BUTTON) ACTUATION CAPABILITY

CAUSE:
INADEQUATE MAINTENANCE PROCEDURE

SAFETY SIGNIFICANCE:
AUTOMATIC AND MANUAL (SINGLE PUSH-BUTTON) INITIATION OF THE ENGINEERED SAFETY FEATURES SYSTEM WAS DISABLED WHILE THE UNIT WAS AT THREE PERCENT POWER

DESCRIPTION OF EVENTS:
- A SPURIOUS UNDERVOLTAGE (UV) SIGNAL ON THE NO. 14 VITAL BUS INITIATED THE START OF THE "A" EDG.
- A WORK ORDER TO REPLACE A FAILED RELAY CARD REQUIRED THE USE OF MAINTENANCE PROCEDURE (MP) M48.14.
- THE CONTROL ROOM FOREMAN IMPLEMENTING THE WORK ORDER QUESTIONED THE PROPRIETY OF OPENING THE A AND B TRAIN ESFAS DC POWER SUPPLY SWITCHES AS DIRECTED BY THE MP.
- CONTROL ROOM ALARM L-31 WAS RECEIVED WHEN THE SWITCHES WERE OPENED.
- THE REACTOR TRIPPED WHEN THE NORMAL POWER SUPPLY BREAKER TO THE BUS WAS OPENED IN PREPARATION FOR TRANSFERRING THE BUS TO THE OPERATING EDG.
- FOLLOWING THE TRIP, THE MP WAS COMPLETED AND THE DC SWITCHES WERE RECLOSED.

DISCUSSION:

- o MP M-48.14 HAD BEEN PREVIOUSLY APPROVED FOR USE IN ALL MODES OF OPERATION BY THE PLANT OPERATIONS REVIEW COMMITTEE (PORC); THE INFREQUENTLY USED PROCEDURE SHOULD HAVE BEEN SPECIFICALLY LIMITED TO USE ONLY DURING COLD SHUTDOWN.
- o THE PORC FAILED TO RECOGNIZE THE INADEQUACY OF THE MAINTENANCE PROCEDURE.
- o PLANT PERSONNEL DID NOT ADEQUATELY PURSUE THEIR CONCERNS REGARDING THE IMPLEMENTATION OF THE MP.

FOLLOWUP:

- o PRIOR TO START-UP, LICENSEE BRIEFED THE REGION AND NRR ON PROPOSED CORRECTIVE ACTIONS
- o AN NRC INSPECTION REPORT WILL BE PUBLISHED WHICH WILL DOCUMENT THE FINDINGS OF A SPECIAL INSPECTION CONDUCTED BY THE NRC REGIONAL STAFF.

HUMAN FACTORS STUDY REPORT

QUAD CITIES - UNIT 2 IRM SCRAM FROM HOT SHUTDOWN - 10/27/90

PRESENTATION TO

ADVISORY COMMITTEE ON REACTOR SAFEGAURDS

JANUARY 10, 1991

BARRY KAUFER
MAIL STOP MNBB 9715
PHONE: FTS 492-4544

REACTOR OPERATIONS ANALYSIS BRANCH
DIVISION OF SAFETY PROGRAMS
OFFICE FOR ANALYSIS AND EVALUATION OF OPERATIONAL DATA

1. INTRODUCTION

2. BACKGROUND

3. DESCRIPTION OF EVENT

4. ANALYSIS

5. CONCLUSIONS

INTRODUCTION

EVENT WAS SELECTED TO BE PART OF AEOD PROGRAM TO STUDY HUMAN FACTORS ASPECTS OF OPERATIONAL EVENTS. ANALYSIS IS BASED ON UNDERSTANDING THE FACTORS AFFECTING CONTROL ROOM OPERATORS' PERFORMANCE DURING EVENTS.

TEAM WAS DISPATCHED TO THE SITE ON OCTOBER 31, 1990. DATA WAS OBTAINED FROM DISCUSSIONS, PLANT LOGS, STRIP CHART RECORDINGS, AND INTERVIEWS OF PLANT OPERATORS. RESULTS OF THIS ANALYSIS WERE ISSUED IN REPORT DATED DECEMBER 28, 1990.

BACKGROUND

FIRST ATTEMPT ON 9/28/90 ABORTED DUE TO EHC PROBLEMS. LOAD REDUCTION ON UNIT 2 BEGAN ON 10/26/90 IN PREPARATION FOR TURBINE TORSIONAL TEST. ON OCTOBER 27, 1990, REACTOR SCRAMMED ON A HI-HI INTERMEDIATE RANGE (IRM) SCRAM SIGNAL.

SAFETY SIGNIFICANCE - THE EVENT WAS OF A LOW SAFETY SIGNIFICANCE BECAUSE AUTOMATIC SCRAM FEATURES PROTECT THE REACTOR IN THESE CONDITIONS.

THE EVENT OCCURRED BECAUSE OPERATOR WAS FOCUSED ON MONITORING REACTOR PRESSURE RATHER THAN REACTIVITY.

CONTRIBUTING FACTORS INCLUDED:

- LOW LEVEL OF TASK AWARENESS
- POOR COMMUNICATIONS
- INSUFFICIENT COMMAND AND CONTROL
- INEFFECTIVE PROCEDURES
- INCOMPLETE TRAINING
- INEFFECTIVE UTILIZATION OF OPERATIONAL EXPERIENCE

DESCRIPTION OF EVENT

10/26/90 - 10/27/90

SHIFT 1 (11:00 PM TO 07:00 AM)

REDUCTION IN POWER FOR INSTALLATION OF TEST EQUIPMENT FOLLOWED BY INCREASE IN POWER TO PERFORM SPECIAL TEST

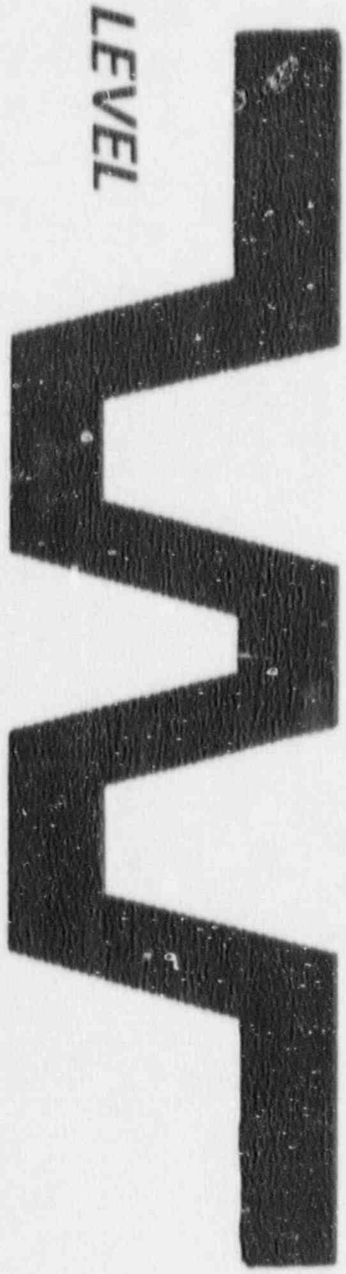
SHIFT 2 (07:00 AM TO 15:00 PM)

PERFORMANCE AND TERMINATION OF SPECIAL TEST

SHIFT 3 (15:00 PM TO 23:00 PM)

REDUCTION IN POWER FOR REMOVAL OF TEST EQUIPMENT AND REACTOR SCRAM ON HI-HI IRM SCRAM

POWER LEVEL



PRIOR TO TEST

SHIFT 1

SHIFT 2

SHIFT 3

REACTOR SCRAM

ANALYSIS

IMMEDIATE CAUSE:

- PERSONNEL ERROR - FOCUS ON REACTOR PRESSURE

CONTRIBUTING FACTORS:

- LOW LEVEL OF TASK AWARENESS
- POOR COMMUNICATIONS
- INSUFFICIENT COMMAND AND CONTROL
- INEFFECTIVE PROCEDURES
- INCOMPLETE TRAINING
- INEFFECTIVE UTILIZATION OF OPERATIONAL EXPERIENCE

CONCLUSIONS

THIS EVENT EMPHASIZED THE NEED FOR CAREFUL PLANNING, INCREASED AWARENESS, TRAINING, PROPER REVIEW AND USE OF PROCEDURES, AND GOOD COMMUNICATIONS, WHEN A PLANT IS PLACED IN A NON-TYPICAL MODE OF OPERATION OR OTHER UNUSUAL CONDITIONS EXIST.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 2 8 1990

MEMORANDUM FOR: Thomas M. Novak, Director
Division of Safety Programs
Office for Analysis and Evaluation
of Operational Data

FROM: Jack E. Rosenthal, Chief
Reactor Operations Analysis Branch
Division of Safety Programs
Office for Analysis and Evaluation
of Operational Data

SUBJECT: HUMAN FACTORS STUDY REPORT - QUAD CITIES 2 (10/27/90)

On October 27, 1990, at 3:59 p.m., Quad Cities Unit 2 scrammed on a hi-hi intermediate range scram signal, because the operator withdrew control rods to increase reactor pressure without recognizing the need to follow the normal procedures for re-establishing reactor criticality. Quad Cities 2 was preparing to restore the plant following an aborted special turbine torsional test and return to power operations. At about 1% power, an operator was inserting control rods to reduce reactor pressure so that the turbine bypass valves would close and test equipment could be removed from the EHC system, when the reactor went subcritical. When the system pressure continued to decrease below the desired level, the operator withdrew rods to increase pressure, but the reactor scrammed on a hi-hi intermediate range scram signal. This event occurred because the operator was monitoring reactor pressure rather than reactivity.

As part of the AEOD program to study the human factors aspects of operational events, a team was sent to the site October 31. The team leader was Gene Trager of AEOD; other team members were Barry Kaufer of AEOD, and Orville Meyer and Mark Parrish of Idaho National Engineering Laboratory. The team was at the site for two days and gathered data from discussions, plant logs, strip chart recordings, and interviews of plant operators.

Enclosed is the report prepared by INEL of the results of the team's human factors study. Specific human performance aspects of this event are addressed in this memorandum.

Task Awareness

There was a low level of awareness that the operations required to support the special test might require special attention. Operations personnel were not sufficiently aware that careful reactivity management would be necessary during installation and removal of the special test equipment to avoid either subcriticality or short startup periods.

Shift Organization and Command and Control

The shift organization consisted of a shift engineer (SE; SRO), who had overall responsibility for operations, a shift control room engineer (SCRE; degreed SRO/STA) who directs control room operators and activities for both units, nuclear station operators who are the licensed control room operators, and shift foremen (SF; SROs) who report to the SE and who direct equipment operators for inplant activities. The shift organization was not effective in preventing this event.

A contributor to this event was the difficulty experienced by the SE and SCRE in managing operations in support of the special test. During shift change there were many people in the control room in the vicinity of the SCRE's desk monitoring the test, and the SCRE finally asked them to leave the control room. When the decision was made to return the unit to power operation, the SE and SCRE were both surprised, as they had expected to go to cold shutdown to repair intermediate range monitoring equipment. They were both involved in reinerting the drywell (to meet a technical specification time limit) and returning the EHC system to service. The combination of these factors may have been distracting. The SE realized that the SCRE was busy, but he did not return to the control room until the time the scram occurred.

The SCRE did not monitor and direct the activities of the unit NSO in controlling reactor power, because he was busy with other things. Unfortunately, the NSO thought he was being watched, as he reduced power unnecessarily until the reactor was subcritical, and then quickly pulled control rods to increase pressure.

Procedures

The procedure governing operations from power operation to hot standby did not have cautions regarding the possibility of high rod and notch worths and the need for special reactivity management. In addition, when the procedure was first performed on Shift 1 the operators were unwilling to sign off a step regarding subcriticality, because it was unclear. However, they accepted the step as completed when it was signed off by an operating engineer. Furthermore, the Shift 3 unit NSO did not use a new copy of the procedure, but referred to the copy that had been signed off by Shift 1.

Communications

There was a low level of communications among station operators prior to the event. The SCRE directed the unit NSO to take certain action, but he did not verify that his instructions were understood nor that the actions were taken.

Training

While operating the plant in a hot standby condition is rare at this site, no special training was requested for performing this special test and there was no simulator drill, classroom instruction, or "read only" instructions for the control room operators. Furthermore, maintaining the reactor in a hot standby condition was part of initial licensed operator training, but was not part of the requalification program.

Use of Operating Experience Information

Operating experience information was not fed back prior to and during this event. An SRO had been assigned to review a previous reactivity management event that occurred at LaSalle in 1990, but no information on the significance of the event relative to Quad Cities was given to the operators. Similarly, high notch worth was experienced and understood by Shift 1, but this information was not recorded nor passed on to Shift 3.

This event emphasizes the need for careful planning, increased awareness, training, proper review and use of procedures, and good communications, when a plant is placed in a non-typical mode of operation due to special testing or other unusual conditions.

This report is being sent to Region III for appropriate distribution within the region.

Original signed by

Jack E. Rosenthal, Chief
Reactor Operations Analysis Branch
Division of Safety Programs
Office for Analysis and Evaluation
of Operational Data

Enclosure: As stated

cc: Richard L. Bax, Station Manager
Quad Cities Nuclear Power Station
22712 206th Avenue North
Cordova, IL 61242

Distribution: See attached

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TRIP REPORT:
ON-SITE ANALYSIS OF THE HUMAN FACTORS OF AN EVENT AT QUAD CITIES 2 ON OCTOBER 27, 1990

(HI-HI IRM SCRAM FROM HOT STANDBY)

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EXECUTIVE SUMMARY

At 3:39 p.m., October 27, 1990, the Quad Cities Unit 2 reactor scrammed on a Hi-Hi trip from the intermediate range monitors (IRMs). The scram occurred when the Unit 2 Nuclear Station Operator (NSO) was operating in the Hot Standby mode and attempting to control reactor pressure by means of control rod positioning. The scram occurred when the NSO withdrew rods to increase pressure. A team led by Eugene Trager, of Nuclear Regulatory Commission, Office for Analysis and Evaluation of Operational Data (NRC/AEOD), visited the site on October 31 and November 1 to conduct an analysis of the human factors involved in this event as a part of an on-going AEOD program to study the human factors of operating events. Other team members were Barry Kaufer, of NRC/AEOD, and Orville Meyer and Mark Parrish, of Idaho National Engineering Laboratory. This report provides a reconstruction and review of the details of the event and an analysis of the human factors embedded within the event.

The Quad Cities Nuclear Generating Station is located near Cordova, Illinois, and is owned and operated by the Commonwealth Edison Co. of Chicago, Illinois. The station consists of two General Electric BWR-3 reactors with Mark I containment and each plant rated at 789 MWe.

Both units are operated from a common control room, and an NSO, who is a licensed reactor operator (RO), is dedicated to the controls of each reactor. There is an NSO serving as the Center Desk Operator and an additional NSO at the panels. The NSOs for both units are under the supervision of a Shift Control Room Engineer (SCRE), who is a licensed Senior Reactor Operator (SRO). Two Shift Foremen (SF), who also hold SRO licenses, are assigned principally to supervise local operations outside the control room. All operations during the shift are supervised by a Shift Engineer (SE), who is a licensed SRO.

The objective of unit 2 operations during this event was to support the conduct of Special Test 2-95 Partial B, "Turbine Generator Torsional Response Test." The purpose of Special Test 2-95 was to precisely determine the torsional resonant frequencies of the turbine-generator rotors.

The test method was to operate the turbine at 45 to 105% of rated speed with the generator connected to a phase A line-to-neutral short circuit. The electrical load on the generator would be very small. The reactor power required would be approximately 6 to 7%. The turbine speed would be controlled by a test potentiometer in the turbine control valve EHC circuit. Reactor power would be under the control of the Unit 2 NSO.

Temporary Change 6303 was issued on 10/24/90 to normal operating Quad Cities General Procedure (QGP) 2-4, "Shutdown from Power Operation to a Standby Hot Pressurized Condition," in order to allow the use of recirculation pumps and/or control rods to reduce power and thereby provide greater flexibility during power reduction to Hot Standby. Temporary Change 6303 did not add any special instructions or cautions. QGP 2-4 with Temporary Change 6303 was the controlling procedure in use by the Unit 2 NSO during the event.

The Special Test was attempted on 9/28/90 but was not performed due to electrical problems with the EHC circuitry. An extra RO and an SRO were assigned to the control room to perform the test during the 9/28/90 attempt.

The test was attempted again on 10/27/90 beginning with shift 1 (11:00 p.m. to 7:00 a.m.). The Unit 2 NSO inserted control rods to reduce reactor pressure to shut the TBVs and permit connection of Special Test circuitry to the EHC controls.

During this maneuver the NSO experienced high control rod notch worths. The reactor had been in power operation the previous day and high xenon concentrations existed. The tips of the control rods in use were near the top of the core in a region of lower xenon concentration. Information on the high rod notch worth was passed on orally from shift 1 to 2 (7:00 a.m. to 3:00 p.m.) but not from shift 2 to 3 (3:00 to 11 p.m.). No log entry was made of the high control rod notch worths.

The shift 2 operators increased reactor power until 1 to 2 TBVs were open and warmed up the main turbine. However, the Special Test circuitry would not permit increasing the turbine speed above 571 rpm so the turbine was tripped. Unit 2 conditions during shift turnover were ~7% power, 1-1/2 TBVs open, 920 psig reactor pressure, and mode switch in Hot Standby.

When Shift 3 began their orientation, a meeting was being conducted near the SCRE's desk with use of the SCRE's phone among test engineers, the SE, and other station staff concerning the Special Test. The SCRE directed that the meeting leave the control room, and it reconvened in the SE's office. Shift 3 began operations at 3:00 p.m.

In addition to the Special Test, there were other conditions that were of concern to the SE and the SCRE: two IRM channels were in "bypass," one IRM had a spurious trip, and one IRM remote detector drive was inoperable with the detector inserted, and the drywell had been deinerted with a LCO (limiting condition for operation) that requires reinerting within 24 hours or being in Hot Shutdown.

At 3:10 p.m., the above conferencees decided to abort the Special Test and return to power. The SE phoned the SCRE and directed him to take the EHC off-line to permit removing the Special Test circuits. The SCRE directed the Unit 2 NSO to insert control rods to reduce reactor pressure to less than 800 psig.

The NSO inserted control rods a total of 84 steps while observing the reactor pressure decrease. The reactor pressure decreased to 770 psig, but at the same time the reactor power had decreased to Range 1 of the IRM (the lowest range of the IRMs; the reactor was significantly sub-critical). At 3:58 p.m., the NSO began rod withdrawal to increase pressure and withdrew one group of four rods one notch. He then withdrew one rod one notch. The reactor scrammed from an IRM Hi-Hi trip on a 25 second period at 3:59 p.m..

Task Awareness

The dominant human factor in this event was a low level of awareness by the plant staff that the reactor conditions required by the torsional test were difficult to maintain. Reactivity management requires special attention when attempting to control reactor pressure with the control rods while the TBVs are shut because the reactor is at low power (2 to 5%). In addition, high rod notch worths may be experienced if xenon peaking levels are present. This low level of task awareness began with the planning and preparation of the Special Test and carried on through all activities to culminate in the reactor scram.

Procedures

The procedures reflected the low level of task awareness, as there were no special instructions for reactivity management and no cautions for possible high rod notch worths. In addition, procedures were not followed. A test engineer, rather than the Shift 1 Unit 2 NSO, annotated and initialled a step in procedure QGP 2-4 as complete when a controlled change to the procedure would have been more appropriate, particularly since the step involved reactivity management in Hot Standby.

Training

Requalification training had not included a lesson plan for reactor operation in Hot Standby and the operators had no special training nor briefing for the Special Test. The station developed and implemented an appropriate lesson plan within three days after the event.

Dissemination of Operating Experience Information

Information on similar events at other stations had not been disseminated to the reactor operators. The high rod notch worth experienced during shift 1 had not been passed on to the shift 3 operators.

Communications

The Unit 2 NSO did not report back any information to the SCRE while executing the SCRE's command to insert control rods to reduce pressure to less than 800 psig. The changes in rod positions and reactor power level were significant enough to justify supervisory overview by the SCRE.

Command and Control

The commands from the SE to the SCRE and from the SCRE to the NSO were minimal and did not contain cautions or directions to report information back. The lack of reporting from the NSO to the SCRE contributing to the SCRE's failure to direct and oversee the NSO's actions.

Knowledge-Based Versus Rule-Based Operation

The Unit 2 NSO seemed to have been in a rule-based mode of operation, as he was following the procedural rule to "insert control rods until reactor pressure is less than ..." No signal seemed to have been effective to remind the operator to use his knowledge of reactivity management and also monitor reactor power.

ACKNOWLEDGEMENTS

Appreciation is expressed for the cooperation of the Quad Cities station staff and especially for the control room operators who were on duty during shift 3 on October 27, who freely provided information concerning their observations, thinking, and actions during the event. Appreciation is also expressed for the valuable insights and contributions of Hironori Peterson, of NRC Region III, during on-site analysis.

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ACRONYMS

APRM	average power range monitor
EHC	electro-hydraulic control
IRM	intermediate range monitor
NRC/AEOD	Nuclear Regulatory Commission, Office for Analysis and Evaluation of Operational Data
NSO	Nuclear Station Operator
QGP	Quad Cities General Procedure
RO	Reactor Operator
SCRE	Shift Control Room Engineer
SE	Shift Engineer
SF	Shift Foreman
SRM	source range monitor
SRO	Senior Reactor Operator
TBV	turbine bypass valve

1. INTRODUCTION

1.1 Purpose

The purpose of the visit to the Quad Cities Nuclear Generating Station on October 31 and November 1 and of the subsequent analysis was to examine the human factors involved in the automatic reactor scram from Hot Standby that occurred on Unit 2 at 3:59 p.m., October 27, 1990. The scram originated from a Hi-'Ii trip on intermediate range monitors (IRMs) 13 and 16 while the Unit 2 Nuclear Station Operator (NSO) was attempting to control reactor pressure by means of control rod positioning. The reactor scrammed on a 25 second period when the NSO withdrew control rods to increase pressure. This site visit was the sixth site visit to be conducted by the NRC staff with the assistance of INEL, for the purpose of acquiring and analyzing data on the related human factors issues of operating events.

1.2 Scope

The on-site data acquisition and analysis focused on the factors that contributed to the reactor trip: operator tasks, control room activities, and control room crew composition immediately preceding the scram. The human factors related to the preparation for the test were also analyzed: planning of the operation, preparation and review of the controlling procedures, specific training for the operation, and on-shift and shift-to-shift operator communications.

1.3 On-site Analysis Team

The on-site analysis team was led by Eugene Trager, of NRC/AEOD, and included Barry Kaufer, of NRC/AEOD, and Orville Meyer and Mark Parrish of Idaho National Engineering Laboratory.

2. DESCRIPTION OF THE EVENT ANALYSIS

2.1 Background

The Quad Cities Nuclear Generating Station is located near Cordova, Illinois, on the Mississippi River approximately 20 miles north of Moline, and is owned and operated by the Commonwealth Edison Co. of Chicago, Illinois. The station consists of two General Electric BWR-3 reactors with Mark I containment and each plant rated at 789 MWe. Unit 1 entered commercial operation on February 18, 1973; Unit 2, on March 10, 1973.

Both units are operated from a common control room, and an NSO, who is a licensed reactor operator (RO), is dedicated to the controls of each reactor. There is an NSO serving as the Center Desk Operator and an additional NSO at the panels. The NSOs for both units are under the supervision of a Shift Control Room Engineer (SCRE), who is a licensed Senior Reactor Operator (SRO). Two Shift Foremen (SF), who also hold SRO licenses, are assigned principally to supervise local operations outside the control room. All operations during the shift are under the supervision of a Shift Engineer (SE), who is a licensed SRO.

The objective of Unit 2 operations during this event was to support the conduct of Special Test 2-95 Partial B, "Turbine Generator Torsional Response Test." (Unit 1 was in commercial power generation at 90 to 100% power.) The purpose of Special Test 2-95 was to precisely determine the torsional resonant frequencies of the turbine-generator rotors. The test method was to excite the resonant frequencies by operating the turbine at 45 to 105% of rated speed with the generator disconnected from the grid and instead connected to a phase A line-to-neutral short circuit. The phase A fault current would be limited to low values by the use of a low-power dc source in place of the normal field excitation. The electrical load on the generator would be very small and the turbine load would be slightly above the no-load value. The reactor power required would be that necessary to support the turbine and the auxiliary steam loads which would total approximately 6 to 7% of full reactor power.

During the actual measurement of the resonant frequencies, the turbine speed would be controlled by a test potentiometer speed reference setting in the turbine control valve electric-hydraulic control (EHC) circuit. The potentiometer setting would be under the direction of the test director. Reactor power would be under the control of the Unit 2 NSO with the automatic pressure control adjusting the opening of the turbine bypass valves (TBVs) to maintain reactor pressure near the setpoint.

The Special Test 2-95 Partial B procedure does not specify the reactor power level for the performance of the measurement of the resonant frequencies. It does state that the Mode Switch must be in Startup/Hot Standby and the reactor power must be less than 12% to prevent a reactor scram due to an average power range monitor (APRM) Hi-Hi trip. The "Limitations and Actions" section of the Special Test procedure states that the Test Director shall order the reactor to be scrammed if any of the following conditions exist and are "not part of a controlled evolution:"

- Reactor pressure increasing above 960 psig
- Reactor pressure decreasing below 890 psig
- APRMs increasing above 11% of rated power
- APRMs decreasing below 2% of rated power.

Temporary Change 6303 was issued on 10/24/90 to normal operating procedure QGP 2-4, "Shutdown from Power Operation to a Standby Hot Pressurized Condition," in order to allow the use of recirculation pumps and/or control rods to reduce power and thereby provide greater flexibility during power reduction to Hot Standby. Temporary Change 6303 deleted certain sections of QGP 2-4 as not applicable to the Special test evolution and did not add any Special instructions or cautions. QGP 2-4 with sections deleted by Temporary Change 6303 was the controlling procedure in use by the Unit 2 NSO during the event on 10/27/90. The combination of Special Test Procedure 2-95 Partial B and Temporary Change 6303 constituted the procedures for the Special test evolution.

The on-site analysis of this event disclosed that there were five phases to this Special test evolution, as defined in Table 1.

The Special Test 2-95 Partial B procedure gave explicit instructions for reactor operation only for the fourth item in Phase 3, that is, the procedure gave no instructions for reactor operation during installation and removal of test circuits. The only applicable procedure for reactor operation for the remainder of the evolution was QGP 2-4 as modified by Temporary Change 6303. The reactor scram during the event occurred during the performance of Phase 4. There was no special training for Special Test evolutions.

2.2 Event Time Line

The following event time-line sequence was constructed based upon interviews with the station personnel listed in Table 2 and upon reviews of the control room logs and recordings and control room copies of Special Test 2-95 Partial B and Temporary Change 6303. The IRM recorders were operating on slow speed during the event and the station was attempting to decipher the recordings during the site visit (some entries in control room logs required interpretation):

9/26/90

Safety evaluation for Special Test 2-95 Partial B approved by the Quad Cities On-site Safety Review Board. The conclusion of the safety evaluation was that the Final Safety Analysis Report and the Technical Specifications were not affected and did not need to be changed.

Table 1. Reactor operating cycle for performance of Special Test
2-95 Partial B, "Unit 2 Turbine-Generator Torsional Response Test"

Phase 1. Initial conditions

Low power operation (~10%).

Automatic reactor pressure control at ~900 psi with 1-1/2 TBVs open.

Reactor power level is high enough for the void coefficient of reactivity to provide reactor power stability.

Infrequent notching of individual control rods used to adjust power level.

Xenon at greater than equilibrium due to power history.

Phase 2. Installation of Special Test circuits on EHC controls

Requires the EHC to be taken out-of-service with main turbine secured and all TBVs shut.

Operating method selected is to reduce reactor power by inserting control rods until the automatic pressure control has shut all TBVs and then to continue reactor power reduction until the auxiliary steam loads have reduced pressure to less than 900 psig.

Reactor power reduction by rod insertion will have little effect upon pressure reduction after reactor power is reduced below the decay heat level [below the Point of Adding Heat (POAH), Range 7 on IRMs]. Pressure reduction will be determined by the auxiliary steam loads and ambient losses, which may not total much in excess of the decay heat levels.

Continued rod insertion may be required to compensate for the temperature affect on reactivity during cooldown and for possible decay of xenon.

Continued rod insertion may drive the reactor subcritical since power level is too low for the void coefficient of reactivity to have much effect.

Reactor criticality may be sensitive to rod motion on rods high in or on the periphery of the core due to xenon peaking in the central regions of the core.

Table 1. (continued)

Phase 3. Operate Turbine-generator per Special Test 2-95 Partial B.

Restore EHC.

Increase reactor power by notching out control rods until the increasing reactor pressure causes the automatic pressure control to begin to open a TBV.

Continue until in low power operation with one to two TBVs open.

Turbine-generator will be operated at very low load with speed adjusted as requested by the Test Director.

Phase 4. Remove Special test circuits on EHC controls.

Reactor operation is the same as in Phase 2.

Phase 5. Return to normal commercial operation.

Table 2. Station personnel interviewed

10/27 Shift 1:	Unit 2 Nuclear Station Operator[a]
	Shift Control Room Engineer[a]
10/27 Shift 3:	Unit 2 Nuclear Station Operator
	Shift Control Room Engineer
	Shift Engineer
	Shift Technical Advisor
	Nuclear Engineer
Training Manager	
Simulator Training Manager	

a. These operators were also on-duty during the 9/28/90 attempt to perform Special Test 2-95 Partial B.

9/27/90

Validation of Special Test 2-95 Partial B was signed off as completed. The validation sign-off form offers four validation methods:

Simulator performance

Plant walk-through

Bench check

Tabletop check, which was selected.

Rev 0 of Special Test 2-95 Partial B received on-site review and approval signatures.

9/28/90

Phase 2 of Special Test 2-95 Partial B (see Table 1) was attempted but not completed due to electrical problems with the EHC circuit.

An extra RO and SRO were assigned to the shift to perform the Special Test (the extra RO and SRO were the unit 2 NSO and SCRE on duty on shift 1 on 10/27/90 later in this sequence.)

10/24/90

Temporary Change 6303 was issued against QGP 2-4, "Shutdown from Power Operation to a Standby Hot Pressurized Condition," to "allow the use of recircs [reactor coolant recirculation pumps] and/or control rods to reduce power to provide greater flexibility during power reduction to hot standby."

10/27/90, Shift 1 (11:00 p.m. 10/26 to 7:00 a.m. 10/27)

11:00 p.m.	-	Shift turnover.
	-	Unit 1 at 95 to 100%.
	-	Unit 2 at 141 MWe and preparing for turbine torsional test.
11:45 p.m.	-	Made entry into Unit 2 drywell to disconnect drive from IRM 16 detector and manually insert detector, since remote drive was inoperable (drywell had been deinerted previously).
00:52 a.m.	-	Reduced Unit 2 power to 130 MWe and took turbine off line.
	-	Began inserting rods to come to Hot Standby.
2:40 a.m.	-	Unit 2 Mode Switch to Startup/Hot Standby.
	-	Began inserting rods to reduce reactor pressure to target value of 850-900 psi to close the TBVs and turn off EHC pumps.
	-	Test Director for Special Test 2-95 Partial B was present (also the individual who planned the Special Test, is a licensed SRO, and has had experience as a nuclear engineer.)

3:40 a.m.	-	Received Channel A half scram while ranging IRM 14 from range 7 to 6. This appeared to be a spurious electrical problem. A "near miss" memo was written to inform the on-coming shift.
(time approx)	-	The SCRE and the Unit 2 NSO could not understand step D.38.b and would not sign it as completed. The Test Director then annotated and initialled step D.38.b of operating procedure QGP 2-4 as complete.
	-	"Hot rod" condition experienced ["hot rod" is terminology used by station operators for unusually high rod worth]. Significant IRM increase of 1 to 2 ranges resulted from one notch rod withdrawal. The auxiliary NSO assigned to the control room was directed to help observe IRM responses.
4:20 a.m.	-	Unit 2 reactor pressure steady at ~830 psig. The EHC pumps were turned off.
	-	Technicians began to connect test circuitry to EHC controls for Special Test 2-95 Partial B.

10/27/90-Shift 2 (7:00-3:00 p.m.)

7:00 a.m.	-	Shift turnover.
	-	Unit 1 operating at 710 to 780 MWe.

- At Hot Standby; reactor pressure ~860 psig; drywell deinerted because of entry required during Shift 1; limiting condition for operation (LCO) action statement to reinert the drywell or in shutdown within 24 hours; IRM 17 inoperable; IRM 16 remote drive for detector inoperable.

- Shift 1 operators orally advise on-coming shift 2 Unit 2 operators of the "hot rod" condition experienced. However, no written information was provided.

10:10 a.m. - Turned on Unit 2 EHC pumps and began notching rods out to increase power until 1 to 2 TBVs are open.

- Began turbine warmup.

12:20 p.m. - Closed generator field circuit breaker for turbine torsional test.

12:24 p.m. - Adjusted Unit 2 APRM gains to 7% power.

12:26 p.m. - Began turbine acceleration.

1:23 p.m. - Turbine speed seems to plateau out at 571 rpm, which is less than minimum speed required for the turbine torsional test.

- Conference begins among the Special Test Director, other utility personnel, and vendor personnel concerning the turbine speed problem.

- Opened generator field breaker and tripped the turbine.

2:30 p.m. - Shift 3 operators arrive on-site and begin preparations for assuming control at 3:00 p.m.

2:50 p.m. (approx) - SCRE directed Special Test conferees to leave the control room.

<u>10/27/90 - Shift 3 (3:00 to 11:00 p.m.)</u>

3:00 p.m.

- Unit 1 at 710 to 780 MWe.

- Unit 2 on "hold" for Special Test 2-95 Partial B, ~7% power, 1-1/2 TBVs open, 920 psig.

- Four out of eight IRMs had problems [the A channels have one in "bypass' and one with caution tag because of 1/2 scram on Shift 1, and B channels have one on "bypass" and one (#16) with detector inserted but with inoperable remote detector drive.]

- Unit 2 was in LCO action statement to reinert drywell with approximately 12 hours remaining or be in shutdown. Withdrawal of IRM #16 would require entry into drywell. Reinerting drywell would require 10 to 11 hours elapsed time.

- No information concerning the "hot rod" experience during shift 1 was passed on to the on-coming shift 3 Unit 2 operators.

- Conference was still on-going concerning the problem with the Special Test 2-95 and was taking place near SCRE's desk with use of SCRE's phone.

- Conference resumed in SE's office.

3:10 p.m. - Decision made by conferees in SE's office to abort Special Test 2-95 Partial B and return Unit 2 to commercial power generation. The IRM 16 detector with the inoperable drive was left inserted, which would destroy (burn-out) the detector during power operation.

- SE directed the SCRE by telephone to insert control rods to take the EHC off-line and began directions to other personnel for reinerting the drywell and other preparations for disconnecting the Special Test equipment and returning Unit 2 to power operations.

- Nuclear engineer "on-call," who had been called to be present for the Special Test, left site since the test was aborted.

- SCRE directed Unit 2 NSO to insert control rods to reduce reactor pressure to less than 800 psig. (During similar maneuver on shift 1 the pressure was not reduced below ~860 psig. The purpose of the pressure reduction was to prevent an increasing pressure reaching 920 psig and signal the TBVs to open. The SCRE on shift 3 was opting for a larger pressure margin to prevent this. However, this would require more rod insertion.) Unit 2 NSO began inserting control rods per step D.38.b of QGP 2-4.

3:30 p.m.	-	Unit 2 NSO continued rod insertion.
	-	Fourteen rod groups were inserted, a total of 84 steps.
	-	Unit 2 NSO was observing pressure decrease with objective of decreasing pressure to less than 800 psig.
	-	Unit 2 NSO stopped rod insertion at ~ 850 psig
	-	IRM indications decreased from Range 6 to 1 (reactor was significantly subcritical, however, Unit 2 NSO was still focusing attention on reactor pressure).
	-	At 805 psig the TBVs were completely closed by the automatic pressure control and the EHC pumps were turned off. Reactor pressure was decreasing. Unit 2 NSO attempted rod withdrawal to increase pressure.
3:43 p.m.	-	Rod block annunciator indicated that rod withdrawal was blocked due to source range monitor (SRM) indication being less than 100 cps and SRMs not fully inserted. Unit 2 NSO began inserting SRMs to increase their indicated level.
3:57:45 p.m.	-	Rod block cleared as SRMs were being inserted. Reactor pressure was 770 psig.

3:58 p.m.	-	Unit 2 NSO began rod withdrawal to increase reactor pressure; withdrew one Group (G-7, G-9, J-9, J-7) from position 04 to 06; then withdrew rod G-7 from position 06 to 08.
3:59 p.m.	-	Unit 2 reactor scram from IRM Hi-Hi trip.
		(Note: No significant changes in reactor feedwater flow or reactor water level occurred during the 3:30-3:59 time interval relative to reactivity.)
	-	Entered procedure QGP 2-3 for Hot Shutdown.

2.3 Analysis

2.3.1 Task Awareness

A dominant factor underlying all other factors of this event was a low level of awareness that the reactor operation tasks required by the Special Test 2-95 on the Unit 2 turbine generator might require special attention. Table 1 was prepared during this event analysis to identify five different phases of reactor operation that were required to perform the Special Test. This tabulation indicates that Phase 2 and 4, the installation and removal of Special Test circuits on the EHC controls, may require special attention to reactivity management to avoid either subcriticality or short reactor startup periods. However, the event analysis indicated that a low level of task awareness for reactivity management persisted through the preparation and conduct intervals for the Special Test.

The reactor was to be maintained in Hot Standby with the TBVs shut during Phase 2 and 4. Maintaining the reactor critical in Hot Standby with the TBVs shut is an infrequently performed operation of limited durations since the normal operating plans would usually call for continuing on either to Hot Shutdown or to Power Operation.

Safety Evaluation 90-601, 9/24/90, which was prepared for Special Test 2-95, Partial B, does not address reactivity management during the Special Test. Temporary Change 6303 to QGP 2-4, "Shutdown from Power Operation to a Standby Hot Pressurized Condition," was prepared by deleting those parts of QGP 2-4 that were not needed to support the Special Test 2-95 to provide greater flexibility during power reduction to hot standby. Temporary change 6303 did not add any notes or cautions to QGP 2-4. As summarized below QGP 2-4 is not explicit for reactivity management of the Phase 2 and 4 condition (Table 1) and contains no cautions for possible high rod or notch worth.

2.3.2 Procedures

The controlling procedure for reactor operations for the Special Test was Temporary Change 6303 to QGP 2-4, "Shutdown from Power Operation to a Standby Hot Pressurized Condition." As noted above, QGP 2-4 has no cautions for reactivity management. The possible need for a caution is demonstrated by the fact that QGP 1-2, "Unit Startup to Hot Standby," has a caution concerning the possibility of high rod and notch worths existing after a shutdown from power operations. QGP 1-3, "Hot Standby to Power Operation," has a similar caution that is more generally worded and is not restricted to specific, limited rod positions.

The control room copy of the controlling procedure, Temporary Change 6303 to QGP 2-4, had been initialled as complete through Step D.38.b by the Shift 1 operators. The Shift 3 Unit 2 NSO was using the marked up copy of the procedure for guidance, but was not formally following the procedure. There was no procedure covering the complete sequence of reactor operations outlined in Table 1.

At the time of the event, the Unit 2 NSO had Temporary Change 6303 on his desk and was attempting to carry out the SCRE's command to reduce pressure to less than 800 psig in accordance with Step 38 b of Temporary Change 6303. The "less than 800 psig" is a variation from the "920 psig" in step 3.8.b.:

b. Insert control rods until reactor pressure equals 920 psig and the reactor is subcritical by at least three rods.

The Unit 2 NSO copy of Temporary Change 6303 contained an added handwritten note: "Impossible to tell exact number of rods subcrit., took pressure to 825 psig," adjacent to step 38 b and the step had been initialled off by the operating engineer on shift 1 of 10/27/90. The insertion of the control rods until the reactor power was below the range of the IRMs was consistent with the controlling procedures.

To summarize, the controlling procedure for the Special Test had no special instructions for reactor power or reactivity control or cautions for high rod or notch worth and relied instead upon the QGPs for Hot Standby. The adequacy of these QGPs in this respect is questionable and is under review by the Quad Cities Station staff.

A signal occurred on shift 1 of 10/23/90 that could have alerted the control room crew to the possibility of a problem in the use of the controlling procedure for the Special Test. That signal was the request by the SCRE and Unit 2 NSO for help in interpreting Step D.38.b of Temporary Changes 6303. The request was resolved by the operating engineer on shift 1 who discussed Step D.38.b with the SCRE and the Unit 2 NSO, annotated and initialled the step on the control room copy of Temporary Change 6303 as complete. This resolution was apparently adequate for shift 1, as no reactivity management anomaly occurred on shift 1. A preferred resolution would have been to put the test on hold and initiate a change request for the controlling procedure. The change control process may have uncovered the fact that QGP 2-4 was missing the caution with respect to high rod notch worths that existed in QGP 1-2 and QGP 1-3. However, it may not have uncovered the knowledge that central rods may have a high notch worth when these tips are near the top of the core, since that knowledge was not widely available. A full resolution to the interpretation and usage of Step D.38.b would have required a higher level of task awareness, specifically, a greater knowledge of the possible sensitivity of the reactivity management task during the test planning and procedure preparation stages.

2.3.3 Training

No special training was requested for this Special Test and there was no simulator drill, classroom instruction, or "read only" instructions for the control room operators. Further, there was no lesson plan that specifically covers reactivity management in Hot Standby conditions. Hot Standby may be transitioned during some simulator exercises but the high rod notch worths experienced on 10/27/90 would not have been simulated. Maintaining criticality in Hot Standby was not included in previous Requalification training.

On the job training or experience in reactivity management in Hot Standby is limited since this is an infrequent condition. The Unit 2 NSO operator who had experienced the scram could not recall any time since 1982 that he had been involved in Hot Standby operations.

The Requal/Remediation Lesson Plan that was issued on 10/31/90 and the Hot Standby Operations lesson plan for SRO/RO licensee training that was issued on 10/30/90 define training that would have been appropriate for supporting operations during the 10/27/90 event.

2.3.4 Dissemination of Operating Experience Information

An SRO was assigned to review the reactivity management event that occurred at La Salle on 6/23/1990. However, no written information on the significance of this event relative to Quad Cities was prepared for the reactor operators.

Special Test 2-95 had been attempted on 9/28/90 and Phase 2 and 4, installation and removal of the test circuits on the EHC controls, was performed. An extra SCRE and NSO were present at the Unit 2 controls for this trial. No written information on the reactor control experience during this 9/28/90 test run was prepared for the benefit of other reactor operators or other station staff.

Phase 2 of Special Test 2-95 was performed by the 11:00 p.m. to 7:00 a.m. shift on the morning of 10/27/90. High notch worth had been experienced and understood by the NSO and the SCRE (who incidentally were the same NSO and SCRE at the controls on 9/28/90). No written information on this experience was prepared; there was no entry in the logs. Oral information was passed on during the turnover to the 7:00 a.m. to 3:00 p.m. shift, however this shift did not pass this information on to the 3:00 to 11:00 p.m. shift who ultimately experienced the scram at 3:59 p.m.

2.3.5 Communications

The low level of awareness of the reactor operations task demands that existed during the planning of Special Test 2-95 was followed by a low level of communications that existed among the station operators as demonstrated by the following information from the on-site analysis.

The command communication from the SE to the SCRE by telephone was to reduce pressure, turn off the EHC pumps, remove the Special Test circuits, and restore the EHC to service. The command communication from the SCRE to the Unit 2 NSO was to reduce the pressure to less than 800 psig to permit turning off the EHC pumps. There was no communication from the Unit 2 NSO to the SCRE to acknowledge understanding of the command or to report progress in execution of the pressure reduction. Immediately before the scram, the SCRE realized that the Unit 2 NSO was pulling rods and that the SRMs were fully inserted, but there was no communication between the SCRE and the Unit 2 NSO.

2.3.6 Command and Control

The low level of communication among the SE, the SCRE, and the Unit 2 NSO implies a diminished level of command and control of the Unit 2 reactor, as does the absence of a brief review by the shift 3 operators of the planned operations for the shift prior to initiating a significant change in the operating mode of the reactor. There were several factors that contributed to the diminished status of command and control: (a) the continuously low level of task awareness, which perhaps was compounded by a shift turnover during which there many people in the control room; (b) the conference in the control room among the SE and other station staff concerning a decision as to whether to return to power or to shutdown; (c) the need to resolve the question concerning the time limit on an LCO which required reinerting the drywell versus the inoperable IRM detector drive which would require entry into the drywell to repair; (d) concern about the reliability of other IRM channels; and (e) when the Unit 2 NSO began to lower reactor power to reduce pressure, the SE and the SCRE were involved in reinerting the drywell and other activities pursuant to returning to power.

A command to hold the existing reactor operating mode until the situation was reviewed among the SE, the SCRE, and the Unit 2 NSO would have been appropriate. However, given the low levels of task awareness and communications and the absence of detailed operating instructions, precautions, and training for Phase 2 and 4 of the Special Test, it cannot be determined if a "hold and review" command would have prevented the reactor scram.

2.3.7 Knowledge-based Versus Rule-based Operation

The expected range of knowledge of an NSO includes the fact that Range 6 of the IRMs is below the POAH as is the heat balance principle that results in little effect on pressure reduction if the reactor power is reduced below the POAH. However, it appears that the Unit 2 NSO was in a rule-based mode of operation, as he was fixated on following step 38 b of Temporary Change 6303, "Insert control rods until reactor pressure is less than 920 psig and the reactor is subcritical," as modified by the SCRE's direction to reduce pressure to less than 800 psig. His knowledge base would have told him that it was unnecessary to reduce power below Range 6, however, a rule-based manner of operation is self-reinforcing. Once an operator is engaged in executing a set of specific rules, the operator will tend to continue until some signal alerts him to reconsider, such as an annunciator alarm, a procedural caution, a cautionary principle retained from training, or a communication from another control room team member. In this event no such signal was present and the Unit 2 NSO had confidence stemming from a use of the procedure by a previous shift as attested by the initials of an experienced operating engineer.

Once the reactor power was down to the bottom of the range of the IRMs, the stage was set for obtaining a short reactor period and Hi-Hi IRM scram due to the combined effect of reactor cooldown, xenon decay, and high notch worth of the center control rods.

3. SUMMARY OF FINDINGS

There were several human factors that were evident contributors to the reactivity transient and Hi-Hi IRM scram on October 27, 1990. However, our analysis indicates that the factor that underlay all the other factors was a low level of task awareness concerning the management of reactivity by the reactor operator when operating in a post-shutdown, Hot Standby mode. Several conditions combine to present a unique challenge to the reactor operator who is executing this task: increased control rod notch worth due to post-shutdown xenon conditions, variable levels of decay heat, low level of control of heat removal, and low level of negative reactivity feedback from temperature changes or void formation. In addition, planning for the turbine torsional response test apparently did not consider the possibility that operations during preparation for and restoration from the test would be more challenging than operation during the test itself.

Given this low level of task awareness at the test planning stage, there would not have been a strong signal to review the written procedural instructions and cautions, the task specific training, and the command and control structure and staffing for the entire Special Test evolution. These were the human factors that ultimately led directly to the unanticipated, automatic scram.