ORIGINAL ACRST-1778

OFFICIAL TRANSCRIPT OF PROCEEDINGS

Agency: Nuclear Regulatory Commission
Advisory Committee on Reactor Safeguards

Title: 357th ACRS General Meeting

Docket No.

LOCATION: Bethesda, Maryland

DATE: Thursday, January 11, 1990 PAGES: 1 - 99

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UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

DATE: Thursday, January 11, 1990

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

357TH ACRS GENERAL MEETING

Nuclear Regulatory Commission
Room P-110
7920 Norfolk Avenue
Bethesda, Maryland

Thursday, January 11, 1990

The above-entitled proceedings commenced at 8:30 o'clock a.m., pursuant to notice, Carlyle Michelson, Vice Chairman of the Committee, presiding.

PRESENT FOR THE ACRS SUBCOMMITTEE:

James C. Carroll, Member
Ivan Catton, Member
William Kerr, Member
Harold W. Lewis, Member
Paul G. Shewmon, Member
Chester P. Siess, Member
David A. Ward, Member

PARTICIPANTS:

R. Fraley

T. Murley

S. Diab

R. Barrett

J. Murphy

G. Burdick

J. O'Brien

P R O C E E D I N G S

[8:30 a.m.]

MR. MICHELSON: The meeting will now come to order. This is the first day of the 357th meeting of the Advisory Committee on Reactor Safeguards. During today's hearing, the Committee will discuss and/or hear reports on the following: Interfacing Systems LOCA; preparation for meeting with NRC Commissioners; meeting with the NRC Commissioners; future ACRS activities; and, ACRS Subcommittee activities. Items for tomorrow's discussion are posted at the back of this meeting room.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act and the Sunshine Act. Raymond F. Fraley is the designated Federal official for the initial portion of the meeting. A transcript of portions of the meeting is being kept, and it is requested that each speaker identify himself or herself and speak with sufficient clarity and volume so that he or she can be readily heard. We have received no written comments or requests to make oral statements from members of the public regarding today's meeting.

The first item on today's schedule I think is items of interest. There are a couple of items of interest. The first one is, we believe that we can probably complete this meeting on Friday, which is tomorrow of course, but there are a couple of questions that I need to ask first to be sure. Hal Lewis is not here and two or three items are his. Until we know whether he has a coherence letter or a report on the State of Nuclear Power letter we are not sure if we can finish tomorrow. If he does not propose to put out those letters at this meeting, then we will be able to finish by 6:00 o'clock.

The Interfacing Systems LOCA letter, I assume Ivan, you will have one ready and we do intend to get it out. Those are the three letters that are on the agenda. Are there any others that I am unaware of that are anticipated?

[No response.]

Seeing none, then we assume that unless Hal has a plan to get his letters out we can certainly finish by 6:00 o'clock tomorrow. Another item of interest is that Florida experienced a rolling blackout during Christmas Eve and Christmas Day. It was caused in part, perhaps, by the fact that the Turkey Point units were shut down at the time but it is rumored at least that the blackout would have been required anyway, put probably less extensive.

MR. KERR: Some reindeer got tangled up in the powerline?

MR. MICHELSON: I think it was just a whole lot of load. My daughter cooked Christmas Eve and Christmas Day on the grille. It was bitterly cold in Tampa. It was a three degree chill factor that evening and that day, so everybody was loading it up.

Another item of interest to the Committee is that our proposed meeting with the Advisory Committee's of France and Germany and a similar type group from Japan has been deferred indefinitely. The reason given is that the French Group, Permanante and apparently other advisory groups in France are undergoing some kind of a reorganization. Until that gets straightened out, they are unprepared to meet. So, we don't know when that will be, but certainly it will probably be several months off would be my guess.

The Crystal River Plant has been fined $50,000.00 for accepting some non-safety grade components for use in safety grade systems. Apparently, they also had a problem of accepting a five bladed propeller when they should have been -- when a seven blade propeller was ordered. So, somewhere along the way their system had broken down.

The last item of interest is that about 12 percent of over 300,000 fingerprint cards that have been processed for unescorted access authorization to restricted areas of nuclear power plants, since April of 1987, there has been 300,000. About 12 percent have uncovered arrest records for the people filing the fingerprint cards. This seemed to us to be a fairly sizeable number, but we are not sure what it means.

MR. SHEWMON: Is this grounds for dismissal or just perjury charges if they said they hadn't, or what?

MR. MICHELSON: No. In order to get unauthorized, unescorted access, you have to file fingerprint cards and so forth. In the process of screening those --

MR. SHEWMON: That is not my question though.

MR. MICHELSON: In the process of screening those through the system -- I don't know of the consequence.

MR. SHEWMON: Okay.

MR. MICHELSON: This only came from the screening process.

MR. SHEWMON: Is that for DUI?

MR. MICHELSON: No, I think that DUI you have to --

MR. CATTON: It depends on the traffic violation.

MR. MICHELSON: Yes. At any rate, 12 percent is an interestingly large number. Those are the only items of interest. Do any other members have anything that they would like to bring up at this time? Hal is here now, okay.

MR. KERR: While you were talking about fines, to me a more interesting one is this fine of Duke Power because of something that happened at the Catawba Plant where apparently the NRC people disagreed with the way in which some surveillance of maintenance was done on a feed water pump. It is sort of incredible to me that a $50,000.00 fine would have been assessed for what happened there, but perhaps the news release doesn't describe it accurately.

MR. MICHELSON: Hal, the first item of interest to us was whether we can finish tomorrow night. It is dependent upon two letters that I think you have in your mind at least, and we wanted to know if you actually intend to get out. One is the coherence and the other is state of nuclear power plants.

MR. LEWIS: Okay. I am sort of overcome with the flush of power I can tell people whether they will get home tomorrow night or not. I had to think about that. The state of nuclear power, I didn't think was on a short time fuse. So, my plan was to hope we would get some opportunity today so I could solicit ideas. I have my own ideas, but I would like to get input from everybody to put together something that has a chance of being a Committee letter.

As far as a coherence letter is concerned, I have outlined and have to step up to a word processor and write it, which I will try to do during the day today so we will have a letter. Then, it is a matter for the Committee whether it has a sense of urgency about getting it out at this meeting or not. When I finish it, of course, I will be willing to approve it but that doesn't guarantee anything.

MR. MICHELSON: Well, there is, I think, adequate time to get the coherence letter out before 6:00 o'clock tomorrow.

MR. LEWIS: Okay, when would we --

MR. MICHELSON: That was the key one.

MR. LEWIS: That would be fine. When would we be working on it, so that I know when I have to have the draft ready.

MR. MICHELSON: I would have to look at the schedule. When is it Paul? There is some time alloted for it, but there is a quite a bit tomorrow afternoon. Four to 6:00 o'clock of course, tomorrow afternoon we have only one letter for sure -- well, your coherence letter and the Interfacing System LOCA letter would be the two.

MR. LEWIS: Okay.

MR. MICHELSON: We get a hit at those ahead of time, at least the Interfacing Systems LOCA.

MR. LEWIS: Realistically, I have no doubt that we will need two goes at the coherence letter. We will need a first go in which everybody gets the shouting at me out of their system, and then a second go at a real letter.

MR. MICHELSON: Is there space today anywhere? We will try to get the first shot in whenever we can. If we are getting ahead anywhere we will put it in.

MR. LEWIS: Okay, then I will get a draft done as quickly as I can.

MR. MICHELSON: Because you kind of need overnight to think on it so we can get a final one out.

MR. LEWIS: Well, there were some off the record comments just made across the table. If I could select the people to leave even earlier it could even go faster.

MR. MICHELSON: Well, we are intending to be here until 6:00 o'clock to get these two letters out. I think we can do it.

MR. LEWIS: If we work until 6:00, it's up to you.

MR. MICHELSON: Certainly by that time. I am hoping that both of these letters can get out by Friday night, but not necessarily before 6:00 o'clock tomorrow night. I think we may have to work all the way until 6:00 to do it. We will just plan on that.

If there are no other items of immediate interest, then I believe we will go to the first agenda item which is going to be the NRC Interfacing System LOCA program. I believe we are scheduled first for a short Subcommittee report from Ivan Catton, and that will be followed by a presentation by NRR. So, Ivan.

MR. CATTON: We had a Subcommittee meeting on the 7th of December, and then I gave a fairly lengthy Subcommittee report at the last full Committee meeting. So, I would just like to make a brief statement at this time.

In summary, the ISLOCA was described by the staff as a problem of sufficient risk potential, that a special effort for its resolution is warranted. The basis for this view is that a ISLOCA creates the potential for loss of two of the three barriers to fission product release. Further, under some circumstances, the lost coolant cannot be recovered. While we share the staff's concerns, I believe the Subcommittee consensus was that we do not believe they had demonstrated that the ISLOCA is a problem of sufficient magnitude; that it needs attention outside of the IPE program.

I think at this point, I would like to turn it over to the staff, maybe to convince us different.

MR. MURLEY: Thank you, Mr. Chairman and Ivan. My name is Tom Murley from the staff. Since I guess I am the one who raised the sensitivity of this issue in recent years, I thought I would come down and explain why I am concerned and why we are doing the study.

First, I think I need to just mention that I think all of our jobs is to be constantly aware of what operating experience is telling us and whether there might be precursors in that experience to unexpected accident sequences. In particular, I am sensitive to the need not to be lulled into complacency by predictions by PRA's; that an accident sequence may have a very low probability. I will give one example that we all know, and that was in the area of the pressure vessels. Back when WASH 1400 was done there was a pressure vessel failure probability given of 10 to the minus seventh per reactor -- per vessel year.

It probably was a good estimate for a fresh vessel back then, but it didn't consider the risk from pressurized thermal shock sequences and the fact that those risks increase with time. And, fortunately, we maintained a vigorous research program in that area. And fortunately, in examining some operating events, particularly the Rancho Seco event, the staff concluded there was a need to protect against a sequence that wasn't even considered in WASH 1400. I think this is a good example of how the system is supposed to work.

Now, of course, the Intersystems LOCA sequence -- and we are going to find out it really many sequences but as a class -- was found in WASH 1400 as the so-called Event V sequence. And, as I read through the NUREG 1150 analysis, here again we are seeing that the predictions are of very low probability. The Surry Plant, the sequence frequency as I read it, is 1.6 times 10 to the minus sixth per year, per reactor year. Sequoia is even lower, 6.5 times 10 to the minus seven. Zion is 1.5 times 10 to the minus six per reactor year. At Peach Bottom in Grand Gulf, it doesn't even show up on their sequences.

But, in recent years, we have seen a number of events that one could characterize as precursors to an Intersystem LOCA, events like check valve failures, isolation valve leakage, human errors leading to incorrectly opening isolation valves, operators ignoring indications of leaking isolation valves. And, the list is quite extensive, as a matter of fact.

Overall, I guess of most concern to me personally is a general lack of sensitivity to the potential for over pressuring low pressure systems, lack of sensitivity on the part of the people that operate the plants and, even to some extent, on the NRC staff, particularly inspection staff. I think we perhaps over the years have been lulled into a kind of sense of complacency that this sequence is not to be worried about.

So, that gets us to I guess the root of my concern. But also, I think we have to ask, isn't this being addressed and isn't it being looked at in current programs. Here, I think not, because some of these precursors involve sequences that have not been modeled at any PRA. Therefore, my staff and I believe that current PRA methodology may not be adequate and probably is not adequate to give a true picture of the Intersystems LOCA frequency.

MR. CATTON: Tom, that's kind of where I lose it a little bit. What is wrong with the methodology?

MR. MURLEY: You are going to find out today.

MR. CATTON: Oh, okay.

MR. MURLEY: They will tell you why a lot of these things are not modeled in PRA's.

MR. CATTON: I understand that sometimes they are just left out, but that isn't that we don't know how to do it. They just don't do it.

MR. MURLEY: Yes.

MR. CATTON: Or, things like we know with respect to the valves that the failure rate should be a lot higher but they don't seem to get into the PRA's. I think that's where the problem is.

MR. MURLEY: It's not just a matter -- it is not just a matter of putting in a different failure rate for a valve. One has to go in and look at what I call the sneak paths or the various sequences where you can overpressurize a low pressure system. That's not been systematically done.

MR. CATTON: But it should be, or the PRA is no good.

MR. MURLEY: Well, that's right.

MR. CATTON: I think we agree with you on that.

MR. MURLEY: Didn't I just say that we don't have much confidence that the current methodology is adequate for this sequence, and that's why I have decided that a separate comprehensive study is needed. One could, of course, delay the IPE and wait I don't know how many years until we get the methodology and then send it back out again. I don't think that's a wise thing to do.

I think there's very little chance that we will get the analysis we need from the IPE's that are being done right now. I have looked over the IDCOR methodology in this area for example, and I have set aside myself that it is not adequate. And, furthermore, I don't want to wait three to five years to find out that it was inadequate all the time.

MR. LEWIS: Tom, I'm the known statistical purist in this crowd, so let me complain just very s ightly. You used the term a little earlier of true picture This is in line with your conversaticn with Ivan. A pro) abilistic risk assessment, of course, only gives a pro) abilistic picture, nothing gives the true picture except hindsight and even that is a little bit iffy to many own peopl 's self-interest.

So, the issue is only all t'e PRA does is reflect the best thinking and the best data avai able at the time if it is done conscientiously and well. So, it never tells the truth and one should never be surprised vnen a PRA is wrong, but one should be less surprised when a P'A is right. And, that's really all it is for.

MR. MURLEY: Yes.

MR. LEWIS: So, yo complaint is that it hasn't been done as well as it could hav been done.

MR. MURLEY: That's a better way to say it.

MR. LEWIS: And I wish I knew and exception to that comment in real life.

MR. MURLEY: I accept that. A true picture is -- what I should have s id is that we know there are some weaknesses in the rethodology to treat this sequence so let's go and deal with .t. I think we have got the tools to do it. I think you are joing to hear today how they are proposing to do it.

MR. CARROLL: I guess one other clarification that I am interested in, clearly every small leak between systems does not have the potential for creating an unrecoverable LOCA. In your laundry list of precursors, many of the things were a valve just cracked causing pressurization of a RHR System. But you certainly have to make a distinction between a small flow that is easily handled by makeup systems and precursor situations where there is a real potential for a LOCA that you can't recover from.

MR. MURLEY: Yes. I agree fully that not all events where you, in fact where you overpressurize a low pressure system lead to any consequences at all. We have seen many already. My point is in the past I am afraid that they have been dismissed for that very reason, that it is just a small leak. I have to confess to this Committee, I was embarrassed when I was the Regional Administrator in Region I we had one, and a BWR where the suction to the RHR pump was overpressurized and received system pressure and temperature, and it didn't even come to my attention. I mean, the inspectors didn't even think it was a big enough deal. All it did is fail some seals in the pump.

I read about it in an AEOD report where they analyzed the sequence. So, I think when I did find out about it, I certainly raised the consciousness of my inspectors to look for things like this. I think we are slowly raising the sensitivity of everyone to look for this and be sensitive to it.

MR. CARROLL: But you do agree that there is a whole bunch of events that occur out there that clearly aren't precursors to anything?

MR. MURLEY: Sure. Let me conclude because I do have to put this in perspective. I am not saying and we have not concluded that there is an immediate safety problem, nor that any plant improvements are needed. It is quite possible that we will find that the risks are acceptably low, even in view of this precursor experience that we have seen. I do believe, however, that we need to promote an increased sensitivity of this issue on the part of the plant operators as well as the NRC staff.

So, we have scoped out a closure strategy which Mr. Barrett and the staff will talk to the Committee about. But, briefly though, we are first going to scope out the problem. One thing I think that I need to emphasize is that in scoping out the problem we have to take a broad view of the operating record of the plants and, particularly, we have to consider all check valve and isolation valve failures that can contribute to the precursor record even if they did not happen in systems considered for Intersystems LOCA.

Nonetheless, one has to consider that that event could have happened in a sensitive system or a system connecting say the primary system to a secondary system.

Furthermore, I think we have to consider all human errors where valves are left open or incorrectly operated that could contribute to the precursor record for the same reason.

We are going to do a comprehensive search for possible Intersystems LOCA sequences; we are going to improve our PRA models which you will hear today; and then, we are going to do thermal hydraulic and stress analysis to find out in fact whether even if you do pressurize some of this low pressure piping, maybe it can withstand it and not fail. So, by way of background, that is why I have decided to undertake this task. I think it is important. Quite frankly, I think it is my job to do things like this, to be sensitive to things that might have been overlooked and to study them, just like we did pressurized thermal shock. Maybe it will lead nowhere, but on the other hand it might lead to some improvements.

In any case, I think what we are doing is raising the sensitivity of people to the issue, and I think that in itself is going to turn out to be useful.

MR. WARD: Tom, I think you have made a good case. There certainly is a risk issue here. Whether it is worthy of being singled out for the attention it is getting, I think I still have some question about. In particular, I would like to hear your views on why this one is singled out in comparison with another issue, and that is the one of loss of decay heat removal during a shutdown. There was a generic issue 99.

That particular issue seems to have some of these same characteristics that you are concerned about, and I think rightly concerned about in this one. This is an accident that could occur under conditions when the containment is open, the pressure vessel is open, administrative controls are relaxed. There have been precursors which indicate this is a threat. Even though decay powers are low in this instant compared to the one you are concerned about, this is somewhat -- the fact that water levels can be quite low, the net effect is about the same.

In further, PRA doesn't deal with this type of issue or any shutdown issues. But yet, this one is being -- GI 99 or this decay heat removal issue at shutdown is being handled kind of a low keyed way.

MR. MURLEY: I agree with you, Dave, that it is an equally -- a sequence of equal concern in this sense, that it hasn't been dealt with adequately and there was not the sensitivity on the part of operators. There is a general feeling out there I can guarantee you, that once a plant is shut down and in Mode V or Mode VI, that there is nothing to worry about and that's not the case.

But we did a lot of work on it. My staff worked for over a year looking at the various ways you can get into trouble in shutdown decay heat removal loss, and we issued a bulletin to each licensee and made them take corrective actions. And, I personally wrote to each licensed operator in the United States and told them, you better be concerned about serious accidents can happen during shutdown and here's the bulletin and you better read it.

Now, if you think we should do more, maybe we need to improve our PRA models more or something like that. I would be glad to hear that, because I don't disagree this is an issue. Why the Intersystems LOCA is of particular concern to me is the high consequence it can have. It can bypass the containment and it effectively can bypass any effective emergency planning, because it can happen in a fairly short time. It is just because of those consequences that I think we need to pay attention to it.

MR. CATTON: So, is your goal to do the same thing with the Interfacing LOCA? You are going to say gee, this could be serious, you better pay attention to it?

MR. MURLEY: I guess the question is, are we going to do the same thing in terms of sending information out to operators and things on Intersystems LOCA as we did on Midloop Operation.

MR. CATTON: Right.

MR. MURLEY: I haven't reached that conclusion yet, although if that's what it takes to increase the sensitivity of operators and people we may have to do that. Right now I wouldn't know exactly what to tell them, other than some exhortations of good practice or something.

MR. CATTON: But, increased sensitivity ought to improve the PRA they do or the IPE and it should. It should turn up, and I think that is an admirable goal.

MR. MURLEY: If we do it right and if they do pay attention, then it will show up in the precursor records with time, yes. But just me sending a letter out, I don't know that I can take credit for that in any kind of risk analysis. It has got to show up in actual changes in operating practice.

I should say, there seems to have been an effect on our Midloop Operation Bulletin because people are sensitive. I personally talked with operators who said that they weren't aware of the problem and they thought that was a good bulletin, and they read it and paid attention to it. But, we had done a lot of homework before that and we were able to give them some real meat and some real substance. I don't think we are quite there yet in Intersystems LOCA.

MR. CARROLL: I can confidently report that the operators at Diablo are very sensitive to it.

MR. MURLEY: Good. I am glad to hear that.

MR. MICHELSON: Tom, I have two questions regarding Interfacing Systems LOCA, or maybe they are more like observations. The first one deals with the PRA that one would have to do properly to understand the effects of an Interfacing Systems LOCA. The difficulty I foresee is that once you have looked at say overpressurization, you will perhaps find that the pipe isn't the first thing to rupture but perhaps it's an instrument blows off or a seal relieves itself or whatever.

These perhaps are even relatively modest leaks in terms of gallons of minute, but they are released to an atmosphere which is not necessarily a confined atmosphere and controlled, a large amount of water vapors, some amount of heat and so forth. The PRA, to be done right, has to first of all determine the probabilities of this happening and then it has to have in the model, the consequence so that you can really determine whether this is a core melt contributor or just what it is.

And, it appears to me in inquiring in a number of areas, we don't know how to determine the effect of these unusual environments upon sensitive equipment, particularly electronics equipment. We pursued this at great lengths on the APWR yesterday, and clearly it hasn't been explored. So, one of the parts of your program somehow has to be what are the consequential effects so we can determine that blowing an instrument off is not a big deal. You don't just look at the drain lines and see if the water can be carried away. That's only part of the problem. You have to look at the first protection to see if it is set off and a number of other possibilities.

MR. MURLEY: I agree.

MR. MICHELSON: So, that's just kind of an observation. I assume that part of your program is going to have to be to think about control of the environment or analyzing the consequences of the adverse --

MR. MURLEY: You will hear more about that today. But if it's not in there, I think you ought to point that out to the staff.

MR. MICHELSON: The second observation deals with a system which I think is particularly vulnerable to the problem because, in particular, the system is a reactor water cleanup on a boiling water reactor. It's an Interfacing System. It is at full reactor pressure and essentially full temperature for a portion of it during normal operation. If any kind of a failure occurs, then you have a problem of how do you isolate the break. It is a LOCA until isolated.

And, how do you isolate it, can you isolate it, do you have valves that will even close under those conditions, and what are the consequences to the environment in the plant because this is, again, outside of containment until such time as you get it isolated and under control. Again, I don't see these in the models. I see the probability of the failure in the model, but I don't see the consequence being adequately modeled to be sure where we are.

MR. MURLEY: I agree. In addition to the typical eventries and faultries that one has to do, there is a lot of deterministic kind of analysis that has to go with it that has never been done before. Of course, w don't have an infinite budget to do this and an infinite program, but I think we do have to look at some of these types of questions that have never been looked at before.

Just to give another example Carl that happened at Arkansas, as I recall, some of the piping outside containment received primary system temperature and pressure and the piping was designed for the pressure but it wasn't designed for the temperature. Therefore, you can get who knows what kind of expansion stresses and bending stresses and so forth you can get. These kinds of things have been, as far as I can tell, totally overlooked in this kind of analysis before.

MR. LEWIS: Tom, there are two questions of completeness that are getting a little mixed up here. One is the question of whether you can do everything in the world which, of course, you can't do.

MR. MURLEY: Right.

MR. LEWIS: The other is, whether having set an objective you have done all you could do to achieve that objective; that is, it is possible to set as a PRA the calculation of a probability and to hell with the consequences. It is not that that would be a very good guide to decision making, to regulatory decision making, but it is possible to do it within the context of a self-consistent PRA. You have to set a limited objective and then do as well as you can within it, because you can always price yourself out of doing anything by saying you haven't done enough.

You have to start at the beginning, decide what it is you are going to do, do it as well as you can and then, by golly, those are the probabilities as well as anybody knows and to the extent that you calculated the consequences and those are the consequences. But, you don't need to do everything as long as you know what you've done.

MR. MURLEY: Yes. And that's where I think starting out on a program like this, it takes a lot of wisdom and judgment to make sure that we are focusing on the right things. And that's why I would appreciate your insight when you hear what the staff is going to lay out for you today. Have we focused our limited resources on the right approach to this question?

MR. SIESS: Tom, NRR people are now reviewing designs for a proposed future evolutionary reactors. Are they addressing this issue?

MR. MURLEY: Yes.

MR. SIESS: The new?

MR. MURLEY: Yes.

MR. SIESS: Has ABBR and SP-90 gotten around this to satisfy you?

MR. MURLEY: Yes, absolutely. Now, we don't -- the

Commission wants to be involved in any decisions on requirements that go beyond our regulations. So, this matter is in a paper which will be sent to the Commission I hope within a week or so, which you will get a copy of. It lists 15 areas where we are proposing to deviate from the regulations, various areas. This is one of them, Intersystems LOCA.

MR. SIESS: By deviate, which direction?

MR. MURLEY: Both.

MR. SIESS: Up, down, or sideways?

MR. MURLEY: Both. Most of them are increases or go beyond our regulations, but some like the OBE SSE question are relaxations. There is one on Intersystems LOCA and, for example, we are proposing that where you can you make the piping be able to withstand primary system temperature and pressure.

MR. SIESS: You make the distinction between being able to withstand and design for?

MR. MURLEY: Yes. Some cases you can design for it and other cases it is not practical but you can probably --

MR. SIESS: Some places where it is not designed for but it could withstand?

MR. MURLEY: Yes.

MR. MICHELSON: Tom, there is one small nomenclature problem with this Interfacing Systems LOCA which allows some kinds of things to fall in a crack. The problem is that I think most people think of Interfacing System LOCA and somehow the Interfacing System is designed for lower pressure and temperature conditions and somehow it experiences the higher pressure in temperature condition.

That, of course, is not the case in reactor water cleanups. So, that kind of -- it's a LOCA, and it's an Interfacing System but it is not of the kind that people classically think of. Are you also picking up those kind of LOCA's?

MR. MURLEY: I hope so. Why don't you ask the staff when we get to it.

MR. MICHELSON: It is by your definition then, any Interfacing System whose failure would lead to a loss of reactor coolant; is it that kind of definition?

MR. BARRETT: Outside of containment.

MR. MICHELSON: Yes, outside of containment.

MR. BARRETT: Yes.

MR. MURLEY: Then you encompass it. Thank you. Of course, designing the pipe for full reactor pressure isn't the answer.

MR. MURLEY: I know. That's a good point. That's a good point, yes. Thank you.

MR. CATTON: Thanks, Tom.

MR. BARRETT: I am Richard Barrett. I am Chief of the Risk Applications Branch in NRR. Mr. Chairman, the notes and viewgraphs that you have in front of you are an abbreviated version of the presentation that I gave to the Subcommittee on December 7th. I think that Dr. Murley in his remarks and, also, Dr. Catton in his report, have covered many of the important points that are in that presentation. So, after a discussion with Dr. Catton before the meeting, what I would prefer to do, rather than go through that presentation again would be to give you a presentation which addresses the three principal questions that were raised by the Subcommittee during the Subcommittee meeting in December.

Those three questions were, broadly stated, first of all, why do we need an ISLOCA project given the fact that the ISLOCA is handled in the IPE's, in the PRA's that will done for the IPE's? Secondly, how does the ISLOCA core melt frequency goal -- the 10 to the minus sixth goal that we have stated -- how does that relate to the NRC's safety goal policy? Thirdly, what actions, if any, are we planning to take as a result of this study once we have completed it and how do they relate to the IPE?

If you are agreeable to that, I would like to pursue it.

MR. CATTON: I see no disagreement.

MR. BARRETT: Thank you.

MR. CATTON: On your first question, why an ISLOCA project, I think in my own case the question was really not why a project but why something other than an IPE when you are done with it. In other words, the increased sensitization may be necessary, but that doesn't mean once they are sensitized it can't be just included in the IPE.

MR. BARRETT: I think I understood the question to be a little broader than that. Why have a project at all --

MR. CATTON: There are others here that it is probably broader.

MR. BARRETT: If you would like to narrow the question, I would certainly prefer to answer a narrower question than a broader one.

MR. CATTON: No, I won't do that.

MR. BARRETT: Let me just proceed to answer the broader question of why, given the fact that we are about to embark on an IPE project which will involve the conduct of in excess of 100 PRA's, one for each operating reactor in the country, and each one of those PRA's will address the ISLOCA accident using the current state of methodology, why is that we the staff need to have an additional study to analyze this accident?

I think the answer to that question is quite a simple one. In general in PRA's that have been done in the past and that are being done now, including the NUREG 1150 PRA's, the WASH 1400 PRA's, and the PRA analyses that were done by the Brookhaven National Laboratory as part of the resolution of generic issue 105, there is a limited scope of the modeling that is done of the ISLOCA sequence. It is generally treated as a hardware problem. It is treated as the rupture or failure of redundant check valves. And, quite often, it is limited to the discharge lines of the RHR systems in PWR's.

MR. CATTON: But that doesn't have to continue, does it?

MR. BARRETT: No, it does not have to continue but given the current state of --

MR. CATTON: If it is not correct or not complete, it should be made complete, it seems to me.

MR. BARRETT: Exactly. As I think Dr. Murley pointed out, we could give the industry guidance on how to do it more completely, but at this point we don't know what guidance to give. The purpose of the study is to understand what kind of guidance we might give if we are to give it. All we know right now is that --

MR. CARROLL: Why is it a given that the industry needs that guidance?

MR. CATTON: Just look at their PRA's?

MR. CARROLL: Well, except if NRR or the NRC says hey, to have an acceptable IPE you are really going to have to rigorously deal with Intersystem LOCA issues. Why do you have to say more than that?

MR. BARRETT: It's not a given. It is not a given.

All we know right now is that there are operational events which point to scenarios which are not modeled in PRA's. When we finish this study, we may find out that in spite of that fact, they are not very important to risk. It may very well be that the current PRA's are modeling the most important contributors in which case, we will just close shop and do no further work. We will put no further guidance to the industry of any type.

But at the moment, we have the suspicion that these operational events are pointing to important risk contributors.

MR. CARROLL: Don't you think people in the industry are considering that in their IPE's?

MR. BARRETT: I really have no indication that that is the case.

MR. CARROLL: They read Nucleonics Week inside NRC.

MR. BARRETT: They certainly do. What I would like to see is that if this is a bigger risk problem than has been modeled in past PRA's, I would like to be certain that all of the PWR's, all are doing it in a systematic way or considering this. I have no way of being assured of that at this point.

MR. KERR: When you talk about risk, I presume you are talking both about total risk due to all the operating reactors as well as risk to individual reactors?

MR. BARRETT: Yes, sir.

MR. KERR: It seems to me that one of the characteristics of this problem is that more than some other sequences, it is likely to be extremely plant-specific. And hence, doing an analysis of four or five plants will tell you something about the risks associated with those plants. If I accept the premise of the people who have completed 1150 up to this point, it will tell you very little about those other plants out there.

What sort of conclusion are you going to draw on the basis of your limited analyses?

MR. BARRETT: I suspect that you are right. I suspect that we will find that if we analyze four plants we will find four very different situations and, from that, you might conclude that for all the PWR's each one of them is very plant-specific. That's, to a certain extent, that's why we have the IPE. We are looking for plant-specific vulnerabilities. I think by analyzing three or four plants, specific plants, we can begin to understand what factors are important to consider in analyzing this for an individual plant.

The guidance that we might put out to the industry in terms of the IPE would be guidance as to what factors to consider and perhaps how to consider it.

MR. KERR: I think that may well be true. On the other hand, suppose on the basis of your analyses you decide that there isn't sufficient risk to carry on the program. How much confidence are you going to have in that conclusion, assuming that you have sampled only a limited number of plants? What I am getting at sort of, and I am not sure it's the right answer is, it seems to me this almost has to be done on each individual plant and it has to be done in a context in which one is looking at the total system, not just the isolated unisolable LOCA.

As Mr. Michelson points out, it can well influence many things other than just these high and low pressure systems. Therefore, it seems to me it almost has to be done in a context which is present only when one is doing something like an IPE. If it's just done where one is looking at this one sequence, I think it may be ineffective. But, maybe I am getting ahead of you so I will --

MR. BARRETT: Well, again, as Dr. Lewis pointed out, we have limited resources and we have to make choices as to what is the best way for us to deal with the problem as we perceive it. We have looked at the operational experience and we have an idea of what the potential problem is and what the potential sources of problems are, and I will get into a little bit of detail about that in a minute.

I think that within the limited resources that are always available, the limitations that are always there, I think we have to study the problem as we see it. And, if we are neglecting some -- if a lack of a more integrated approach neglects some unperceived problem, of course, that's always a possibility that we have to live it. I think what we are trying to do is deal with the operational events as we see them and as we understand them in a generic sense.

MR. CATTON: Can I try to paraphrase what I think you said?

MR. BARRETT: Okay.

MR. CATTON: The purpose of the study will be to determine whether or not today's PRA's properly deal with the ISLOCA and what properly entails. Is that what you said?

MR. BARRETT: I'm not sure. No, I didn't say that, but I am not sure what that means.

[Laughter.]

MR. BARRETT: It could very well be that no PRA is perfect as Dr. Lewis pointed out. The question is, is the current way of doing PRA's capturing the most important part of the risk associated with ISLOCA or is there an entirely different element over here that is being shown by this operational experience which is actually dominating what we are modeling.

MR. CARROLL: How do the people that worked on 1150 answer that question?

MR. BARRETT: Well, the people who worked on 1150 are here, if you would like to pose it to them.

MR. CARROLL: I would like to hear their comments at some point.

MR. BARRETT: The people who worked on 1150 or the people in NRC who ran the 1150 project are involved also in the planning of this project. I don't believe there's any disagreement about the need to pursue this new area. Perhaps I could ask Joe Murphy from the Office of Research to address the question, if you heard it Joe.

MR. MURPHY: Joe Murphy, from the Office of Research. I agree completely with Rich and what Rich has said. We done 1150 techniques that were rather standard for PRA in looking at the ISLOCA, which means there was an emphasis on the hardware failures. I think what the operational events have shown us recognize that in the analytical work on 1150 started I guess about six years ago. What's happened in this six year interim, there have been enough operational occurrences to show us that there is a potential at least for significant involvement in the human hardware interaction of effecting the ISLOCA probabilities that, to my knowledge, hasn't been included in any PRA that has been done.

The PRA's have focused on the hardware contribution and not really looked adequately at the effect the human can have in doing things that you may not think will happen as you look at the hardware layout. For that reason, we have been intimately involved in the planning of the program. I completely agree with Rich. We have to go forward and take a look at the influence of the human and how it can effect us.

It is going to be a plant-specific problem. And, more than that, it may be even procedure specific in certain areas. But this will tell us what to look for, so that as you do an IPE, as you go forward with future PRA's, I think we will have a much better capability of giving advice to whoever is doing them, whether it's an NRC sponsored study or whether it's an IPE being done by the industry.

MR. CATTON: I gather from what you are saying that this particular problem is just a problem to fine tune your dealing with the human factors issue in your view? It's a problem across the board.

MR. MURPHY: It's a problem across the board. The fine tuning may be too kind.

MR. CATTON: Well, to improve.

MR. MURPHY: In fact, the way the ISLOCA has been looked at in the past, the human has been essentially left out of the problem.

MR. CATTON: It's been essentially left out of the problem pretty much everywhere.

MR. MURPHY: Yes.

MR. WARD: Joe, is that really unique for this ISLOCA, or does that apply to the 30 other sequences that the PRA attempts to model?

MR. MURPHY: It certainly applies to one degree or another. It's a lot of other sequences. I have said many times I don't know whether the Human Factors Branch people who are here would agree with me or not, that we have really progressed a long way in our ability to handle human factors in probabilistic risk analysis since the days of WASH 1400. But we still have a long way to go.

MR. WARD: Do you think though Joe, that this is uniquely a problem for ISLOCA as compared with many other important risk sequences?

MR. MURPHY: We know that the bypass sequences that bypass the containment have from WASH 1400 on in virtually every PRA that has been done to the Level III, these have been important risk contributors. We can look at some of the operational events that have happened and try to ask ourselves honestly say, how would we have modeled the situation where the human was important. And, I think we see in these cases that we would have come up with a very low probability.

There have been instances where I think the average PRA analyst, even if he tried to factor it in -- a human error into the situation because of the mindset that he would be going through, would come out with low numbers. Quite frankly, we saw some operational occurrences that I think told us that the modeling we have done in the past was insufficient and suggested that we needed to go forward with a program now to come up with guidance as to how to look at these in more detail as opposed to say, sitting back and saying let's let the industry do IPE's and they are aware of the operational occurrences as well as we are. We can sit back and we can wait until these come rolling in and do our review at that point.

I think that would sort of be burying our heads in the sand for the next few years and putting the burden on the industry to do something without really telling them that we were putting that burden on them. The purpose here is to get a leg up on the situation. We have something that we suspect we haven't modeled adequately in past PRA's.

MR. SIESS: What's the burden you are putting on the industry? I got lost there.

MR. MURPHY: We are not putting one on. I say if we simply sat back and put our hands in our pockets and sat down and said you are not going to provide any guidance on how to look at ISLOCA at this point. We will wait until the IPE's come in and we will review them and see if they did it properly without -- that's called bring me a rock. We will see if you do it properly but we will give you no guidance as to what properly means.

MR. SIESS: I mean, what's new about that? You haven't told them what is a vulnerability yet either. You told them to bring them in and show us what you think is a vulnerability and we will tell you whether we agree. And, simply to identify a potential vulnerability seems to be one step beyond where you are now. It may still be short of where you would like to be in telling them what to do.

MR. MURPHY: Well, I won't claim that we always give perfect guidance to the industry obviously. I think your point is well taken. But, what I am trying to say is, I don't want to make this sound like it's a big deal because I don't think it is from the standpoint of a burden on industry. I think it is incumbent on us when we think we have a problem, we see a potential problem, to go forward and try to look at it in enough detail so that we can convince ourselves what needs to be looked at, what kind of modeling we might have to go to, what are the important problems and then try to structure that into some sort of guidance that we can provide as to what the problem is.

I may be getting into Rich's --

MR. SIESS: The danger in that is that you may define the problem too narrowly. If you simply tossed it out as a potential problem and let 80 utilities look at it, they might come up with more things than you could think of.

MR. MICHELSON: Bill?

MR. KERR: Joe, in one of your earlier comments you said that you had neglected human error. I look at the examples of human error here that presumably have been neglected -- take that last one for example, which involves potential failure of check valves. If your operational data is valid and maybe it isn't, that failure will enter through a consideration of a combination of random failure and common mode failure independently, whether it was caused by human error or not.

MR. MURPHY: I agree.

MR. KERR: If the things that are causing problems of failures, if your database is okay, it doesn't make any difference if the failures come from human error or whatever, they will show up.

MR. MURPHY: One example might illustrate what I mean. There was one case where at one point they had a leaking check valve. Downstream of that leaking check valve there was a closed MOV. Those were the two barriers. The operator decided that he recognized he had a leaking check valve, and to attempt to seek that check valve he thought he put greater Delta P across the check valve. So, he opened the MOV downstream. What this did then was, it connected the reactor coolant system through refueling water storage tank because he had a leaking barrier and he opened the second barrier, and he opened that intentionally.

What I am saying is, the PRA would not model opening that MOV downstream.

MR. KERR: No, but it would model failures of valves.

MR. MURPHY: It would have modeled the failure of a - what you would have in the PRA typically would be, you had a normally closed gate valve failing open, a very low probability. But what actually happened in this case the operator, because he decided he had a chance of seeding the check valve, intentionally opened the MOV. I don't know whether to call this a human error, but certainly with a human operating in a way we didn't intend.

MR. KERR: No, I am not arguing what happened. I am simply saying if this sort of thing is built into the database through operating experience, it will show up in a PRA whether it was caused by intentional or unintentional behavior on the part of an operator.

MR. BARRETT: Dr. Kerr, I think there is a distinction here between having a sequence that is being modeled currently and yet, you have underestimated the failure rates such as Joe's example. What is modeled in NUREG 1150 is a failure of check valves. If you have new operating experience with say the check valves might fail more frequently, then you could change your data.

I think the problem here is not so much the frequency of the occurrences as much as the types of occurrences that are happening, and that you have scenarios which are entire scenarios which are not taken into account. In fact, the entire concept of the operator as the initiator of the event is not taken into account.

MR. KERR: Rich, I think I understand your point, and

I think it's a valid point. The point that I am trying to make is that one ought to look at this very carefully and make certain that by looking so carefully at the trees, the individual occurrences, one does not lose sight of the fact that what really is occurring is that failures are being interjected, maybe in some cases inadvertantly, and they are being inserted by people but what they are is failures of a system. Human aided failures but nevertheless, if one has enough operating experience one will see these as failures.

If failures show up in your sequences due to whatever cause, they ought to show up. Now, there may be other situations in which you haven't thought of appropriate sequences and they simply wouldn't show up no matter what your database are. And you are quite right, those need to be treated. But I sort of get the impression from the examples that I am seeing that there may be some situations in which this is not necessarily the case.

I am sure that as you look at it in more detail you will probably catch these.

MR. BARRETT: The analysis we are doing, Dr. Kerr, will also include -- will not only include the new types of scenarios which we are postulating as a result of the operating experience, but side-by-side will also include the type of scenarios which have traditionally been modeled in PRA's, and will try to take into account where the operating experience may lea(to higher or even lower failure rates.

So, it is going to be done in an integrated fashion so tha' the entire ISLOCA sequences model in this study, all of the scenarios, all of the types of initiators which we think are important. So, I think we will pick that up.

MR. MICHELSON: Where will you get your data for failures of valves of the type wherein the operator opened them when they weren't supposed to be opened? That normally isn't in a MOV valve failure database because there is nothing wrong with the valves. But, it could be in some other kind of database in which you record cases wherein the valves are opened when they shouldn't have been opened.

I don't know that that database exists. Are you aware of any that compiles that in some kind of a systematic fashion so that you could get a probability number out of it?

MR. BARRETT: That's really the most difficult part of this study, is to model these kinds of human errors, especially human errors of commission. I think possibly -

MR. MICHELSON: The modeling, I think is going to be easier than getting some data to put into the model to get a number out of it. I think the modeling would be relatively straightforward, but getting the data seems difficult if not impossible.

MR. BARRETT: You are absolutely right. The difficulty is compounded by the fact that these error rates that you are talking about being human error rates will vary depending on the types of conditions you will see.

MR. MICHELSON: Are you going to tell us how you are going to do this somehow anyway?

MR. BARRETT: Gary Burdick, he talks about the research program and will give you some -- obviously not too much detail about how we will get the base figures that we will use for these error rates. But also, how the model will take into account varying factors which impact human reliability. I made a promise that I hope Gary can meet.

MR. CATTON: In your search for data, it seems to me that if that's the kind of information that you are looking for you are going to have to broaden the database to well beyond the Interfacing System LOCA.

MR. BARRETT: Absolutely.

MR. CATTON: I mean, some parts I can imagine how you are using it to develop a standard for that part of a PRA. But what I am hearing now is a broader question, and you are going to have to go beyond the ISLOCA, much beyond it, and it's really not a study of the Interfacing System LOCA.

MR. BARRETT: It's a study of Interfacing System LOCA, but we are having to bring into account --

MR. CATTON: You start out with a study of the Interfacing System LOCA and you find that where your problem lies, at least as I hear you, that you can't put good numbers on the probability of the operator doing one thing or another even initiating it. I don't think you have enough events within the ISLOCA type to give you that information, so you need to really back up and put the ISLOCA on a shelf and say gee, this is the kind of information, we need to evaluate it and do a different kind of study which is human factors related by itself.

MR. BARRETT: Yes.

MR. CATTON: And not all of this other stuff that just confuses the issue.

MR. BARRETT: Well, what we need to do is take advantage of all the human factors, methods development and data development that has gone on previously.

MR. CATTON: But it hasn't addressed the question. At least that's what we heard from Joe just a minute ago.

MR. BARRETT: Well, the modeling of ISLOCA hasn't addressed the question.

MR. CATTON: But knowing whether or not he's going to open the valve when he shouldn't is one of the questions, and I think Carl is right. You are not going to find that within the ISLOCA database, you are going to have to go well beyond it maybe even well beyond the Nuclear industry to find this information and that is information is relevant to things other than just the ISLOCA.

MR. BARRETT: Yes.

MR. CATTON: So, why aren't you proposing a study of just that if that's the issue?

MR. BARRETT: We are proposing to do exactly what you said, and then use that information to calculate the ISLOCA probability.

MR. CATTON: So, the actual probability of the ISLOCA is downstream somewhere.

MR. KERR: If that's what you are undertaking, it seems to me that the problem is longer than the five years Mr. Murley cited as being unacceptable.

MR. BARRETT: I think I should probably leave a lot of this discussion to Gary Burdick. I think maybe too bleak of a picture has been painted here. I think you are getting the impression that we are going to start now to understand human reliability analysis. There are existing methods, there are existing data, and we are going to use what is available with some modifications which Gary Burdick describes.

But, the methods and the data and the performance shaping factors, we are not only to have a five year program to develop these things but we are, in fact within a month or so, of having an ISLOCA analysis in a preliminary draft form for one of the plants that we are analyzing.

MR. MICHELSON: I hope in all of this discussion we haven't thought that the remaining problem is the human factor, because unless you have put to bed some way the other problem of having experienced even a modest ISLOCA what consequences it would have in terms of continuing cooling of the core.

One alternative is to say okay, I don't need to worry about that, if I have an ISLOCA, I have a core melt. Assume that. If you do that, you start ending up with probabilities of about 10 to the minus three and 10 to the minus four for the ISLOCA and then you end up with that same probability for the core melt. Until you chase this thing out and prove that even if you get it with fairly high probability, that the consequences are still acceptable.

I haven't heard you say anything yet about that, other than looking at the human factor which again, is dealing with prevention and not with how well can we mitigate once we experience it.

MR. BARRETT: We will model not only the probability that the operator can take action to prevent an ISLOCA from going to core melt, we are also going to take a look at the question of whether or not the pipe will break in the first place.

MR. MICHELSON: My question was the third part that you still haven't said and that is, having broken the pipe what is the consequence, and not just whether the operator can do something about it. You have to understand what the situation he's getting into will be so you know whether he can evaluate whether he could mitigate it or not. I haven't heard you pursue that much yet.

MR. BARRETT: You are right, we haven't.

MR. MICHELSON: I assume you will today.

MR. BARRETT: We haven't discussed that, and I think we are making a lot of promises about what Gary can do with the 30 minutes that is alloted to him.

MR. MICHELSON: Well, if you haven't --

MR. BARRETT: I will simply say at this point that the study will not only deal with the initiators of an ISLOCA, the probabilities of it being initiated either by a hardware failure or by human, it will also deal with the question of what is the likelihood that this type of sequence can be arrested before it goes to core melt including the impact for instance of having a break in the secondary buildings, the impact that would have on equipment, on the availability of injection equipment.

We also are evaluating the procedures and training that the operators have and the probability that they will be able to isolate the break or deal with it in some other way through accident management. We are trying to look at this in a pretty comprehensive way.

MR. MICHELSON: Those are the items I think the industry might need more guidance on as to how far do they really need to pursue this.

MR. BARRETT: Exactly.

MR. MICHELSON: If you haven't pursued it, of course, then they are at loss as to how far they should go. So, even though four studies for instance might tell you only about four plants, the methodology thereby developed might give you an insight as to how you do one properly for other plants wherein the situations are different. At least it gives you some guidance, better than nothing.

MR. BARRETT: Yes, sir.

MR. MICHELSON: Which is, I think, what we have at the moment.

MR. BARRETT: I just want to point out parenthetically, we run the possibility here by including the human initiator, the possibility is there that we might significantly increase the probability, calculated probability of an Interfacing Systems LOCA. But we are also improving on the current method of doing PRA's by doing a more thorough job of trying to understand whether or not, or what is the likelihood that an ISLOCA will go to core melt. What is the likelihood that the operator will be able to mitigate the event or that the pipe won't break in the first place?

So, it may well be that the result of this study is that the ISLOCA core damage frequency is significantly reduced in our opinion. It's a possibility.

[Slides.]

MR. BARRETT: Let me just very quickly tell you why I put this up here. The operational experience that we have seen shows us that it is possible for the human to bypass some of the important safeguards that are in the plant to protect us against this type of an event. The first type of an event, and one of the ones that Joe mentioned, we have seen events where operators have deliberately opened valves which should not be open at full power. The example that Joe gave was one of an operator who thought he was trying to see -- who was trying to see a check valve by creating a differential pressure. He deliberately created an ISLOCA situation.

We had another interesting event --

MR. CARROLL: Did he, in that case?

MR. BARRETT: In that case there was.

MR. CARROLL: Was there the potential in that case for enough flow to cause a LOCA?

MR. BARRETT: In that case there was flow through a four inch line.

MR. CARROLL: A wide open line?

MR. BARRETT: A wide open line to the RWST.

MR. CARROLL: But I thought the check valve was just leaking?

MR. BARRETT: The check valve had gross leak adjustment. No, it was not a wide open line all the way from the RWST, but you can see -- what we are trying to key on here is, what are the modes of failure. This is a mode of failure that was not considered before.

MR. CATTON: Is this the Bibliss instance?

MR. BARRETT: Yes, it is.

MR. CATTON: They didn't take it as seriously as you are.

MR. BARRETT: Well, I believe they are still studying the event.

MR. CATTON: It could be.

MR. CARROLL: I just caution that it is very easy to get hysterical about these kind of things. But you have to look at the real world, and I can't imagine the operator opened the valve wide open but maybe he did. I would expect he just cracked the MOV open, and I can't imagine the check valve was wide open.

MR. CATTON: But then he couldn't get the MOV closed again.

MR. CARROLL: That's okay, if you only cracked it.

MR. MICHELSON: That's a case where you have to look at the plant-specific situation. A lot of times as soon as you turn the hand switch, it goes full open automatically. You can't stop it, it doesn't have intermediate --

MR. CARROLL: That's true also.

MR. MICHELSON: The only way you can stop it is to let it go full open and then turn it around.

MR. CARROLL: That's true also.

MR. MICHELSON: But it depends on the plant. You have to start getting into that degree of detail if you want to understand this problem.

MR. CATTON: It was a human factors issue from the point of view of a shift change or something, wasn't it? Didn't they have a shift change right in the middle of it?

MR. BARRETT: That's possible, but I don't recall.

MR. CATTON: And then it led to more difficulties?

MR. BARRETT: They have all come together in my mind by now.

MR. DIAB: This is just a comment on this event that you were discussing. We had a similar event here in the States, and there was also a complication that the intent was to crack open an MOV. But, by the time the communication went from one to another, the valve was wide -- mid-wide open. That's another human error, that's a communication deficiency.

Again, you had a check valve and the intent was to seal it by creating a Delta P. And, the order was crack open the valve. By the time that went from one to one, the valve was eventually open.

MR. CARROLL: But in tha[illegible] was the check valve open very much?

MR. DIAB: It was also -- I think there was a foreign object in there so you couldn't really see it.

MR. CARROLL: But was there the potential for a core uncovery? Could enough flow have escaped?

MR. DIAB: Yes, I think what Rich is trying to say is that this is a symptom of things that can occur. You could have had a slightly different situation with a much larger flow.

MR. BARRETT: I think that's the important point. We are looking for types of errors which in themselves are not ISLOCA's, but in combination could be ISLOCA's.

MR. CARROLL: With a much lower probability.

MR. BARRETT: Much lower in probability. The question is, is it 10 to the minus six. That is a very low probability.

MR. DIAB: I think once you start -- you begin to introduce these kinds of variations, human errors on things like that, then the problem doesn't really become very much plant-specific like was suggested earlier. The plant specificity comes from the fact that you have hardware oriented modeling. If you have a certain hardware combination in one plant and you don't have it in another plant, that's why you have the plant-specific idea that is floating around now.

But once you begin to introduce these other parameters, the plant specificity sort of fades away to some degree.

MR. KERR: But, the plant specificity is the thing that you will know most about. The human error is of the type that you are talking now, you simply aren't going to be able to predict those probabilities with any level of confidence. You can do the consequence analysis perhaps, but the probability of that combination of human errors is going to be subject to tremendous uncertainty.

MR. BARRETT: Dr. Kerr, let me suggest that that type of question, maybe Dr. Burdick when he is up here can try to deal with the quality of the methods.

MR. KERR: That's a good suggestion.

MR. BARRETT: I am not an expert in this area. I just ask the questions and he answers them. Let me just quickly tell you some of the other types of events that we think are important.

[Slides.]

MR. BARRETT: What is it that we depend on to protect this pressure isolation? We depend in many cases on interlocks. We depend on, for instance, pressure differential interlocks as one of the barriers against opening of the motor operator valves in the RHR drop lines. We have seen at least one case where that interlock was defeated. We depend in many cases, to prevent the operation of a motor operated valve, we depend on someone removing power from that valve.

We have seen cases where there has been a failure to remove power from a motor operator valve when it should have been removed. We depend on good procedures, we depend on good administrative controls to prevent the opening of these valves. We have seen numerous cases where, again, inadequate procedures have led to the opening of valves that should never be opened at power. Finally, here, we generally depend on the assumption that once we have closed the check valve and we have tested that check valve, we can depend on that check valve to be closed.

But we have seen events in which check valves have been stroked during operation, either during a test or for some other reason. And, in one case, 18 check valves were found to be stuck open, 18 of them for the same reason, because someone had installed them incorrectly using a procedure which left out a step. So what we are seeing here is possible initiators, possible contributors which are just not modeled in the PRA's. As a consequence, we have this project and the project is nothing more than a study, nothing more than an analysis to see if this new information changes our perception of the ISLOCA risk, the ISLOCA problem.

[Slides.]

MR. BARRETT: If there are no further questions, let me move on to the second question which I wanted to discuss with you and that is, a question was raised in various different forms at the Subcommittee meeting regarding what is the relationship between the goals that we have set for ISLOCA and the safety goals of the NRC. Let me just try to discuss that. It is difficult to make a clear comparison between these, because the compliance of a particular plant with the safety goals is very plant-specific. So, in a generic sense, it is difficult to discuss it. I think it's instructive to at least talk about it.

The safety goal policy has essentially three types of goals in it. The first goals are the quantitative risk objectives. These are risk objectives for the latent fatality risk to an individual living within one mile of the plant or within 10 miles of the plant, and there's a prompt fatality goal for an individual living within one mile of the plant.

As I pointed out, the compliance of any particular plant, PWR or BWR with these goals is highly plant-specific and site specific. But let me just give you some insight into it. Back in 1984 when the draft policy was published, I did a brief survey of some of the available PRA's at that time to see how they stacked up against these quantitative risk goals. What I generally found for PWR's, even PWR's in high population zones was that, they fell well within the latent fatality goals. At that time, the latent fatality goal was less strict than it is today. But I believe it's fair to say even today, the existing plants, the existing PRA's will not challenge the latent fatality goals.

Furthermore in general, the ISLOCA sequence at the 10 to the minus six level, which is where it generally is, is not the most important contributor to the latent fatality goals. On the other hand, when I looked at the prompt fatality goals, what I found was that for the higher population sites, that the PRA risk estimates were a factor or two to ten below that goal in compliance with that goal again, depending on a lot of factors. In general, the ISLOCA sequence which again was in a numerical region of our 10 to the minus six frequency goal, was a major contributor to that.

So, if we achieve a 10 to the minus six frequency goal for ISLOCA, I think we can say that we will be within the prompt fatality goal for these PWR's as a general statement. On the other hand, if we were to accept a 10 to the minus five or a 10 to the minus four goal for ISLOCA, I don't think I could confidently make that statement for all plants. Again, these goals are generally not as limiting as the final goal, which I will discuss in a minute.

The second type of goal that appears on the safety goal policy is the performance objective for preventive systems. This has been interpreted differently by a number of people. The ACRS in a letter in April of 1988, suggested that this be interpreted as a 10 to the minus four core damage frequency. The staff has proposed a somewhat -- a very similar but slightly different interpretation of this goal. The ISLOCA sequence is generally a very small fraction of the total core damage frequency from internal events. If we meet the goal of

10 to the minus six for the frequency of ISLOCA, it will not in any appreciable way affect our judgment on a plant with regard to the performance objective for prevention.

Let me move onto the third type of goal. That is the proposed general performance guideline which was proposed to the staff for study as a possible goal for the nuclear industry. The way it was stated was that there should be a 10 to the minus six probability of a large release, large release undefined. There have been a number of attempts to define what a large release is. I think that the ACRS definition was that a large release should somehow entail the release to the outside of the containment of a sizeable fraction of the radioactive inventory of the core.

I think that's a sensible definition. I think it's also a definition which a high consequence ISLOCA certainly fits. It's the type of an accident that would certainly fit that definition of large release. The goal, the proposed goal is that that have a 10 to the minus six frequency per reactor year. The goal that we are talking about for the ISLOCA sequence is a 10 to the minus six frequency per reactor year. We didn't derive the ISLOCA frequency goal from that general performance guideline or from anyone of these safety goals. At least in an order of magnitude sense, it is fair to say that the goal we are stating is compatible with the general performance guideline, particularly in light of the fact for

PRA's, for PWR's in general, the ISLOCA sequence is one of the major if not the dominant contributors to offsite risk to large releases.

MR. SHEWMON: When you calculate the probability of a ISLOCA as you define it, is that the probability of it proceeding to a large release or just -- we have had a fair amount of discussion here of when is a precursor significant and when is it minor. What do you take as the end point whose probability you wish to calculate?

MR. BARRETT: We are calling it high consequence ISLOCA. By that what I mean is, an Interfacing Systems LOCA in a sizeable pipe in which the core melts early within one or two hours, in which there is relatively little mitigation of the source term, and in which there is a sizeable release to the public within two or three hours of the beginning of the event.

MR. SHEWMON: So, you carry the probability calculation or would propose to carry it onto that degree?

MR. BARRETT: Yes, sir.

MR. SHEWMON: Thank you.

MR. MICHELSON: Then you do have to do a consequence determination to decide whether you are within the 10 to the minus six?

MR. BARRETT: Yes, sir. That's part of the program.

MR. MICHELSON: I misunderstood I guess too. I thought that was the probability of experiencing a loss of coolant and not the consequence of it. If you are including consequence, then you have quite an analytical problem.

MR. BARRETT: The consequence is being included. Again, simply from a qualitative point of view though, we want to make the distinction between the type of event that can get you into an early core melt, an early release, a release that will be so fast that perhaps your emergency preparedness will not be effective as opposed to an entire spectrum of less significant type of ISLOCA's.

MR. MICHELSON: But this is clearly plant-specific.

MR. BARRETT: Yes, sir, clearly plant-specific.

MR. WARD: I didn't quite follow what you said, maybe I misunderstood. You seem to be saying that with the goals you have for the ISLOCA you would be well within each of the safety goal guidelines from top to bottom.

MR. BARRETT: Except this one.

MR. WARD: Is that what you said?

MR. BARRETT: We would be compatible with this one.

MR. WARD: That's where you said that may be a major contributor to risk expressed in that way.

MR. BARRETT: Yes.

MR. WARD: Okay.

MR. BARRETT: In many past PWR, PRA's, the ISLOCA has been a major if not dominant contributor to this category of events.

2

IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6"

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P.O. BOX 338
WEBSTER, NEW YORK 14580
(716) 265-1600

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IMAGE EVALUATION TEST TARGET (MT-3)

150mm

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IMAGE EVALUATION TEST TARGET (MT-3)

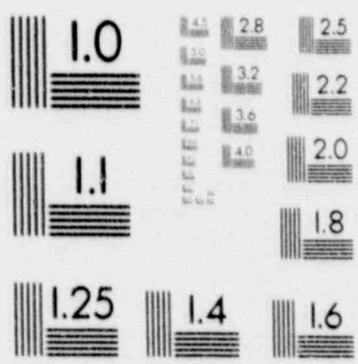

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IMAGE EVALUATION TEST TARGET (MT-3)

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6″

MR. WARD: I understand now, thank you.

MR. BARRETT: It depends on your definition of a large release, of course.

MR. WARD: Yes.

MR. BARRETT: Perhaps there are no further questions about the issue of safety goals.

[Slides.]

MR. BARRETT: Let me go on and discuss the third question which I postulated earlier, namely what is it that we plan to do as a result of this study. As Dr. Murley pointed out and as I have tried to point out, at this point the ISLOCA project is nothing more than a study. We are simply trying to find out if we have a bigger problem than we previously had. If we find out that we don't have a bigger problem, then we will definitely walk away from it with no further action.

Let me just discuss some hypothetical cases. Along the bottom scale here, I have a wide range of possibilities here for the probability of a high consequence Interfacing Systems LOCA. At this point, I might say that I don't know where the results of this study will fall. Let's just play a what if game. The first possibility, if I look at the range from the very best, our estimate of where the very best plant might be to our estimate of perhaps the very worst plant might be, if it looks like this; that is to say, if the median plant is at 10 to the minus six which is our goal, and if the variation that we would expect from plant to plant due to the issues that we are raising is small, perhaps a factor of two in this particular case -- again, we are talking hypotheticals here -- then we would take no action. We would walk away from the problem, declare victory. We would say this looked like a problem but it wasn't.

Let's take a slightly different case. Suppose in this case the median value is still 10 to the minus six of a ISLOCA but based on the analysis that we see, the factors that are important here, we find several factors that we know are important in nuclear power plants based on our experience which could cause this to vary quite widely --

MR. KERR: Is that variation uncertainty in your analysis of one or two plants, or variation among plants?

MR. BARRETT: Among plants.

MR. KERR: How many plants do you anticipate analyzing?

MR. BARRETT: We plan to analyze three or four plants. But each one of those plants will be analyzed from the perspective of looking at the sensitivity to various human factor issues. So, based on those three or four plants, we can learn a lot about what the variation might be from the very best plant to the very worst plant.

MR. MICHELSON: Is your sample big enough to decide that no action is needed based on three or four plants? You might have picked all of the goods one from a particular viewpoint and therefore -- for those, no action was needed. But maybe there's a dozen out there, that if you looked at you would have been way off on 10 to the minus five or four range.

How are you going to kind of assure yourself that your sample is a good sample?

MR. BARRETT: We have three criteria for sampling the plants. The first criterion is that we want to look at a variety of configurations, system configurations. Within each plant we are looking at four or five systems that are low pressure systems. We think we can see by looking at three or four plants we will see a wide variety of these types of valve configurations. And, that will give us a wide variety of scenarios to look at.

The second criterion is, we want to look at each of the three vendor types, I think primarily because the different vendors have different types of procedures. We want to see the effect that the procedures that they have for recovery actions have on this system -- on this accident. The third criterion is, we would like to -- we are trying to sample -- get a sense of how important licensee performance is. So, we are not as you pointed out, going to three or four very good plants. We are trying to look at some plants that have been singled out for the NRC watch list.

MR. MICHELSON: There are four vendors I should say, and if you are only going to pick three or four plants, you are not going to pick more than one boiling water reactor for instance.

MR. BARRETT: Let me point out here, what we are talking about right is just the PWR's.

MR. MICHELSON: Why is it just PWR's?

MR. BARRETT: Well, we decided to do the PWR's first and then after we got started on the PWR's study, we would then begin to determine whether a BWR follow on is necessary.

MR. MICHELSON: Okay. So, we are looking at three vendors and if you pick three plants, you are only going to pick one Westinghouse?

MR. BARRETT: That's right.

MR. MICHELSON: Now, if you like to look at some of the other factors going into it, are you going to search around and figure out what was the worst things that we might run into and look for the plant that has all that combination of worst things; are you going to do it randomly, or what?

MR. BARRETT: There are certain limitations, of course, on which plants we can analyze.

MR. MICHELSON: You are only going to look at one Westinghouse, for instance. How are you going to decide which one is going to lead you to the no action decision?

MR. BARRETT: First of all, we have the two other criteria. One of them for instance is, we would like at plants that have had performance problems, that have been singled out as having perhaps been put on the watch list either in the current one or else in recent years.

MR. MICHELSON: You would use that as --

MR. BARRETT: Yes. We also have constraints, because part of this program involves an audit of that plant where we will actually send the analysis team to the plant to interview people, to walk the plant down for -- it's a very intensive audit process, and one of the constraints we have is the scheduling of the audit.

MR. MICHELSON: If you are lead to no action decision, does that mean then that the IPE won't have to include this scenario in the same depth that you did it when you decided no action was needed?

MR. BARRETT: Exactly. The IPE will include it the way that PRA's have always included it.

MR. MICHELSON: Have been traditionally including it. So, it's a really very important decision that decides whether or not people look at it on their plant in this kind of depth?

MR. BARRETT: In this kind of depth, yes.

MR. MICHELSON: And, a no action decision is a very important one, and only three plants I kind of -- we will see.

MR. BARRETT: We will see. If I had to -- maybe when I am finished I will give you a guess as to which one of these scenarios is going to pan out.

MR. KERR: I think the likelihood of no action is a very low probability, Carl.

MR. MICHELSON: Yes.

MR. BARRETT: In general, that has very low probability, yes, sir.

MR. MICHELSON: I would like to see it in the IPE by the utility themselves to see if it's a problem.

MR. BARRETT: Well, if we find -- if we come to perhaps the more likely conclusion that we still believe the core damage frequency for the median plant is 10 to the minus six but that the variations can be quite wide on a plant-specific basis, then I think what we will try to do is take the most important insights from this research result and give those out as guidance for the IPE process. I don't think we are going to ask anybody to do an IPE analysis for ISLOCA that is as detailed and intensive and expensive as the one we are doing.

I think what we will try to do is take the most important insights from it and ask them to look at their plant from these perspectives. IPE guidance would be the choice at that point.

MR. CARROLL: When would all this happen, at what point in time?

MR. BARRETT: We are going to -- our goal is to have technical resolution for the PWR's by October of this year.

MR. CARROLL: So, there's still plenty of time to factor this into the IPE's that need to be submitted?

MR. BARRETT: Yes. It will impact some of the plants that will have gone beyond the point. Some of the plants would have to go back and redo that analysis. I believe for the majority of the plants, I think this would be timely.

MR. MICHELSON: What is your schedule for BWR's?

MR. BARRETT: We don't have a schedule yet for BWR's.

MR. MICHELSON: Do you think that's because it is a lesser concern or just want to do one at a time?

MR. BARRETT: Well, we wanted to do one at a time. We chose the PWR's for a number of reasons. Yes, we just felt that it was a lesser concern. The primary reasons for that is the lower primary pressure, primary system pressure, the wider variety of injection sources for a BWR. We just felt that it was a lower level of risk.

MR. MICHELSON: Outside of containment on boilers you have much larger pipes that are seeing reactor pressure routinely?

MR. BARRETT: Yes, sir.

MR. MICHELSON: And, whose failure demand that the valves isolate properly or clearly the plant is in deep trouble. Yet, that seems to be more compelling than on the -- less compelling than on the PWR.

MR. CATTON: But they don't have the right valve date in their, Carl.

MR. MICHELSON: I know. Well, that just makes it worse.

MR. CATTON: If they put the right valve date in there, maybe they would study the PWR's first.

MR. SHEWMON: The failure of those pipes is part of the design basis now, isn't it?

MR. MICHELSON: No. Not in terms of non-isolation.

MR. CATTON: That's right.

MR. MICHELSON: The design basis includes getting them isolated again in 20 seconds, 30 seconds, whatever the basis might be. If you don't isolate, you are in deep trouble.

MR. KERR: But the failure probability of those pipes is comparatively low.

MR. MICHELSON: And, the failure probability of the valves is relatively high.

MR. KERR: Yes, but you don't need the valves unless the pipe fails.

MR. MICHELSON: That's true. That's true.

MR. KERR: This is not low pressure piping, it is piping that is designed for the pressures and the temperatures I think, isn't it?

MR. MICHELSON: That's right. In some cases, it's non-sizemic piping though, non-QA piping. That's at full reactor pressure with full force.

MR. SHEWMON: That doesn't change the probability of pipe failure though, actually.

MR. MICHELSON: Well, it depends on what your viewpoint is.

MR. SHEWMON: It doesn't matter. If you go back and look at the sizemic studies, either experience in fossil plants or the research program, whether or not it is designed on that way doesn't have a lot of effect on the failure probability.

MR. MICHELSON: The failure, Paul, they talk about six inches and up. We are talking about -- you know, you can get in deep trouble with a four inch pipe break outside of containment if you don't isolate it.

MR. SHEWMON: We were talking about thick pipes a moment ago. You want to talk about something else, we can talk about that.

MR. CATTON: It just seems to me that if you do a PRA and you have the data, you ought to put the right data in or the answer is nonsense. I think that is what Carl is saying politely.

MR. WARD: Haven't the isolation valves in the big steam lines in BWR's been given a lot more attention all along? I mean, to lump them in with this MOV problem, I think is misleading.

MR. MICHELSON: We are not thinking necessarily main steam and feed water. We are thinking reactor water cleanup, HPCI steam lines, things of that sort and auxiliary feed water steam lines. But the main feed water and steam have gotten a lot of attention.

MR. BARRETT: You are absolutely right. There has been in fact, more experience on BWR's with the loss of pressure isolation.

MR. MICHELSON: That's right.

MR. BARRETT: We are not minimizing the importance of the PWR problem. We simply had to make priorities.

MR. WARD: The selection criteria for the plants, you are going to look at one of each PWR vendor and then problem plants; is that the only two criteria?

MR. BARRETT: The other one is to try to select a wide enough variety of plants that we see, a wide variety of valve configurations. You can two check valves and an MOV, one check valve one MOV.

MR. MICHELSON: We are near the end of your scheduled time, so you need to finish up.

MR. BARRETT: I am almost finished, Mr. Chairman. Let me just talk about one other possibility, and that possibility is that we could go through and find out that in fact the median risk is considerably higher than we previously thought. Under that circumstance it is possible that some sort of generic action would be necessary. When I say generic action, that could be anything.

It could be something similar to what Dr. Murley said earlier about a bulletin for Midloop operation. It could be something more drastic, depending on how bad that median risk is. If I had to make a guess of which of these potential scenarios is the one we might find, I think we might find this one, but we will see. I don't want to prejudice it.

MR. CATTON: Could the generic action be hey, you, a particular plant had better get your IPE in soon and it better include the following?

MR. BARRETT: I don't think we will know which are the worst plants even in this case. We may suspect that some plants are far worse than the median, but we probably won't know which ones they are.

MR. CATTON: But if you are going to do this human factors work, aren't you going to -- part of it, I thought, was methods development which was going to tell you how to make that judgment?

MR. BARRETT: Yes, sir. But then, each plant will have to be looked at individually. In this particular case, each plant will have to be looked at individually before we know which ones are the bad ones. Maybe we can tell them how to do a better job of their IPE, but we won't know of priority which one should be done first because we won't know until the analysis is done which ones are, if any, are the outliers.

MR. CATTON: It sounds kind of mushy to me.

MR. MICHELSON: Why don't we finish up.

MR. WARD: Could I ask a question?

MR. MICHELSON: Go ahead.

MR. WARD: Rich, I am not sure you quite got at least what some of us were driving at for your third -- what you characterized as the third estion from the Subcommittee. As some of us see it, one of th benefits of the IPE process is that it's going to permit licensees to take some sort of common integrated, coherent set of implementation corrective actions against the whole suite of things they find in the IPE process. Whether the IPE process simply entails doing a PRA and responding to what falls out of that -- I don't think it does. I don't think anyone has ever said it does.

It includes doing a PRA, but it might include other ways of looking for things. For example, if you have gathered up some insights on how the ISLOCA might be looked at in specific plants outside of a PRA framework, that could be part of what I would call the IPE process. So, an essential part of it is whether you are going to have a schedule and permit licensees to take actions that are integrated or whether they have to take action on ISLOCA out here in some sort of parallel program ahead of or at least not coordinated with what they are doing from the other IPE or from the IPE work. I think that's the concern.

Do you understand what I said?

MR. BARRETT: Yes.

MR. WARD: I don't know if I made it clear.

MR. BARRETT: I think I heard two concerns. One is the question of whether we would put out guidance that would somehow take the ISLOCA and take it out of context. Is that part of your concern, that we would be asking them to analyze ISLOCA out of the context of the entire IPE process?

MR. WARD: Yes.

MR. BARRETT: I understand.

MR. WARD: And demand some fixes for ISLOCA independent of what fixes are going to come out of whatever the IPE reveals.

MR. BARRETT: No, that would not be -- that would not be the case unless we found some really bad problem. Unless we found, for instance, this other scenario where we just found that things are much worse than we previously thought and then at that point, there might be some sort of generic action that would be required. What that action would be, I don't believe even at that point, even if we were in the 10 to the minus five region, if we were to decide that we wanted to take some sort of generic action it could not be a drastic action. For one thing, cost benefit associated with this level of risk would not allow us to impose a very drastic action.

I think in the area of human factors you gain a lot with awareness of an event, with a little bit of training. One of the issues we find is that some plants, the simulators can simulate an ISLOCA.

MR. MICHELSON: I think with that, we will have to complete your presentation. We are eating into the next presenter's time. Mr. Burdick is going to present the material for research. There is another handout coming.

MR. BURDICK: Thank you, Mr. Chairman and members of the Committee. My task now is to pay off all these I.O.U's. I think I will be able to deal adequately with a number of your questions and concerns.

[Slides.]

MR. BURDICK: That is who I am, Gary Burdick. This research activity was initiated as a result of a user request from Tom Murley to Eric Beckjord. You have heard a lot of discussion of these concerns. I won't dwell on these, but there are some important key elements of the request. You have to get farther into the low pressure systems than has been done, in past PRA's that has been discussed. More analysis of the human actions, human contributors. We have to determine sequence timings. NRR's concern is with the ISLOCA that has a possibility for the large release in a short period of time.

This, we were asked to do in a PRA framework and, in fact, are doing that. In the event that there is some regulatory action required we will, of course, have to go through probably backfit analyses. We were asked to estimate the ISLOCA consequences in terms of risk and identify important factors for consequence reduction.

Right up front, we did take a look at past ISLOCA analyses. Again, there has been discussion of this and I will rapidly go through this. These analyses did little or no modeling beyond the PIV's.

MR. CATTON: What are PIV's?

MR. BURDICK: Pressure Isolation Valves. They make risk important hardware assumptions as to break likelihoods, locations, sizes. They did not account for types of human errors seen in recent events, of course, because they did not go into the low pressure systems. But we are not saying that these past analyses are inadequate. If indeed our more in depth study does not show that there is a risk increase, that these past studies do in fact bound the problem, and that is a distinct possibility -- we are not ruling that out -- then, those past analyses can be considered adequate.

There was some programmatic requirements then identified. We had to do this more in depth modeling of the low pressure systems to include the engineering analyses and human activities. There was a small methods development effort recognized, required to produce a low pressure system rupture model. This, of course, we did not have in past analyses. We want to know as best we can, what are the effects of the introduction of the high pressure. Do we have the single hole in the dike, do we have multiple breaks occurring. We had to have a --

MR. KERR: Do you think you could model accurately whether or not the low pressure system would fail?

MR. BURDICK: I think the engineering analysis being done in this area is going to be top notch and will indicate probabilities of breaks at various locations. I think very -- they will do that job very well, yes. There is preliminary indication of that.

MR. KERR: That's unusual, because engineers are not generally adept at predicting when things will fail. They design things that won't fail by introducing enough margin that they have relatively high confidence. But predicting failure is a different kettle of fish.

MR. BURDICK: We have, I think, one of the top engineering firms in the country looking at this problem, INEL Corporation. They are on subcontract.

MR. SHEWMON: He's not questioning either the moral probity or the capability of the engineers, he's making an observation on the difficulty of the problem. I don't think you are addressing it.

MR. BURDICK: Well, I will acknowledge that the problem is difficult, and I still say we are looking at it with the best people that we can find. We have under contract or the Division of Engineering does, probably the top individual in the country to act as a consultant to review Impel's work in this area, Mr. Rodabow. I don't know if you have heard of him. Otherwise, I think he's known as Mr. Pipe.

MR. WARD: Gary, you say you have to develop this. What was used all the way back to WASH 1400 for Event V, I guess it is. What was assumed there about rupture of low pressure piping?

MR. BURDICK: What specifically was assumed?

MR. WARD: Yes.

MR. BURDICK: Well, I believe it was assumed to rupture not too far beyond the PIV's. Correct me if I am wrong, Joe, but I think at the first knuckle or thereabouts. So, you had leaks coming out of fairly large pipes. What we may in fact find through this more in depth engineering analysis is that you get leaks farther downstream, you have lower volume. This causes lower consequences for, not alone because of the low volume, but because this lower flow rate buys you additional time for recovery actions.

So, I think that the frequency that we may go up a little, but because of these other factors, the consequences may come down. And, because of this in depth modeling of the low pressure systems, we may begin to understand why we are seeing some of these events that have been discussed previously today. These events, again, they may not as was pointed out, be all that serious but they are occurring and they may be expected to occur.

MR. MICHELSON: Which bullet on that slide is the one that deals with the environmental effects of the breaks, so that we are sure that we have everything in the model that needs to be there such as fire protection and so forth being actuated by steam which is not an incredible event. It happens very often when you break a hot water line even. Is that somewhere in one of those bullets?

MR. BURDICK: That is not addressed by any particular bullet here.

MR. MICHELSON: Is it addressed somewhere else then?

MR. WARD: Wasn't that on an earlier slide?

MR. BURDICK: These are not all the programmatic requirements. I recall these are the major ones. I will discuss how --

MR. SHEWMON: Are you postulating that the halogen influences the fracture probability of the pipe?

MR. MICHELSON: No. When a hot water line ruptures portion flashes of steam, water droplets are near and the fire detectors look at it just like smoke and start spraying the area.

MR. SHEWMON: Fine.

MR. MICHELSON: If it propagates further, they spray other areas.

MR. SHEWMON: My question was, you are postulating that that spray influences the fracture probability; is that right?

MR. MICHELSON: No. That spray now influences the ability to mitigate the fracture you already have. You have to get the fracture first. That's the Interfacing Systems LOCA. I am just asking where we chase the consequence to determine how it affects c re melt, because that I think is your goal, 10 to the minus six for a large consequence. How do you know you got a large consequence if an instrument line breaks off?

MR. BURDICK: We are looking at common cause failures in the program.

MR. MICHELSON: That's not common cause, that's consequential effects. Common cause are when several things go crazy at the same time for unrelated reasons possibly. It also could be your common causes the hot water release.

MR. BURDICK: We realize that the affluent coming out of the system has a possibility to cause other problems and, in particular, it could --

MR. MICHELSON: Where is that treated in your program?

MR. BURDICK: I will treat it later.

MR. MICHELSON: Okay. Thank you.

MR. CATTON: It seems to me you have to treat it under your first bullet in engineering analysis. If you have a low pressure system and you are pressurizing it, in order to address Carl's question, you have to know where the leaks are going to be throughout the low pressure system. And then you have to look to see what's around those leaks to find out if they are going to be impacted.

MR. BURDICK: Right on.

MR. MICHELSON: Where is that on your slide; that was the only question.

MR. CATTON: But you said later.

MR. BURDICK: I can't put everything on one slide, okay? Let me just move on here. The program is being done on a phased approach because we want to be a little prudent here. These more in depth analyses cost money and we want to, as we go along, assess what we are getting out of what we are doing, vis-a-vis, what has been done in the past. Maybe what was done is adequate. We don't know at this point.

So, there is going to be an HRA comparative analysis done on the first plant. We are doing the human reliability analyses two different ways. I will get into that a little more later. There is, in fact, a decision after the first plant to decide on which way to go. There is an entire program decision after the second plant. Rich didn't mention this, but this has been imposed upon me by my management to take a look at this entire approach to the problem to see how much we are getting from other aspects and to make some decision as to how many more plants, if any, we have to do to reach some intelligent conclusions here.

MR. CATTON: In which part of this are you going to search for the human factors data that we heard was needed?

MR. BURDICK: Right in this box here, and that will be aided by this box, operational experience and plant audits.

MR. KERR: Where does one enter the process, at that first box on the upper left?

MR. BURDICK: What's the end of the process?

MR. KERR: No, where does one enter, e-n-t-e-r, begin?

MR. BURDICK: One does not enter this program in any particular part.

MR. CATTON: Once you are in you don't get out.

MR. BURDICK: There are a lot of activities that are being worked by different individuals, different disciplines. I mentioned some methods development --

MR. KERR: So, all those things start simultaneously?

MR. BURDICK: These started first, the configuration review.

MR. KERR: Okay. That's where the --

MR. BURDICK: The data analyses, these started simultaneously. There was some human factors analyses that started shortly after that. Instead of going through which started when, I think it's more fruitful if I explain how this all fits together and what these activities comprise.

MR. KERR: I would urge you to be fruitful.

MR. BURDICK: Be what?

MR. KERR: Be fruitful. Your word.

MR. BURDICK: We are looking at operating experience. The human factors people are using that information to develop an initial set of performance shaping factors. As they go through the --

MR. KERR: I apologize for this question, but could you just tell me briefly what a performance shaping factor is?

MR. BURDICK: These are items that the human factors analyst believes have important bearing on human actions in certain situations.

MR. KERR: Okay. One needs to develop them for this particular sequence; is that what you mean?

MR. BURDICK: One of the approaches to the human reliability analysis does use that approach, right.

MR. KERR: Okay. Thank you.

MR. BURDICK: An attempt to identify important items that affect a human's actions as he performs certain tasks. The quantification on the first plant is also going to use the same approach that has been done in past PRA's, generic data, some use of the THARP approach to quantifying human reliability.

[Slides.]

MR. BURDICK: A configuration review was done to identify, as Rich mentioned, a set of systems which we hope would be as representative as possible of what exists out there in the operating plants. This, of course, cannot be perfect but it has to be the best we can do with the constraints we have to live with. The configuration review was -- the systems information was passed to the human factors people so they could get an idea of what it was they were going to have to be dealing with, get some idea of the nature of the beast before they went to the plants for the plant audits and the walk through.

The systems configurations were also passed to the engineering analysis task so it could begin to look at the fragilities, the effects of the high pressure encroachment on the low pressure system, and all of this information -- also, a thermal hydraulic analyses to get timing for the core recovery, of RWST drainage. We were anticipating some physics analysis. There may be some criticality questions, if it came to the point where we were reinjecting unboreated water for example. All of this information was fed into a PRA review. We did look at past PRA's, past analyses, to see what was usable out of those.

And, we had to develop a little new analysis technique to put all of this together. Accident management analysis was singled out here, but this is currently planned to be done in the recovery analysis stage of the normal PRA process. If there is anything that leaps out here, some perceived high risk situation, that information will be passed to another branch in DSR for further analysis.

MR. MICHELSON: Excuse me. In looking at your various scenarios or situations, are you also going to look at for instance, fairly high probability transients that a plant could get into during which, because of whatever is going on, the probability of certain kind of operator errors occurring would be much higher and that might get you into an Interfacing Systems LOCA during the transient.

Do you look at that, or do you just kind of discard that as a low probability situation? Do you look for it, or are you just looking at Interfacing System LOCA as an initiator?

MR. BURDICK: We are simply looking at Interfacing Systems LOCA initiators.

MR. MICHELSON: Is there any reason to be concerned that what is otherwise a low probability Interfacing System LOCA might become a much higher probability if it was in conjunction with a transient during which operators weren't paying attention to that aspect or weren't -- their probability of making errors becomes greater when they already have another problem on their hands.

MR. BURDICK: Are you talking about the coincidence of an Atlas situation?

MR. MICHELSON: No, not Atlas. Just a much less transient than that, a higher probability transience, reactor trips and so forth even.

MR. BURDICK: I will check with the contractor during the next --

MR. MICHELSON: I just kind of wondered if what otherwise might be a low probability ISLOCA might be a high probability ISLOCA because of the situation of the plant at the moment.

MR. BURDICK: I will talk that over with the contractor at the next program review meeting.

MR. MICHELSON: Okay. I don't say it's a problem, I just wondered.

MR. BURDICK: All of these activities are intended to provide support to NRR's near term concerns, as well as contribute to the ultimate resolution of generic issue 105.

MR. MICHELSON: I guess my wonderment, by the way, might -- you might ask the contractor what happens if a plant has a fire and during the fire is there a possibility of an Interfacing System LOCA, not necessarily because of the fire but because of the confusion and the things your operator has to do during a fire.

MR. BURDICK: I think that kind of thing might be beyond the scope. We have funding limitations. We have to bound the problem somewhere.

MR. MICHELSON: We will just leave it as an uncertainty and the first consequence.

MR. BURDICK: We can't deal with everything.

MR. MICHELSON: Right.

MR. BURDICK: Let's see if there is anything that I have left out here.

[Slides.]

MR. BURDICK: We have covered that. Let's move along. I think I've covered just about all of this. As we go through these audits, we are attempting to make them as efficient as we can. As we identify things that can be improved or modifying the procedures --

MR. KERR: What is meant by a plant audit in this context?

MR. BURDICK: What is a plant audit?

MR. KERR: In this context?

MR. BURDICK: Well, we identify beforehand what we think is important to look at with respect to the Interfacing Systems LOCA situation, put together audit procedures, put together a team under a team leader, go to a cooperating plant and look for information with respect to relevant areas.

MR. KERR: Okay, so it's a visit to the plant and examination of the records of the plant?

MR. BURDICK: Yes, indeed.

MR. KERR: Interviewing people?

MR. BURDICK: Yes. Again, the human factors area is having a trial application on one plant, and we do have this methods development activity. I think there was some question raised there. We couldn't ask the contractor to go out and do something on this scale of a nature that has never been done before without giving some thought to how he was going to do it. Furthermore, down the line, there is a possibility that there may be some guidance going out to the licensees.

We have to have some, I think, thought put into that kind of guidance. Right up front, this development effort, everyone concerned thought was necessary.

MR. MICHELSON: Do you have more than one contractor, or are there just one doing the whole package?

MR. BURDICK: We have one contractor, and that's the Idaho National Engineering Laboratory. They have on subcontract, Impel Corporation to do the engineering analyses. Idaho was chosen not off the top of our heads, but after a look at the constituent areas involved in dealing with this problem. They already had ongoing strong teams in each area. They seemed to provide the ability to respond therefore, more rapidly to the needs of this program than other laboratories.

Nothing then is going to be applied in this phased approach to the systems identified in Task 1 in the context of the specific plants. The analysis, we have planned to go forward, at least on two plants before we go through this decision process on how much more of it we have to do and is there any modifications in the method that has to be made. Again, there is a comparative human reliability analysis being done on the first plant.

The decisions, I want to emphasize, these are going to deal with the adequacy of the methods and the decisions are not going to be with respect to the adequacy of the plants with respect to the ISLOCA issue.

MR. CATTON: Maybe I don't understand some of the words you are using. When you talk about method, isn't the PRA method pretty well established; it's the level of detail that you need for a given problem where a little uncertain. Second, the depth of the deterministic analysis that supports the PRA is a little bit iffy.

MR. BURDICK: By method we are not just talking about PRA, although there has been a specific PRA approach selected for that portion of the analysis, and that is a multi-nodal event approach. But, there are other methods that we have had to develop also. One of these is a rupture model development to deal with the --

MR. CATTON: A rupture model is not PRA, it's something that yields --

MR. BURDICK: Well, methods are developed in other areas than PRA.

MR. CATTON: Somehow I am still confused. You have up here depth of analysis. It seems to me determining whether or not something will rupture under a given set of circumstances is done by analysis.

MR. BURDICK: Yes. But, there are different kinds of analysis going on, particularly the engineering analysis.

MR. CATTON: But doesn't this yield you the information that you stick into the PRA?

MR. BURDICK: Well, it's a little more complex than that. We have coming out of the Impel work, a spectrum of data points, associated distributions. We have to have an overall approach to do uncertainty analyses, using those distributions to ultimately come out with the probabilities of failures at certain locations. We have to have a cohesive way of putting all this together so we can do sensitivity analyses, to help identify important constituents if the need exists to go beyond and do cost benefit analyses for PNOSA backfit Rule maybe.

MR. CATTON: I'm still lost. You might as well just continue.

MR. MICHELSON: We are running short of time, so we might as well continue.

MR. BURDICK: This is not a simple problem. I think this will become clear to you after we share the results of this first plant analysis to you. There will be a discussion in that document of the methods.

MR. MICHELSON: Roughly, when do you think you would be prepared to give us the results of this first plant analysis?

MR. CATTON: We heard a draft was in preparation?

MR. MICHELSON: Yes, but I was trying to find out when do you think you would be ready so we can kind of plan accordingly?

MR. BURDICK: Well, I think we are looking toward April.

MR. BARRETT: Yes, we would like to have the opportunity to take a real hard look at the analysis in-house before we bring it down for you.

MR. BURDICK: It all depends on our internal review and how satisfied we are.

MR. MICHELSON: You are talking May then, I guess; is that right?

MR. BARRETT: That's correct.

MR. BURDICK: Correct, that's good.

MR. CATTON: Would it be possible for maybe some of us who are interested to get some of the written material before then?

MR. BURDICK: Before your meeting?

MR. CATTON: Yes.

MR. BURDICK: Certainly, absolutely.

MR. CATTON: Like soon, if possible.

MR. BURDICK: In fact, I am in a position to guarantee it, I guess, if you will cooperate with your scheduling of your -- you can't very much do --

MR. MICHELSON: I think he's referring to not the briefing documents for the meeting but documents even ahead of that. We would like to get an early on view of what you are doing before the Committee considers it as a Committee.

MR. CATTON: Sometimes it's very difficult to absorb six months to a year's of your work while sitting here listening to you talk.

MR. BURDICK: Believe me, I realize that.

MR. CATTON: I would like to kind of keep up, and the way to keep up is preliminary documentation. If you don't give us the preliminary documentation, at least in my own case, we wind up asking awful, sometimes silly questions.

MR. BARRETT: We will certainly try to get you the information as soon as possible. The main concern we have is that we don't want to just take the contractor work and then begin to give it out to people before we have had a chance to evaluate it. But, I think as soon as we get a chance to evaluate it and feel comfortable with it in-house, we certainly could share it with you.

MR. BURDICK: There is a program management task here, of course, the glue that holds all of this together and documentation task.

MR. MICHELSON: Before you leave that, I waited to see -- I understood you were going to show me what task was going to deal with evaluating the environmental consequences of an ISLOCA so that you could do a determination of a possible core melt probability changes. Which one of these tasks is it, I didn't catch it going through?

MR. BURDICK: I couldn't sneak that by you, huh?

MR. MICHELSON: No, I just didn't recognize it, I guess. I thought it would be in your task list, but I guess not.

MR. BURDICK: Well, the list pretty much follows this. It enters in a couple of ways. It is in the PRA analysis portion. Before we go on one of these audits, there is a preliminary PRA analysis done. There is a sequence analysis done to guide the members who actually go to the plants and, as they are doing their walk through, they are mindful of possible break locations and they actually examine those locations for hardware that could be impinged by effluents. They go a little beyond that.

There is also some look during the recovery action phase of the analysis, questions are asked can people really get from here to there to take some action to recover from a situation. It may be some steam or --

MR. CATTON: Can I try, Carl? I don't think he understands your question. If you have a pipe break in a given volume, you have to worry about everything in it. In the past this was not done. It's a lot more than jet impingement. It seems to me that under that box down in the corner there where it says "TH", you ought to be taking a look at what various kinds of leaks can do in a given location. That has not been done in the past.

MR. BURDICK: We are not looking at --

MR. CATTON: All that has been done in the past is jet impingement. I think jet --

MR. BURDICK: We are not only doing --

MR. CATTON: Wait a minute. I think jet impingement is a small part of your problem, that you have to go beyond direct jet impingement or you are going to miss a major part of the impact above this kind of a leak. What are you doing about that?

MR. BURDICK: Well, we are looking at flow rates in relation to compartment sizes, how rapidly the compartments can fill to damage other equipments. We are not only looking at impingement, but steam. I see Dr. John O'Brien has his hand raised.

MR. CATTON: One of the reasons I asked about the availability of early documentation is, I would like to see how you are addressing this particular question in some detail. It is not a trivial problem.

MR. BURDICK: I understand that.

MR. WARD: Isn't that included in your Task number 3 under -- with the systems identified in Task 1, you do all these things and you get your flow rates. The next item should be, I guess, the consequential effects on other equipment.

MR. BURDICK: We do, in the thermal hydraulic analysis, come up with probabilities of break locations, flow rates, and those flow rates are from equipments in particular locations. That information is used in a common cause kind of analysis, as I mentioned.

MR. MICHELSON: Does that include temperature pressure and other entrained water or whatever in the atmosphere? In other words, the environment that the equipment sees, are you going to predict that from the thermal hydraulic analysis? That's what you have to start with to predict how equipment might respond.

MR. BURDICK: To a limited extent we cannot cover everything.

MR. MICHELSON: Well, if you don't do it -- if you do what we have been doing all the time, I wonder why the exercise? Because we have been talking about pipe breaks and the amount of water coming out for a long time, and I think everybody has decided that drains are big enough where the rooms won't come apart. But, nobody has looked at the equipment in the room in terms of what the environment will now do to producing unwanted actions elsewhere in the plant.

MR. CATTON: There has actually been experimental --

MR. MICHELSON: There's plenty of experience to show what happens.

MR. CATTON: Experience at the German reactor containment that shows what these things can do. But, somehow, that never seems to get folded back into this kind of analysis where it is relevant.

MR. MICHELSON: We had a Surry pipe break, for instance, which we set off 63 sprinkler, we set off the fire protection in a remote part of the building relative to where the break was, and activated the security interlocks, things like this, from a pipe break. Now, that's the kind of analysis I thought we were talking about here, if we are going to determine whether the core might melt as a consequence.

MR. BURDICK: This analysis goes beyond past analyses in a number of ways. In the common cause failure analysis area, there was I don't think, anything done at all in past PRA's with respect to the ISLOCA situation. Again, we are doing that in a limited way, and we have constraints on this problem. With common cause failure analysis, you could go on practically forever, I think.

John, you had your hand up?

MR. O'BRIEN: I believe the answer to the question that is being asked by Mr. Catton and Mr. Michelson is that these low pressure lines that we are evaluating are classified by the NRC as high pressure lines and in their normal design are partial to rupture and leak. All equipment in the vicinity of these lines are qualified to withstand the environment associated with leaks and ruptures in these piping.

MR. CATTON: That usually just means time at temperature, humidity and pressure.

MR. O'BRIEN: It doesn't even mean that.

MR. BURDICK: Chemical environment.

MR. CATTON: And, chemical environment. That's not enough.

MR. MICHELSON: Inside a containment, that statement is quite true. Outside of containment, which is where we are dealing with I think on ISLOCA only, this is not true.

MR. CATTON: Well, he says he --

MR. MICHELSON: This is very few specific locations.

MR. CATTON: But he says he is going to do it. But even if he does it, that's not enough. You have to include the effect of the flow as well as just the time at temperature, pressure and humidity or chemistry or whatever. There is a lot more to the problem than just filling the room up with steam.

MR. O'BRIEN: I cannot imagine --

MR. CATTON: If you don't address it, you won't get at the issues that Carl is raising.

MR. O'BRIEN: I cannot imagine that the ISLOCA will present itself with a more harsh environment than the NRC has been postulating for two decades.

MR. CATTON: Well, I felt for two decades that that's probably not harsh enough for what will probably exist.

MR. MICHELSON: I would invite you just to go back and look at the pipe break studies that were done two decades ago, which is in many cases the last ones that were done, and see what they really considered.

MR. CATTON: Or just to visit HDR in Germany. It's really an eye opener. Things are torn off the walls. All kinds of things happened in that place.

MR. MICHELSON: I think we will have to complete the discussion. Chet, would you like to have a closing remark?

MR. SIESS: You are talking about mechanical effects that --

MR. CATTON: Actually it's both, the flow vibration sort of loosens up the seals or something in the seal.

MR. SIESS: That's mechanical.

MR. CATTON: Yes. The mechanical part of it has been ignored.

MR. SIESS: Not just simply the atmospheric environment?

MR. CATTON: That's correct. But I think Carl is right, we are over now, about 10 minutes.

MR. MICHELSON: Did you have anything more. You have one more slide?

MR. BURDICK: Well, I just had a program status thing here.

[Slides.]

MR. BURDICK: I guess you already understand that we are expecting a document, draft document, perhaps the 16th of February it might be in my hands or very shortly thereafter.

MR. MICHELSON: That's from the contractor?

MR. BURDICK: That's from INEL, yes, EG&G, Idaho. We will review that document internally and then have the contractor back for a formal program review. Do I understand your request? You want to see the draft document?

MR. CATTON: For my own needs, I would like to see that little box in the corner that said "TH", the thermal hydraulics part of it, in particular how you treat what is going on in the vicinity of the break.

MR. MICHELSON: The Committee would like to see the draft document. INEL generally turns out pretty clean draft documents, and I think it would be worthy of our just looking at it. We won't call you in for any discussion of it unless it appears to be that we have some extremely serious problems. But, we would like to see the early on information, but we won't comment on it further until you are ready.

MR. BURDICK: I will take a look at that document. If it has too many warts, I may not want to do that.

MR. MICHELSON: We will look forward to that. Would you let us know if you are not going to send it; would that be okay?

MR. BURDICK: Certainly. In case I don't, you will certainly get the completed document as soon as possible.

MR. MICHELSON: We would like to know when the completed document will come if you reject or do not send us the INEL preliminary draft, okay?

MR. BURDICK: Certainly.

MR. MICHELSON: Thank you.

MR. CATTON: I would like to thank you for the presentation.

MR. MICHELSON: I believe there is one more, Ivan. Mr. Barrett had asked for a minute to sum it up, and then you can thank them.

MR. CATTON: Okay, sorry.

MR. BARRETT: As a matter of fact, Gary said a number of the things that I had hoped to say in summing it up. Let me simply say that we have heard a lot of very important comments and questions, both in the Subcommittee meeting and here today, and I know that we haven't addressed all of them fully. But, we intend to take them into account in further planning of the program.

We hope that at the very least, we have convinced you of the importance of conducting this study and of the soundness of our approach to this study. As Gary pointed out, we will -- we intend to keep you fully informed of the technical results as they become available, starting as soon as we get the first analysis for the Davis-Besse event. Thank you very much.

MR. CATTON: Thank you. Carl?

MR. MICHELSON: The Committee will take a break now until 10 after, at which time we will pick up the agenda for the discussion with the Commissioner's this afternoon.

[Whereupon, at 10:57 a.m., the general meeting recessed, to reconvene the following day, Friday, January 12, 1990.]

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: ACRS 357th General 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.

Mary C. Rosenberg

Mary Rosenberg
Official Reporter
Ann Riley & Associates, Ltd.

NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: ISLOCA PROGRAM OVERVIEW

DATE: JANUARY 11, 1990

PRESENTER: RICHARD J. BARRETT

PRESENTER'S TITLE/BRANCH/DIV: CHIEF, RISK APPLICATIONS BRANCH
DIVISION OF RADIATION PROTECTION
AND EMERGENCY PREPAREDNESS

PRESENTER'S NRC TEL. NO.: 492-1089

SUBCOMMITTEE: FULL COMMITTEE

CONSEQUENCES OF AN ISLOCA

- o LOSS OF REACTOR PRESSURE BOUNDARY AND CONTAINMENT (Two out of three fission product barriers)

- o POTENTIAL FOR EARLY CORE DAMAGE

- o POTENTIAL FOR HIGH OFFSITE DOSES

- o LIMITED TIME FOR OFFSITE PROTECTIVE ACTIONS

CURRENT PRA RESULTS

- ISLOCA ANALYZED AS A HARDWARE PROBLEM (TWO VALVES IN SERIES)
  - WASH 1400
  - NUREG 1150
  - NUREG/CR 5102 (BNL Study)
- RELATIVELY LITTLE ANALYSIS OF HUMAN ELEMENT
- LITTLE OR NO CREDIT FOR ACCIDENT MANAGEMENT
- CORE DAMAGE FREQUENCY ~1E-6
- ISLOCA A MAJOR CONTRIBUTOR TO EARLY FATALITIES

EXAMPLES OF HUMAN ERROR

- o OPERATOR ACTION TO OPEN PIV
  - WRONG UNIT ERROR
  - OPENING OF MOV TO RESEAT CHECK VALVE
- o FAILURE TO REMOVE POWER TO MOV PRIOR TO LOGIC TEST
- o DEFEAT OF PRESSURE INTERLOCKS
- o INADEQUATE PROCEDURE FOR MOV STROKE TESTS
- o INADEQUATE INSTALLATION PROCEDURE LEADING TO SIMULTANEOUS FAILURE OF 18 CHECK VALVES

ACRS BRIEFINGS ON ISLOCA

- APRIL 1989

  Tom Murley informed Full Committee of existence of ISLOCA Project

- DECEMBER 1989 / JANUARY 1990

  Staff briefing regarding goals, structure and elements of project

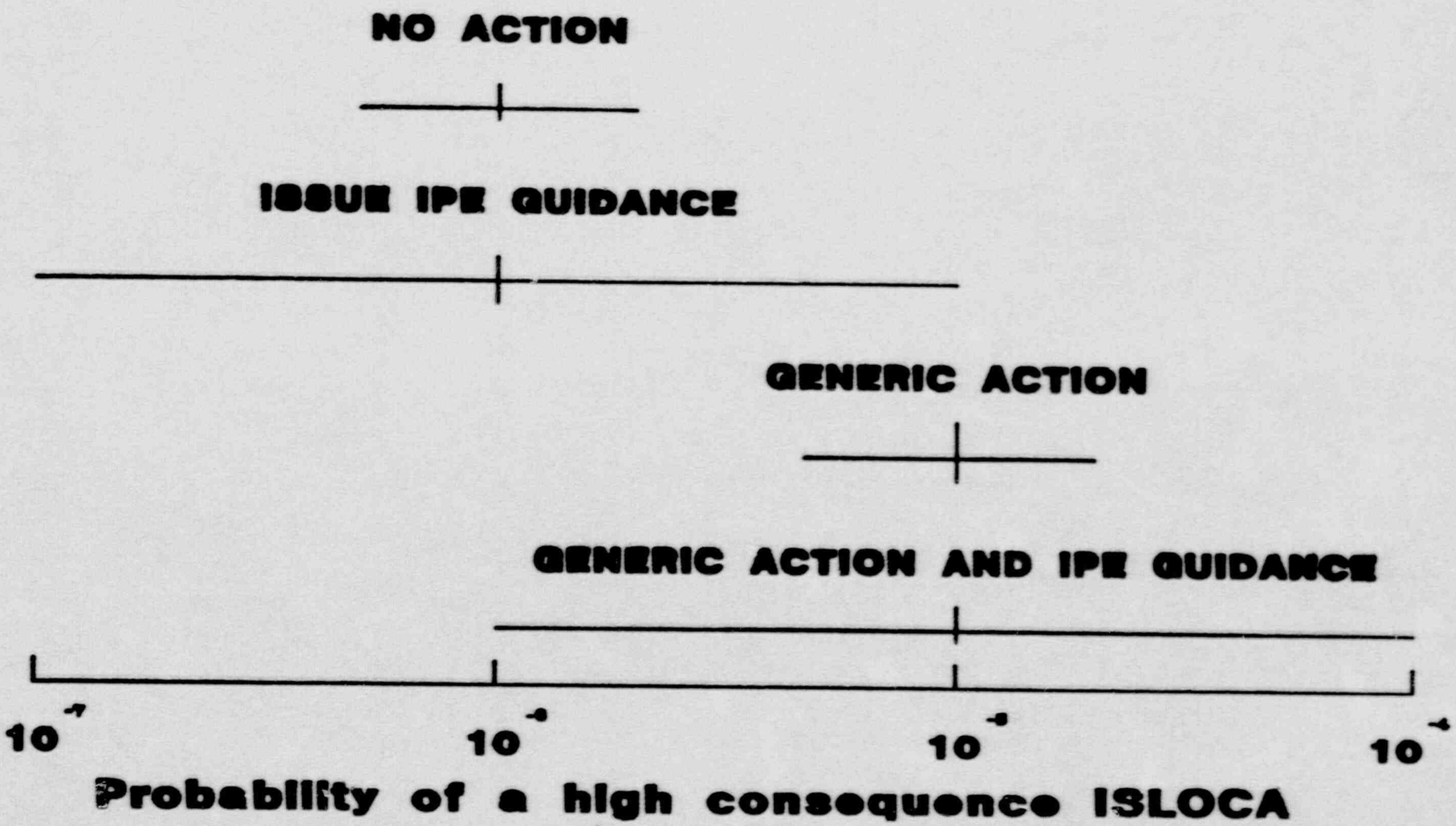
- SPRING 1990

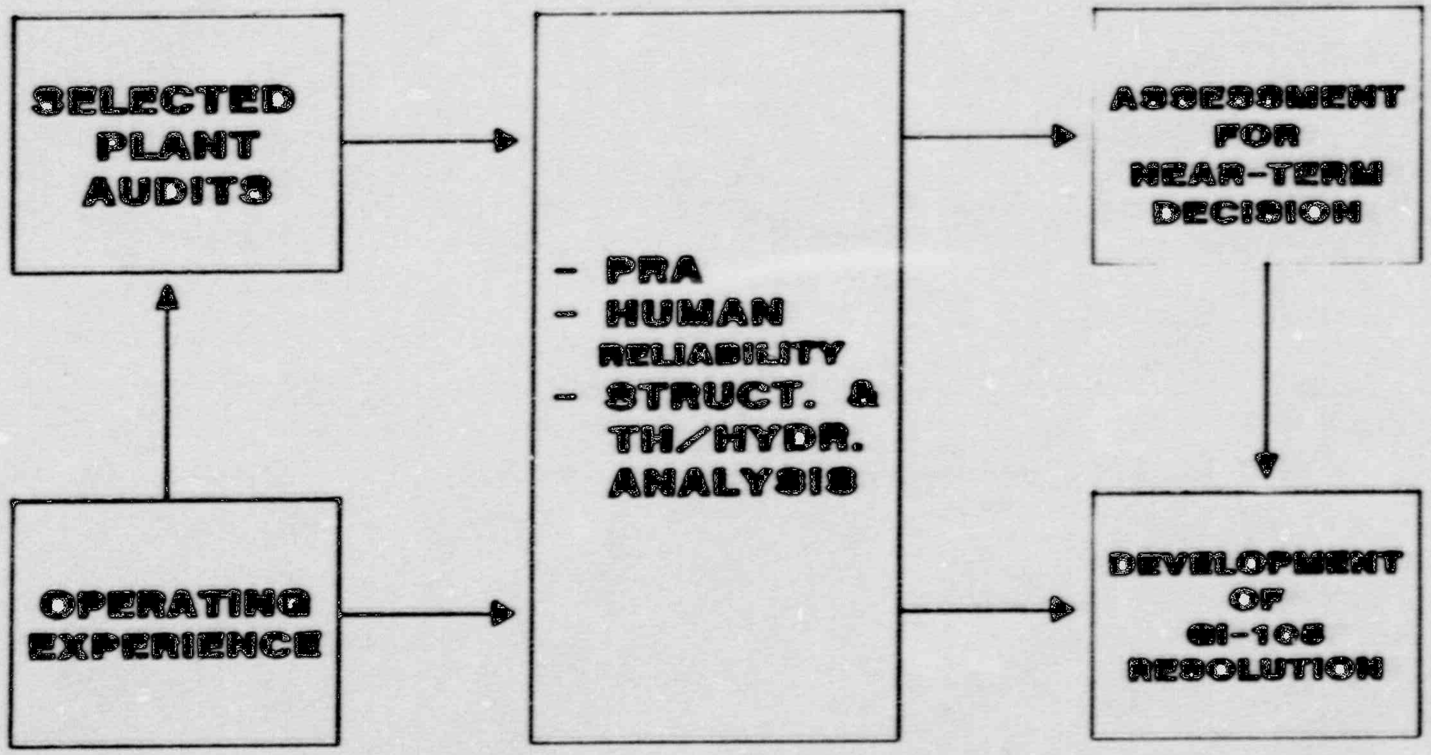
  Subcommittee briefing on preliminary technical results

- FUTURE BRIEFINGS

  At appropriate intervals

ISLOCA RESOLUTION OPTIONS




SELECTED PLANT AUDITS
OPERATING EXPERIENCE
- PRA
- HUMAN RELIABILITY
- STRUCT. & TH/HYDR. ANALYSIS
ASSESSMENT FOR NEAR-TERM DECISION
DEVELOPMENT OF GI-105 RESOLUTION

RES STAFF PRESENTATION TO THE

ACRS

SUBJECT: ISLOCA RESEARCH PROGRAM (NEAR-TERM)

DATE: JANUARY 11, 1990

PRESENTER: GARY BURDICK

PRESENTER'S TITLE/BRANCH/DIV.:

SPECIAL ASSISTANT

DIVISION OF SYSTEMS RESEARCH

OFFICE OF NUCLEAR REGULATORY RESEARCH

PRESENTER'S NRC TEL. NO.: 49-23509

ISLOCA RESEARCH PROGRAM NEAR-TERM OBJECTIVES

- EVALUATE LOW PRESSURE SYSTEMS FRAGILITIES UNDER HIGH PRESSURES/TEMPERATURES TO IDENTIFY LIKELY FAILURE LOCATIONS.

- IDENTIFY SPECIFIC HUMAN ACTIONS AND ROOT CAUSES IMPORTANT TO ISLOCA FOR RECOMMENDING RISK REDUCTION ACTIONS.

- DETERMINE ISLOCA SEQUENCE TIMING, FLOW RATES, ACCIDENT MANAGEMENT STRATEGIES, AND ISLOCA EFFECTS ON OTHER EQUIPMENT.

- DEVELOP A PRA FRAMEWORK TO EVALUATE HUMAN AND HARDWARE CONTRIBUTIONS TO ISLOCA.

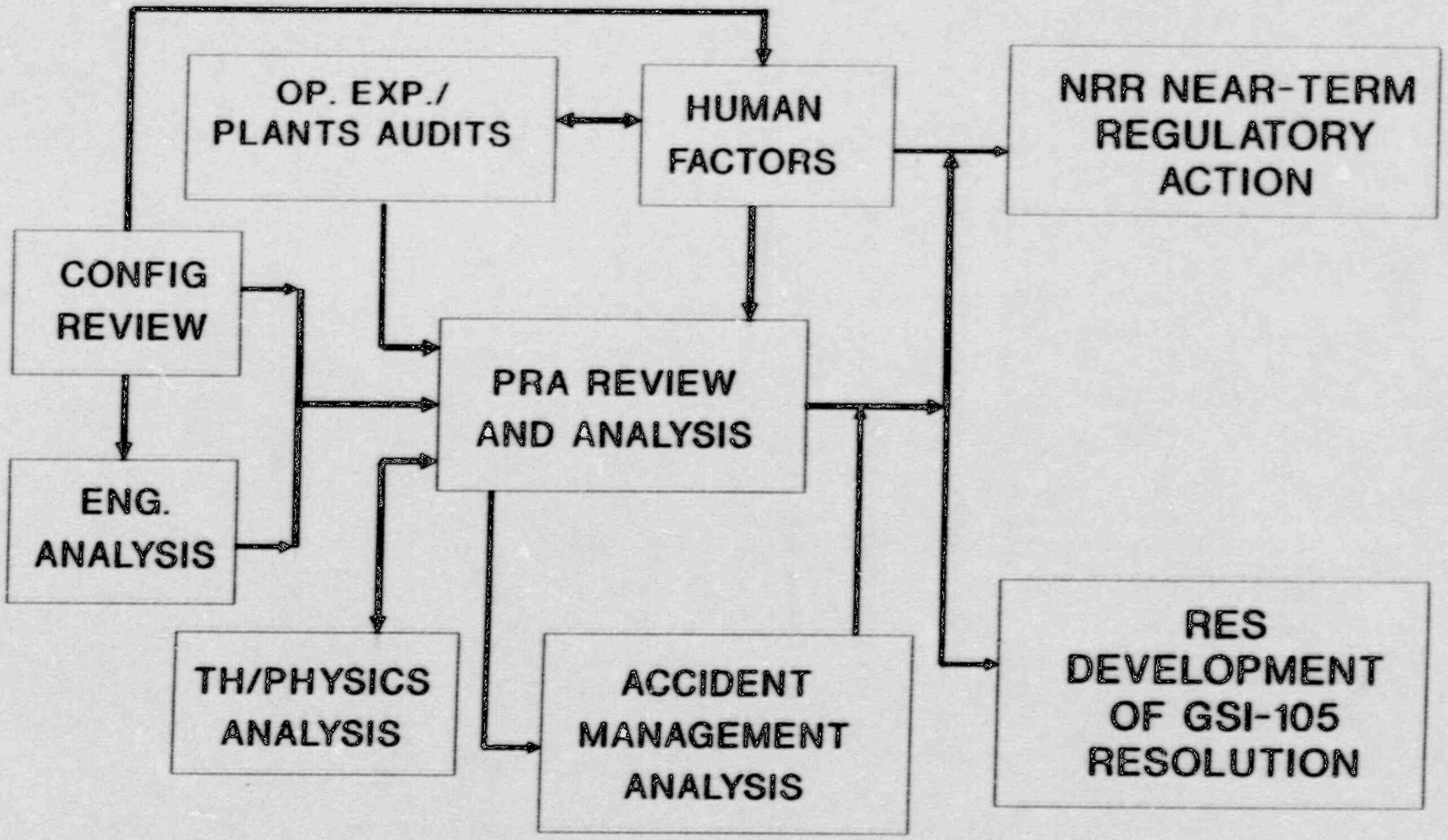
- ESTIMATE ISLOCA CONSEQUENCES AND IMPORTANT FACTORS FOR CONSEQUENCE REDUCTION.

PAST ISLOCA ANALYSES

- DID LITTLE OR NO MODELING BEYOND PIVs
- MADE RISK-IMPORTANT HARDWARE ASSUMPTIONS:
    - BREAK LIKELIHOODS
    - BREAK LOCATIONS
    - BREAK SIZES
- DID NOT ACCOUNT FOR TYPES OF HUMAN ERRORS SEEN IN RECENT EVENTS
- MAY BE ADEQUATE IF THEY:
    - CAN BE SHOWN TO BOUND THE PROBLEM
    - ESTIMATED RISK IS SMALL

PROGRAMMATIC REQUIREMENTS

- MODELING OF LOW PRESSURE SYSTEMS BEYOND PAST STUDIES:
  - ENGINEERING ANALYSES
  - HUMAN ACTIVITIES
- SMALL METHODS DEVELOPMENT EFFORT REQUIRED TO PRODUCE:
  - LOW-PRESSURE SYSTEM RUPTURE MODEL
  - APPROACH TO INTEGRATE ANALYSES FROM VARIOUS DISCIPLINES
- PHASED PROGRAM TO ASSESS ANALYSIS DEPTH VIS-A-VIS PAST APPROACHES
  - HRA COMPARATIVE ANALYSIS BEING DONE ON 1ST PLANT
  - HRA DECISION AFTER 1ST PLANT
  - ENTIRE PROGRAM DECISION AFTER 2ND PLANT



RES ISLOCA PROGRAM FLOW CHART

BRIEF TASK DESCRIPTIONS

1. CONFIGURATION REVIEW

   - IDENTIFY "REPRESENTATIVE" SYSTEMS

2. DATA ANALYSIS

   - REVIEW OPERATING HISTORY FOR ISLOCA EVENTS
   - ESTIMATE PRA PARAMETERS
   - IDENTIFY POTENTIALLY IMPORTANT HUMAN ACTIONS

3. ENGINEERING ANALYSIS

   FOR THE SYSTEMS IDENTIFIED IN TASK 1:

   - CALCULATE COMPONENT FRAGILITIES W.R.T. PRESSURE AND TEMPERATURE
   - ESTIMATE LIKELIHOODS OF FAILURES AT SPECIFIC SYSTEM LOCATIONS
   - ESTIMATE FLOW RATES AND TIMINGS

BRIEF TASK DESCRIPTIONS (CONT'D)

4. HUMAN FACTORS

   - ANALYZE HUMAN ACTIONS FROM TASK 2 FOR PERFORMANCE SHAPING FACTORS
   - COLLECT ADDITIONAL DATA FROM PLANT AUDITS
   - RETROSPECTIVELY REVIEW AUDIT PROCEDURES IN LIGHT OF CURRENT PROGRAM RESULTS
   - RECOMMEND AUDIT PROCEDURE REVISIONS
   - DEVELOP FINAL PERFORMANCE SHAPING FACTORS FOR ESTIMATION OF HUMAN ERROR CONTRIBUTION TO ISLOCA
   - TRIAL APPLICATION ON ONE PLANT

5. ANALYSIS METHOD DEV.

   - DEVELOP PROCEDURES TO INTEGRATE ANALYSES AND RESULTS (TASKS 1-4) INTO ISLOCA PLANT EVALUATION METHOD

BRIEF TASK DESCRIPTIONS (CONT'D)

6. EVALUATION METHOD APPLICATION

   - APPLY PROCEDURES OF TASK 5 TO SYSTEMS IDENTIFIED IN TASK 1.
   - ANALYSES TO GO FORWARD ON TWO PLANTS
   - COMPARATIVE HUMAN RELIABILITY ANALYSES TO BE DONE ON 1ST PLANT
   - DECISION ON FURTHER APPLICATIONS FOLLOWING 2ND PLANT
   - DECISIONS WILL DEAL WITH ADEQUACY OF METHODS AND DEPTH OF ANALYSES
   - PAST EFFORTS BEING UTILIZED WHERE APPROPRIATE (BNL REPORTS FOR HARDWARE DRIVEN SCENARIOS)

7. PROGRAM MANAGEMENT

   - IDENTIFY CRITICAL PATH ITEMS
   - ENSURE COORDINATION AMONG TASKS

9. DOCUMENTATION

   - SYSTEM MODELS AND ANALYSES
   - RESULTS AND CONCLUSIONS

PROGRAM STATUS

TASK

1. CONFIGURATION REVIEW (COMPLETED
2. DATA ANALYSIS (COMPLETED)
3. ENGINEERING ANALYSIS
   (DAVIS-BESSE UNDERWAY)
4. HUMAN FACTORS (UNDERWAY)
5. ANALYSIS METHOD DEV.
   (UNDERWAY)
6. METHOD APPLICATION (DAVIS-BESSE)
7. PROGRAM MANAGEMENT (UNDERWAY)
8. DOCUMENTATION
   (DELIVERY POSSIBLE IN LATE FY1990)