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NUCLEAR REGULATORY COMMISSION

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MEETING**

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1 UNITED STATES OF AMERICA
2 NUCLEAR REGULATORY COMMISSION

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4 BRIEFING ON IPE INSIGHT REPORT

5 ***

6 PUBLIC MEETING

7 ***

8 Nuclear Regulatory Commission

9 Room 1F-16

10 One White Flint North

11 11555 Rockville Pike

12 Rockville, Maryland

13
14 Wednesday, May 7, 1997

15
16 The Commission met in open session, pursuant to
17 notice, at 2:01 p.m., the Honorable SHIRLEY A. JACKSON,
18 Chairman of the Commission, presiding.

19
20 COMMISSIONERS PRESENT:

21 SHIRLEY A. JACKSON, Chairman of the Commission

22 KENNETH C. ROGERS, Member of the Commission

23 GRETA J. DICUS, Member of the Commission

24 NILS J. DIAZ, Member of the Commission

25 EDWARD MCGAFFIGAN, JR., Member of the Commission

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1 STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

2

3 JOHN C. HOYLE, Secretary

4 KAREN D. CYR, General Counsel

5 JOSEPH CALLAN, EDO

6 GARY HOLAHAN, Director, Division of Systems Safety
7 and Analysis, NRR

8 WAYNE HODGES, Director of Systems Technology, RES

9 ASHOK THADANI, Deputy Director, RES

10 MARY DROUIN, IPE/IPEEE Section Leader, RES

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P R O C E E D I N G S

[2:01 p.m.]

CHAIRMAN JACKSON: Good afternoon. It is always good to see the handsome faces. I am pleased to welcome members of the Staff to brief the Commission on the IPE insight report.

In November of 1988 the Commission issued the Generic Letter 8820, requiring each utility licensed to operate nuclear power plants to perform an Individual Plant Examination, or IPE, of each of its plants to search for previously unidentified vulnerabilities to severe accidents.

As a result of performing an IPE a licensee was expected to develop an appreciation of severe accident behavior, to gain an understanding of the most likely accident sequences that could occur at its plants and to gain a more quantitative understanding of overall probabilities of core damage and fission product releases.

The Staff examined the IPE submittals to determine what the collective IPE results imply about the safety of U.S. nuclear power plants and how the IPE program has affected reactor safety.

During today's briefing the Staff will summarize the results of the IPE insights program examination. I and my fellow Commissioners are looking forward to your briefing today and I understand that copies of the viewgraphs are

1 available at the entrances to this room.

2 Good afternoon. Please, Mr. Callan, proceed.

3 MR. CALLAN: Good afternoon. With me at the table
4 are Ashok Thadani, the Deputy Office Director of the Office
5 of Research -- you are into your second week?

6 MR. THADANI: Second week, yes.

7 MR. CALLAN: I still want to say NRR.

8 Mr. Gary Holahan, the Director of the Division of
9 System Safety and Analysis from NRR; Wayne Hodges, the
10 Director of the Division of Systems Technology and Research;
11 and Mary Drouin, the Acting Branch Chief of the
12 Probabilistic Risk Analysis Branch in Research -- she works
13 for Wayne Hodges. She is also the technical lead for the
14 IPE program.

15 Mr. Thadani will give an overview of the IPE
16 program. He will then be followed by Mary Druin, who will
17 cover the status of the IPE program, the insights documented
18 in NUREG-1560, and the recent NRC IPE public workshop that
19 was held in Austin, Texas a few weeks ago.

20 Finally, Mr. Holahan will brief the Commission
21 about the NRC follow-up activities.

22 Ashok?

23 MR. THADANI: Could we go to viewgraph number 3,
24 please?

25 As you well know, following the accident at Three

1 Mile Island was tremendous activity, both within the
2 industry as well as at the Agency. Focus was starting to be
3 given to the potential for severe accidents that now became
4 more credible than they had been considered in the past.

5 During the early period after the accident, a
6 significant number of backfits were imposed on the industry
7 and a number of research activities were initiated, both in
8 this country as well as other countries.

9 In mid-1980s the Commission issued a policy
10 statement on severe accidents. In that policy statement the
11 Commission concluded that the existing plants do not pose an
12 undue level of risk to the public and that no immediate
13 changes were necessary. This statement recognized a number
14 of changes that had been imposed during the previous few
15 years as a result of the accident at TMI.

16 The Commission, however, recognized that there may
17 be some aspects of designs and that some plants may be
18 outliers in terms of potential impact on public health and
19 safety, and so the Commission indicated that the Agency was
20 going to move towards developing a systematic approach to
21 trying to understand what the impact might be on a plant-
22 specific basis.

23 As part of the severe accident closure plan, the
24 Staff had three key elements to address to ensure that the
25 issues of severe accidents were being adequately addressed.

1 The three elements were -- the first one was the
2 concept of making sure that there was much better
3 understanding of capability of containments, various types
4 of containments to deal with severe accidents.

5 There was a considerable margin in terms of design
6 of these containments and it was judged that the
7 containments could handle significant types of challenges
8 from severe accidents.

9 This was called the Containment Performance
10 Initiative. By and large it was the Agency's effort with
11 some limited work also done by the industry.

12 The second element of the closure plan was
13 accident management.

14 It was indeed critical to fully understand severe
15 accident behavior and a lot of research went into getting
16 that understanding.

17 With that understanding and the sense of
18 containment capability, it was then deemed that one can use
19 that information in conjunction with individual plant
20 examinations -- that is, a plant by plant look at the design
21 aspects that integrate this information and then make
22 decisions on whether any further actions were required,
23 backfits or whatever those actions might be.

24 The important element of this was the recognition
25 that IPEs provide very valuable information to the

1 licensees, that they can develop their command and control
2 activities in dealing with accidents, taking information
3 from Individual Plant Examination, the severe accident
4 behavior studies, and integrating them and making sure that
5 the emergency response organization then could deal, if
6 there were an accident deal with that accident.

7 These were the three key elements. Of course,
8 today we are going to be discussing what was in Generic
9 Letter 8820, and as the Chairman noted, the objective there
10 was to look for potential vulnerabilities on a plant-
11 specific basis.

12 CHAIRMAN JACKSON: Let me ask you a question
13 before you go on. How many generic issues are there that
14 are on the books? How successful have we been in resolving
15 them, using IPE insights or results?

16 MR. THADANI: I don't know the number of generic
17 issues we have on the books, but a fair number of generic
18 issues have been resolved on the basis of getting some
19 insights from these Individual Plant Examinations.

20 One that clearly comes to mind is one of the more
21 important ones, which was reactor coolant pump seal LOCA
22 issue, and the Commission indicated that the Staff should
23 follow up on the basis of looking at the Individual Plant
24 Examinations -- but we can get the numbers.

25 CHAIRMAN JACKSON: I think it would be useful

1 because I think it seems that we have some softness in terms
2 of how many generic issues are still out there, and the
3 question would be is there a systematic approach to
4 resolving or dispositioning them?

5 MR. THADANI: There are two elements that I may
6 just touch. Clearly, the first -- whenever there is a
7 generic issue identified there is clearly prioritization
8 that is done and the prioritization utilizes information
9 from the Individual Plant Examinations and then in some
10 cases even resolution is based -- but we will get the
11 numbers.

12 CHAIRMAN JACKSON: Well, it relates really to two
13 things. It's systematic disposition of the generic issues,
14 and the second is the use of the IPE.

15 MR. HOLAHAN: There is an additional set of
16 generic issues associated with the IPEEE program.

17 CHAIRMAN JACKSON: Right.

18 MR. HOLAHAN: That have to do with external
19 events, and of course the Agency has a tracking system
20 for --

21 CHAIRMAN JACKSON: I know, but the issue has to do
22 with resolving them as opposed to tracking them.

23 MR. HOLAHAN: Yes, but there are many of them I
24 think which -- for which IPE is not the ideal mechanism for
25 resolving those issues.

1 CHAIRMAN JACKSON: I think Commissioner Diaz --

2 COMMISSIONER DIAZ: I was just going to say that
3 if we are going to get the numbers, they might be in some
4 categories so that we can determine this and work on it.

5 CHAIRMAN JACKSON: That is the whole point of
6 using the IPE results, because they give you a way of
7 assessing risk significance to the extent that they are
8 useful.

9 MR. HOLAHAN: Yes.

10 MS. DROUIN: What I would also add is that as part
11 of the generic letter the licensee could elect to try and
12 resolve on a plant-specific basis a generic issue, and there
13 were some that some of the licensees for the most part most
14 licensees did not elect to resolve generic issues.

15 There were some. We do discuss that in the NUREG.

16 CHAIRMAN JACKSON: They elected not to do it on a
17 plant-specific basis?

18 MS. DROUIN: On a plant-specific basis.

19 CHAIRMAN JACKSON: But what about invoking IPE
20 results to -- as part of those plant-specific --

21 MS. DROUIN: That is what I am saying. Very few
22 of them did.

23 We are going to be issuing a report over the next
24 couple of months in terms of what generic issues were
25 resolved through the IPE process.

1 CHAIRMAN JACKSON: That would be helpful. Yes,
2 okay.

3 MR. THADANI: Yes, I think that would address the
4 question you have raised.

5 May I have the next viewgraph, please -- no,
6 Viewgraph Number 4, please.

7 Again, you have covered, in your introduction you
8 covered the focus in attention of the generic letter. I do
9 want to make a point that the probabilistic risk assessments
10 are probably the only tool we know where you integrate
11 design and operational aspects and you take a total look at
12 the plant rather than a part of the plant at a time, so to
13 speak.

14 In that sense, it provides very useful, very
15 important understanding of the behavior and interaction of
16 man-machine, so to speak.

17 And we in the generic letter emphasized the
18 importance in terms of participation on the part of the
19 utilities in the conduct of these studies, and a number of
20 licensees did play a fairly active role in the conduct of
21 these studies, and in fact when we go through some of the
22 results and so on, the maximum I would say the biggest
23 benefit of these studies was (a) the understanding on the
24 part of the industry, and as I said, it's being utilized as
25 part of accident management plan. But also during the

1 conduct of these studies, some licensees identified some
2 significant safety issues, and in some cases actually made
3 changes, design changes, before they in fact submitted the
4 individual plant evaluations. And I think that was -- in my
5 mind that was a great benefit, because these were
6 potentially very significant outliers they identified during
7 the conduct of the evaluations, took corrective actions, and
8 in many cases, the results they submitted took credit for
9 those modifications. So I want -- the point I want to make
10 is the purpose of the IPE in that sense was served initially
11 through these evaluations.

12 CHAIRMAN JACKSON: Well, in a sense, doesn't that
13 address the fourth objective?

14 MR. THADANI: Yes, but there are two parts to
15 that. The first one is what I would call very significant
16 safety problems that they identified and fixed essentially
17 by and large. The next step is are there still some
18 concerns, some potentially significant contributors? I
19 would put these in generally two categories. Some would be
20 very plant-unique. Maybe there is a significant accident
21 sequence. It's a very plant-unique issue. If we want to
22 take action of course we would use our backfoot requirements
23 rule to make sure we're consistent with our procedures.
24 Another element of this is when you see similar insights
25 from let's say 20, 30, 40 plants, and the one you've heard

1 more than once I know, for example, station blackout is
2 still an important contributor when you look at these
3 studies, so there's that generic implication there still,
4 and as you will hear, our plans are to look at both
5 elements. Should we be taking plant-specific followup
6 actions? And we are reassessing some generic issues such as
7 station blackout. I mentioned that in an earlier --

8 CHAIRMAN JACKSON: You've identified a time line
9 on which you plan to do this?

10 MR. THADANI: Well, I received the message of the
11 schedule I had for station blackout which initially was
12 1298. We're relooking at that as I indicated during the
13 grid reliability discussion. We will be reassessing
14 schedule.

15 CHAIRMAN JACKSON: So would you say that there are
16 licensees or any licensees that did not meet the fourth
17 objective of reducing the probabilities, because -- where
18 there were significant contributors to risk?

19 MR. THADANI: There -- if I may hold back on that
20 one, if you focus only on IPE's, then I think by and large
21 licensees have taken what I would call at least minimum
22 steps. There may be other things that could be done. You
23 will hear a little bit about some plants. There are some
24 questions about how close they come to quantitative health
25 objectives. There may be other things that can be done, and

1 perhaps ought to be done. That's now our responsibility to
2 see. I will qualify my comments by saying that is only on
3 IPE's. IP triple E's there are already some indications, at
4 least I know of one plant where there's a significant issue
5 on fire. That licensee has made initial modifications to
6 reduce risk from fire, but there are still some questions
7 how far have they reduced risk from fire, and we're going to
8 be looking at that issue further.

9 COMMISSIONER ROGERS: Just before we leave this, I
10 may be wrong on this, but my recollection is that when we
11 got into the IPE process, when we first started to think
12 about requiring IPE's, it was really on the basis of closing
13 the severe-accident program, and that that looked like the
14 final cap of that program, to ask each licensee to do an
15 individual plant examination. Now, there was no requirement
16 that that be done using a PRA. As a matter of fact, back in
17 1988, as I recall, we were very antsy about using risk
18 analysis, PRA analysis, that when we're talking about
19 probabilities and risk and so on and so forth, it was with
20 some ambivalence about how to do this, and we certainly
21 didn't require that every plant do a PRA. They had to do a
22 plant examination, and they had flexibility in how they
23 could do it. In the long run it turned out I guess that
24 everybody did a PRA, when all things shook down.

25 MR. THADANI: Yes.

1 COMMISSIONER ROGERS: But I think that it is
2 important to keep that in mind, because the general approach
3 was, in my recollection, that this was really to be a value
4 to the licensees in understanding their plants better in
5 light of the severe accident possibilities, not for all
6 purposes in the plant, but really originally directed
7 towards closing the severe-accident program. And what I
8 think is happening here, and I'm not sure it's a bad thing,
9 but I think we ought to recognize that it's happening, that
10 we are drifting over now into using the results of the
11 IPE's, which now have turned out to be PRA-based, for
12 broader purposes. Now that may be very good, but I think
13 that one should recognize that we are taking steps beyond
14 what the original purpose of the IPE was, and I'm a bit
15 concerned because I feel that at the time that -- and I may
16 be not quite right on this, and the record will have to be
17 looked at to find out -- that I think the Commission's
18 general posture of the Commissioners was that we weren't --
19 we didn't expect to use those IPE's for regulatory purposes.

20 MR. THADANI: If I may comment on that, you're
21 quite correct. In the '88 time frame the focus clearly was
22 to identify those potentially handful of plants which may
23 pose significant risk, and so to identify what we called
24 outliers --

25 COMMISSIONER ROGERS: Right.

1 MR. THADANI: That was the language. And it's not
2 to say that the staff was -- I think the staff was of the
3 view that risk assessments -- doing risk assessments was a
4 good idea. The concern was the cost of risk assessments,
5 and staff had a dialogue with the industry, and there were
6 simpler methodologies developed by organizations outside
7 which we said -- which was short of risk assessments -- with
8 reduced scope as a matter of fact which we said would be
9 acceptable to meet the intent of these evaluations, but the
10 industry chose to go beyond, and they did spend more
11 resources, and that was the basic concern we had.

12 COMMISSIONER ROGERS: Well, I think our own
13 resources, I think we made a statement that we couldn't
14 possibly review every one of these --

15 MR. THADANI: That's absolutely correct. We could
16 not review these.

17 The staff review of the IPE's has always been
18 mindful of what was the intent of these studies, and the
19 scope of the reviews therefore has also been fairly limited
20 in that sense, but as we go into the kind of regime that
21 we're talking about now of risk-informed use in essentially
22 all of our regulatory activities, then the issue of scope,
23 quality reviews and so on clearly has to be --

24 COMMISSIONER ROGERS: Oh, absolutely.

25 MR. THADANI: Consistent with that application.

1 COMMISSIONER ROGERS: I just think that it's
2 important that the Commission keep in mind that historical
3 background, because we didn't start out with this program as
4 a uniform PRA for every plant, that then we would look to
5 see what more could be done on the basis of it. It was
6 really to really find the outliers.

7 MR. THADANI: Yes, indeed. That was the
8 objective. And now --

9 CHAIRMAN JACKSON: Well, were the IPE's
10 consistently reviewed or was there guidance to ensure
11 that --

12 MR. THADANI: We had guidance for consistent
13 review of the IPE's. The issue is the scope and the depth
14 of our reviews was fairly -- in most cases I guess we call
15 step 1, and then step 2 reviews. The scope and depth of
16 step 2 review was higher than that of step 1. We had to
17 have a reason to go on to step 2 review because of resource
18 considerations, and Mary can probably tell you if you're
19 interested that what level of effort we expended on these
20 reviews, it was not very significant, if you look at a
21 plant-by-plant basis.

22 CHAIRMAN JACKSON: You say it was not very --

23 MR. THADANI: Not very significant.

24 CHAIRMAN JACKSON: Okay.

25 MR. HOLOHAN: Could I add something before we

1 leave the subject? That is, in trying to come to grips with
2 the issue of where did we start on the IPE program, and
3 where are we going in the future, I think it's helpful to
4 distinguish between what is IPE and what are PRA's. The IPE
5 was really intended to be a one-time examination of plants.
6 The PRA's are really the tools to do that. I think in the
7 long run the PRA's have a role, but the IPE's I think will
8 come to an end. I think there are some additional things
9 that we are talking about doing, and sometimes we get a
10 little confused about the IPE's as though they are the
11 tools, and I think it's helpful to maintain that distinction
12 between the tool and the program, and the IPE reviews were
13 for the purpose of the IPE program. Were the analyses good
14 enough to find vulnerabilities? Now when we're talking, as
15 we did yesterday, talk about future uses of PRA, I think it
16 raises, you know, additional issues and additional reviews.

17 CHAIRMAN JACKSON: So the PRA's were a tool to do
18 the IPE's.

19 MR. HOLOHAN: Yes, exactly.

20 CHAIRMAN JACKSON: It was of finite duration.

21 MR. HOLOHAN: Yes, exactly.

22 CHAIRMAN JACKSON: Always meant to be with a
23 specific focus, but the PRA's live on with these other
24 regulatory potential uses?

25 MR. HOLOHAN: Exactly.

1 CHAIRMAN JACKSON: A la the discussion yesterday.

2 MR. HOLOHAN: Yes.

3 CHAIRMAN JACKSON: Okay.

4 MR. HOLOHAN: Or maybe even newer and better
5 versions of PRA for future uses.

6 CHAIRMAN JACKSON: Okay.

7 MR. THADANI: Okay. Mary.

8 MS. DROUIN: Okay. Slide number 5, please.

9 Before we get into NUREG 1560 I think we can
10 benefit by talking just briefly about the whole IPE program,
11 because the IPE program is much broader than the actual
12 NUREG that was issued. Two points here that I want to make
13 on the slide is one, in looking at all these IPE submittals,
14 the staff received a tremendous amount of information on
15 severe accidents, plant design and operating
16 characteristics, core damage frequency, system dependencies,
17 so when you look across these 76 submittals, the wealth of
18 information there was just tremendous.

19 In trying to understand all the information that
20 was contained in these submittals, we divided up the program
21 into four primary activities.

22 The first one, of course, was to look at each of
23 the submittals and review them against the intent of the
24 generic letter. Was the analysis, as Mr. Holahan said,
25 adequate enough such that had a vulnerability existed at the

1 plant and indeed been discovered.

2 In parallel with that, we created an IPE database
3 where we took information out of the submittals, entered it
4 into a database that allows the user to query across plants
5 so if you are interested in something on a group of plants,
6 you could get that without having to dig through 76
7 different volumes of information.

8 Also, as we were reviewing -- all these activities
9 have been going on in parallel. We have been going out to
10 each of the regions, meeting with the resident inspectors
11 and various regional personnel, providing them insights on a
12 plant-specific basis of what we have been learning from
13 these IPE submittals.

14 And then, lastly, the main topic for today is
15 NUREG 1560, what we have documented as the different
16 insights that we have gleaned from looking at all these
17 different submittals.

18 COMMISSIONER ROGERS: Just before you leave that,
19 how do you define within class in the IPE?

20 MS. DROUIN: Within a class, we define class, for
21 example, when you are looking at the reactor design by
22 interopolis design so we are looking at the BWR 1/2/3s, the
23 isolation condenser plants, the BWR 3/4s, Westinghouse four
24 loops, Combustion Engineering BMW and then on the
25 containment side, dividing it by containment type and that

1 is what we meant by class of plants.

2 Just quickly, also giving you a status of where we
3 are on the four various activities, in terms of the IPE
4 reviews, out of all of these the staff evaluation reports
5 have been issued to NRR and to the licensees on all the
6 submittals except five and we are in the midst of wrapping
7 up these remaining five as we speak.

8 In terms of the IPE database, it's complete. It
9 has been made available to the public. It is on the web
10 page and we have also issued a NUREG. I believe it is 1603,
11 which is a user manual of how to use the database.

12 COMMISSIONER ROGERS: Do we have any information
13 on users of that database, yet? I mean, do we have any
14 indication of how useful it is or has been so far?

15 MS. DROUIN: Well, we have been using it
16 internally for several years now.

17 COMMISSIONER ROGERS: I was thinking, since it's
18 on the Internet.

19 MS. DROUIN: In terms of the public, we just put
20 it there. I mean, it's been there like less than two weeks.
21 So in terms of how many people have downloaded it --

22 COMMISSIONER ROGERS: I had a little trouble
23 getting on it myself this morning.

24 MS. DROUIN: Well, we will be delighted to come up
25 and personally, you know, load it for you.

1 CHAIRMAN JACKSON: What use have the regions made
2 of the IPE results?

3 MS. DROUIN: I think a lot in their inspection
4 activities because we have also been given briefing for the
5 inspections, the IPAP inspections, day to day decisions.

6 MR. CALLAN: Chairman, Mary is right. The regions
7 are getting into it but they have been lagging NRR
8 substantially and it has only been in the last several
9 months that the graduates from this two-year training
10 program, the -- what's the title?

11 MR. THADANI: Senior reactor analyst.

12 MR. CALLAN: Senior reactor analyst, which is a
13 fairly intense qualification process, are now starting to
14 become productive and that was a major, major step in the
15 process of exporting PRA expertise to the regions.

16 Now speaking as an ex-regional person is one of
17 the frustrations the regions have is their perceived
18 inability to interact with the licensees in their region on
19 PRA issues and licensees, as you know, are making increasing
20 use of PRA risk insights and all facets of their
21 interactions with the staff, whether it be on enforcement
22 issues, requests for enforcement discretion and the whole
23 range of issues that we interact and the regions are very
24 frustrated because they don't have the expertise to deal
25 with those things without extensive support from NRR.

1 CHAIRMAN JACKSON: So it is an expertise issue,
2 not having put the framework into place?

3 MR. CALLAN: Yes. The inspection procedures are
4 out there, the training programs are in place but the
5 regions don't have the expertise, the sophistication.

6 CHAIRMAN JACKSON: In the regions?

7 MR. CALLAN: In the regions at this point.

8 As I said, that may change in the coming year or
9 so as the SRAs, the senior reactor analysts, start stepping
10 out and exerting some leadership.

11 CHAIRMAN JACKSON: Do we have -- I mean, are we
12 going to have going out this year senior reactor analysts to
13 each of the regions at least?

14 MR. CALLAN: Each region has two billets. One of
15 the problems is that the individuals who were selected for
16 these positions were, as you would expect, are among the
17 best and brightest of the inspectors. They are also the top
18 candidates for promotion and several of them have been
19 promoted. Several of them are now in headquarters. Some
20 have been on your staff and my staff and because -- so there
21 has been a substantial turnover in the role. That was
22 intended, actually.

23 The intention was to train these people and have
24 them move on but, unfortunately, the demands of the
25 organizations have often plucked them out of the training

1 program prematurely so that has been frustrating.

2 This will take time to get the regions up to
3 speed. The regions are definitely lagging in this area.

4 CHAIRMAN JACKSON: That's interesting. Okay,
5 thank you.

6 MS. DROUIN: Okay.

7 Regarding NUREG 1560, we did publish volumes one
8 and two last October for public comment. Over the last
9 several months, we have received comments from a dozen
10 utilities. We have received comments from EPRI, from NEI
11 and other members of the public. We held a three-day
12 workshop back in April and we had an attendance of about 100
13 people and I am going to speak more to the workshop later on
14 in the presentation.

15 We do plan on issuing a final version of the NUREG
16 this summer.

17 Okay, NUREG 1560. As I spoke earlier, when you
18 look at all these submittals, there is just a tremendous
19 amount of information and deciding what perspectives, what
20 insights, how you are going to slice information was a job
21 in and of itself. What we finally settled on was to look at
22 it from four different perspectives. One was first going
23 back to the original intent of the generic letter which was
24 the impact on reactor safety. So that was one of the first
25 objectives in terms of the perspectives we wanted to get

1 from these submittals and document.

2 The second one was now looking more towards the
3 actual results in the submittals, you know, looking at the
4 core damage frequencies at the accident sequences, at the
5 containment failure modes. What were the results telling us
6 in terms of reactor design and containment performance
7 versus the assumptions that are in these analyses? So we
8 were trying to get perspectives on that item.

9 Third, moving away from the actual results,
10 looking at the models and the methods that were used, what
11 insights and perspectives could we learn about the models
12 and methods that were used in these submittals and to
13 provide perspectives on that one.

14 Then, last, there were two things that we were
15 explicitly asked to look at. Was one, what could we say
16 from the IPE results regarding the Commission's safety goals
17 and also what has been the impact of the station blackout
18 rule and core damage frequency. So we were looking at the
19 results for that too.

20 Next slide, please.

21 Before I get into some of the results, I think it
22 behooves to put into perspective, into context, what NUREG
23 1560 addresses and what it doesn't address. First of all,
24 it was 75 submittals we looked at that covered 108 units so
25 we did make the decision early on that the perspectives were

1 going to be treated on a unit basis, not a submittal basis.
2 That seems trivial but that actually can really skew your
3 results and your insights but we did decide --

4 CHAIRMAN JACKSON: I was actually going to ask you
5 a question about that when you said there were 75 and I knew
6 there were more units than it actually represented.

7 MS. DROUIN: Yes. It represents 108, so we did
8 treat the results on a unit basis.

9 Also, the IPEs only cover a level one two PRA at
10 full power internal events only with internal flooding. So
11 perspectives regarding low-power shutdown, other modes of
12 operation, external events, those are not covered in this
13 insights report.

14 Now, some of the external events stuff will be
15 covered later on as part of the IPEEE program but it is not
16 in this document.

17 Next is that we do recognize that these PRAs were
18 originally done back in the era of about 1990. Utilities
19 have been, in some cases, updating them. That updated
20 information is not reflected in here. It is based on the
21 original IPE submittals.

22 And, lastly, the accuracy of the information is
23 not reflected so if a utility told us they had a two-train
24 system, we believed them so we did not go and verify --

25 CHAIRMAN JACKSON: So you didn't verify any of the

1 IPE results for any of the plants by, say, getting the fault
2 trees and event trees and looking at it in terms of the
3 systems for any of the plants?

4 MS. DROUIN: No, that's correct.

5 CHAIRMAN JACKSON: You just took it as it was?

6 MS. DROUIN: We took it as it was.

7 COMMISSIONER ROGERS: What would be -- how
8 difficult would it be to update, you know, the third bullet?
9 The fact that, you know, you took things -- this report --

10 MS. DROUIN: Can I address that later on? Because
11 that is something we will talk about when I get to the
12 workshops, what we plan to do.

13 COMMISSIONER ROGERS: Oh, sure.

14 MS. DROUIN: Next slide, please.

15 Okay, if we look at the first objective, which was
16 the impact of the IPE program on reactor safety, there were
17 several questions that we asked ourselves in pursuing these
18 perspectives and, you know, what was the type of
19 vulnerabilities that were identified, you know, what were
20 the improvements and what was the impact of these
21 improvements on the overall safety.

22 And what we saw was, first, that very few
23 vulnerabilities were identified. That was more, I believe,
24 due to the different definition that was used for
25 vulnerability. Vulnerability was not defined in the generic

1 letter or NUREG 1335, which was the supporting guidance
2 document. Definition of vulnerability was left to the
3 licensees and we saw many different definitions. Most of
4 them came down to either using, for example, like one E
5 minus four per reactor year and if you were above that, it
6 was the vulnerability. If your accident sequence or
7 contributor, for example, was greater than 50 percent of
8 your core damage or your containment failure, that would be
9 a vulnerability.

10 Some of them use sensitivity analyses but they
11 were different definitions.

12 CHAIRMAN JACKSON: So the industry did not develop
13 itself some overall --

14 MS. DROUIN: There was and it was the NUMARC but
15 not every licensee, only about 25 percent of the licensees
16 elected to use the NUMARC guide document for their
17 definition of vulnerability. I think it was around 25
18 percent.

19 CHAIRMAN JACKSON: Okay, Commissioner Dicus, I
20 think, had a question.

21 COMMISSIONER DICUS: Pretty well along those
22 lines, but I guess I want to be sure I understand this.

23 So few "vulnerabilities" were identified not
24 necessarily because there are few but because of the
25 definition issue? Is that another way to look at this?

1 MS. DROUIN: I think that is one way to look at
2 it, but I would think the next thing is to look at the next
3 bullet. Regardless of whether a licensee explicitly used
4 the word "vulnerability," they all identified weaknesses or
5 safety issues, if you want to call it that, and identified
6 improvements.

7 CHAIRMAN JACKSON: Do they credit the IPE program
8 for those improvements?

9 MS. DROUIN: Yes. Well, I don't want to say --
10 they discussed them in their submittal. So if you go to
11 each submittal, there are improvements that are discussed in
12 great length in each submittal that have been made. I would
13 suspect that probably some of them, if they weren't an exact
14 result of the IPE analysis, they certainly are using these
15 improvements.

16 CHAIRMAN JACKSON: Okay.

17 MR. THADANI: If I may, NUMARC issued guidance
18 document and in terms of their thought process on what
19 should one do with the results and they indicated they had
20 two key areas. One was frequency of core damage and the
21 other was frequency of potential for large early release.

22 In terms of frequency of core damage, they
23 indicated that if that frequency is greater than 10 to the
24 minus four, design options should be considered by the
25 licensee, design improvements hardware changes, whatever

1 have you. If the frequency of core damage is in the range
2 of 10 to the minus four to 10 to the minus five, one could
3 look into procedural improvements and enhancements. And if
4 the frequency was below 10 to the minus five, then that
5 could be considered down the road as part of accident
6 management considerations.

7 As far as frequency of large release is concerned,
8 everything I said applies except reduced by an order of
9 magnitude in frequency. Frequency of 10 to the minus five
10 for large releases, if it's higher than that it is either
11 design or hardware changes. Ten to the minus five to 10 to
12 the minus six, look at procedural changes. Below that,
13 then, look at it down the road as part of accident
14 management.

15 We -- we thought that was a fairly reasonable
16 approach and it turns out, I would say, reasonably
17 consistent with some of the things we have been talking
18 about.

19 COMMISSIONER ROGERS: When did we settle on our
20 definition of a large release? When -- what point --

21 MR. THADANI: We never did settle on the
22 definition of large early release. What we settled on was
23 we will convert that to early containment failure and we
24 defined early in terms of number of hours after onset of
25 core damage. But we didn't really end up defining large

1 early release because we started out with release that has a
2 potential for prompt fatality. One or more. And then there
3 were a lot of discussions back and forth.

4 So what we have now is, I might say, some kind of
5 surrogate means of saying if these conditions exist we
6 believe that would lead to a large early release, without
7 defining what that is.

8 COMMISSIONER ROGERS: I understand. But when did
9 we come to the conclusion of what that definition of what
10 that surrogate is?

11 MR. THADANI: In 1993, in a Commission paper, we
12 indicated the difficulties with the definition and the SRM,
13 I don't remember the dates, but soon after the SRM came
14 indicating, discontinue those studies of trying to define
15 large early release.

16 COMMISSIONER ROGERS: The only problem I was
17 trying to get at is when the licensees had something to work
18 with that was more or less common --

19 MR. THADANI: I think this -- their definition
20 was, I think, reasonably consistent. We used early
21 containment failure and they also were talking about early
22 containment failure. And the differences, I think, could be
23 in timing of early containment failure. But the thought
24 process still was, does it lead to early containment failure
25 and as you know, over the years we have had a number of

1 issues, what kind of challenges one should worry about with
2 the potential for early containment failure.

3 We have taken some actions in those areas, I
4 think, over the last several years and, by in large, it has
5 been a timing approach.

6 MR. HOLAHAN: The other thing I would add is
7 regulatory analysis guidelines contain effectively a
8 definition of -- a working definition of large early release
9 in the context that Mr. Thadani mentioned but also in the
10 guidance documents we spoke about yesterday.

11 The regulatory guides of standard review plans
12 provide effectively a working definition for large early
13 release. That's a little different, but basically what Mr.
14 Thadani said. It's a timing issue with respect to core
15 damage and containment failure.

16 MR. THADANI: The definition is in fact given in
17 the regulatory analysis guideline, and it talks about x
18 hours after onset of core damage as a definition.

19 CHAIRMAN JACKSON: Please?

20 MS. DROUIN: Okay. Just to give you a couple of
21 examples of some of the improvements, we certainly saw a lot
22 of improvements were associated with loss-of-power concerns,
23 and we are seeing improvements, you know, like adding,
24 replacing diesel generators, increasing redundant offsite
25 power capabilities, improving the ability to cross-tie from

1 buses or units. We saw things, replacing the emergency core
2 cooling system pump, air -- motors with air-cooled motors,
3 using the fire water system for core cooling. Also using
4 the fire water system for sealed cooling to your pumps,
5 increased training for feed-and-bleed operation. So this is
6 just a small sample of the improvements, but I think we
7 cataloged like over 500 improvements when you went through
8 across all the 70-some-odd submittals received by the staff.

9 Of all those improvements we did try and get a
10 feel for what was the status of them, and at the time of the
11 IPE submittals that we're now going back you know to the
12 1992 time frame, about 50 percent of those improvements had
13 been implemented at that time.

14 CHAIRMAN JACKSON: Let me ask you this question at
15 taking great risk, but if you look back at some of the
16 requirements that came post-TMI, are they any of them that
17 upon review or that the IPE insights would suggest were less
18 significant or less important than others? Or have you
19 really done that examination?

20 MR. THADANI: We haven't done that examination.
21 It may not be very easy to do that, but the converse I think
22 one can say that a number of the changes clearly were
23 significant improvements.

24 CHAIRMAN JACKSON: Okay.

25 MS. DROUIN: I would agree with that. I'm sorry,

1 I lost my train of thought.

2 One of the things is that we also did look at as
3 part of the review to see what level of participation you
4 know, the licensees had in their analyses, and we did see
5 that there was a good-faith effort. I mean, we did not -- I
6 don't recall of an instance -- I mean, I could be wrong, but
7 I don't recall one -- where a licensee just went out and
8 turned over their IPE to a contractor. You saw a lot of the
9 work being performed in-house so that you were seeing, you
10 know, this in-house capability certainly increasing.

11 I don't want to mislead you, because one of the
12 things that did come out of the workshop, you know we're now
13 in the time frame of 1997 versus back in 1990 when they were
14 being done, but one of the things that did come out of the
15 workshop was even though this in-house capability had, you
16 know, increased, we're now starting to see a decrease,
17 because of a sense of frustration on the public, you know,
18 how quickly we're moving forward in this area.

19 Next slide, please.

20 If we move to the second objective, which was
21 looking at the results themselves and what they were telling
22 us, some of the things that we were trying to get a feel for
23 is that when you take a class of plants, for example, if you
24 look at all your BWR 6's or you look at all your CE plants
25 or you look at your large, dry containments, within that

1 group you see tremendous variabilities in the results, and
2 begs the question, you know, what's driving this
3 variability? Is it due to plant-specific design
4 differences, or is it due to assumptions or methods, you
5 know, how does the human play a role in this. And these
6 were the type of things that we were trying to derive as we
7 went through all of these submittals.

8 The biggest thing that comes out is that the
9 plant-specific features certainly play a tremendous role in
10 that variability, and I can't emphasize that enough. No two
11 plants look alike when you start getting into the depths of
12 these plants, and you start looking at the support systems,
13 you start looking at electric power, at service water, at
14 component cooling water, these plants start looking very
15 different, and these are the things that tend to drive the
16 results. But at the same time the differences in the scope
17 and the boundary conditions and the assumptions also played
18 an equal part in causing the variability. So it's not
19 strictly plant design, you have a mixture of these two in
20 there.

21 When you look at the results across the plants,
22 you do see that station blackout and transients are the
23 primary contributors to risk across all the plants, whether
24 you're looking at boilers or whether you're looking at your
25 pressurizers, and even when you look at your individual

1 classes. However, when you start looking at on a plant-
2 specific basis and trying to understand the reason, the
3 reason from plant to plant to plant varies. Why station
4 blackout is important at one plant and why it's important at
5 another plant are for very different reasons, and that
6 usually gets down into the design differences of the support
7 systems, and in many cases also of the analysis assumptions
8 that are behind it.

9 When we started looking at the human actions, this
10 was a little bit more difficult, because this is the one
11 area where you have very much inconsistency in how some of
12 the methods are applied, and I'm going to talk a little bit
13 more than that, but I think the biggest thing that we noted
14 is that what human actions are important is probably more
15 driven by analysis here than plant-specific design
16 differences. When you start looking at what were the top
17 human actions, it wasn't surprising what we saw. I mean,
18 for the boilers you saw depressurization, containment
19 venting, aligning containment or suppression pool cooling,
20 initiating your standby liquid control system, on the PWR
21 side of course the switchover to recirc where you don't have
22 the automatic switchover, feed and bleed, depressurization,
23 and cooldown, these were the ones that tended to be the top,
24 but they weren't important in every single plant.

25 CHAIRMAN JACKSON: Let me ask you this question.

1 This is more similar to Commissioner Rogers' question about
2 large early release. Is there a common definition of core
3 damage used in all of the --

4 MS. DROUIN: You preempted my next slide.

5 CHAIRMAN JACKSON: Oh, so sorry.

6 MS. DROUIN: So why don't we go to the next slide,
7 because I think that's where the heart of a lot of this is.
8 When we got past the results in trying to, you know, look
9 at, you know, the design differences and the assumption
10 differences in terms of, you know, what was causing the
11 variability in the results, you know, the other thing of
12 course that we were looking at, you know, was what -- and
13 where were the strengths in these models and methods, and
14 where were the weaknesses, and were the weaknesses more due
15 to a lack of knowledge versus misapplication of the method,
16 and I think that's a very, you know, difference between the
17 two, because in some cases it's not a lack of knowledge,
18 it's a lack of -- misapplication, and that's really what we
19 found.

20 When you looked at the different methods that are
21 used in these PRA's, when you look at your systems analysis,
22 your accident sequence analysis, your plant damage that your
23 containment of entry, the methods and the models behind
24 them, you know, are very well established. The problem
25 comes into how they implement these methods when you look at

1 the scopes and the boundary conditions, you start seeing
2 very differences, and I'll address, you know, for example,
3 the core-damage definition. There's not a standard core-
4 damage definition, so you could see anywhere from someone
5 defining core damage as once the reactor water level gets
6 below the top of active fuel to two feet above the bottom of
7 active fuel, to the peak cladding temperature. You saw a
8 varied differences, and there's no right or wrong in this
9 case, but it bounds and it scopes the problem, and they
10 will -- you will now get very different results.

11 CHAIRMAN JACKSON: Well, let me -- you know what
12 my next question inevitably is going to be, and that is, you
13 know, this is along the line of some of what we were
14 discussing in the briefing yesterday where we were talking
15 about, you know, five 10 to the minus 4 versus five point
16 one 10 to the minus 4. Since core damage frequency is what,
17 you know, many of these PRA's reference, what can you tell
18 me?

19 MS. DROUIN: I think it's like any analysis. You
20 have to look at what the analysis handles and what it
21 doesn't handle, and it doesn't mean the number is right or
22 wrong. I think when you look at any engine in the analysis
23 and you look at, you know, what was the input and what was
24 the scope that dictates then, you know, what that result
25 means.

1 CHAIRMAN JACKSON: No, I appreciate completely
2 what you're saying, but, you know, we have some triggers or
3 thresholds or whatever that are built into --

4 MR. HOLOHAN: Guidelines.

5 CHAIRMAN JACKSON: Guidelines. Okay.

6 MS. DROUIN: And if you get into the -- because I
7 was here yesterday, and if you start looking at the
8 uncertainties in the distribution on these things, if you go
9 back, for example, to NUREG 1150 and you start looking at
10 other PRA's and you look at what their distributions are,
11 and I'm just going to focus in on the level 1 part, because
12 that's all I have in my head at the moment, but if you look
13 at what their main values are, and you look at what the 95th
14 percentile, what you see is a factor of 3.

15 CHAIRMAN JACKSON: Okay.

16 MS. DROUIN: You do not see, you know, a factor of
17 10 or a factor of 100.

18 CHAIRMAN JACKSON: You don't see orders of
19 magnitude.

20 MS. DROUIN: No, you do not.

21 CHAIRMAN JACKSON: Okay. Then that's the most --
22 okay.

23 MR. THADANI: But I would also -- I think I would
24 also hasten to add that that's a rather stylized look at
25 hardware data.

1 CHAIRMAN JACKSON: Yes.

2 MS. DROUIN: Yes.

3 MR. THADANI: I think what we're talking about
4 could be more important, and if you step back and look, what
5 Mary said was dominant contributors are transients, which
6 means if you're starting to uncover the core, it is -- it
7 could take some time before one can get to a peak clad
8 temperature of 2,200 degrees Fahrenheit, which means there
9 is that much time available for intervention, corrective
10 action, and so on. That means that is a conservative
11 analysis if we accept peak clad temperature of 2,200 degrees
12 Fahrenheit as reflective of core damage. What that says is
13 that the licensees in some cases have made more conservative
14 assumptions on failure definition and that the results are
15 probably biased in that direction. Sometimes that is done
16 just to reduce the cost, because it is much simpler to go
17 forward with those assumptions, and this is just one
18 example. There are differences sometimes in success/failure
19 criteria. Some licensees will go to greater lengths to try
20 and better define what is that minimum required to deal with
21 a challenge. Others will not do that. They will use what is
22 a final safety analysis report, transient and accident
23 analysis values, which we know are conservative. So there
24 will be those differences.

25 CHAIRMAN JACKSON: Mr. Holahan, you had a comment?

1 MR. HOLAHAN: I just wanted to mention that what
2 Mary was talking about is the amount of variability that you
3 see in the analysis. That doesn't reflect those things that
4 you didn't analyze, which I think are also an important
5 contributor to the uncertainties, and it doesn't really
6 reflect also the fact that something in the analysis might
7 be an error or some sort of a bias. So I think although I
8 would think that a factor of three is maybe the minimum
9 value, I don't think we're talking about orders of
10 magnitude.

11 When I see the number 4.1 times ten to the minus
12 five, it means to me that the answer is somewhere between
13 ten to the minus four and ten to the minus five. It's in
14 that range.

15 CHAIRMAN JACKSON: Okay. Let me ask you this
16 question. How many of the inconsistencies that you speak
17 of, that you've delineated on this viewgraph, would be
18 eliminated with the issuance of the regulatory guidance and
19 documents and the standard review plan sections that we
20 talked about?

21 MS. DROUIN: I think the bulk of them would be.
22 When we went through, I believe it was Mr. King who spoke to
23 this yesterday, and we talked about NUREG-1602 which goes
24 through and systematically, you know, gives the attributes
25 of, for lack of a better word, of a quality PRA.

1 We started that in NUREG-1560 and we actually
2 broke down the PRA, you know, starting with your level 1,
3 your level 2, your level 3, and then, looking at each of the
4 different levels, what are the different tasks associated
5 with doing that part of the analysis. And if you're looking
6 at, for example, one task would be your initiating event
7 analysis, regardless of what -- the application or the
8 reason you're doing, if you just wanted to do a very high
9 quality PRA and given the current models and methods, what
10 do we mean by that?

11 CHAIRMAN JACKSON: I understand.

12 MR. HOLAHAN: In addition to that, even if there
13 were areas for which changes or improvement were made, using
14 the regulatory guides I think would highlight those areas
15 where there were differences and give insights, both to the
16 licensee and the staff of the limitations of the tool that
17 they've got.

18 MR. HODGES: And also, NUREG-1602 is not a
19 requirement. It says here's what we think would be a good
20 way of using the state-of-the-art technology to do an
21 analysis; and if you were reviewing one and they had already
22 used their bounding assumptions and analysis, you're not
23 going to make them go back and change. So you won't
24 necessarily eliminate this, but you might constrain.

25 CHAIRMAN JACKSON: What it does is it says -- it

1 constrains what the use is.

2 MR. HOLAHAN: Yes. Exactly.

3 CHAIRMAN JACKSON: How much you can rely on that.

4 MR. HODGES: Yes.

5 MR. HOLAHAN: Yes.

6 CHAIRMAN JACKSON: And that's really what it says.

7
8 MR. HOLAHAN: Probably the first and the most
9 important step is understanding the tool that you propose to
10 use.

11 CHAIRMAN JACKSON: Right.

12 MR. HODGES: Yes.

13 CHAIRMAN JACKSON: Right. Exactly. Okay.

14 MS. DROUIN: When we start looking more at these
15 models and methods, as I said, where we really saw
16 tremendous inconsistency, not incorrectness but
17 inconsistency, was in, you know, primarily the scope and the
18 boundary conditions and the assumptions that were implied or
19 -- not implied, I'm sorry -- used by the various analysts.

20 The one area that I probably would highlight would
21 be the human reliability. There were a couple of things
22 that we did see here. Certainly again was inconsistency in
23 the identification and selection of what human actions to
24 model, and then inconsistency in the implementation of the
25 various methods.

1 The last one was certainly there are types of
2 errors that the current methods do not cover when you start
3 looking at errors of commission, those things that the
4 operator elects to do on his own, not that he has failed to
5 implement but that he thinks he's doing the right thing but
6 he does the wrong thing. Those types of errors are not
7 currently modeled which could have some impact on the final
8 results in terms of identifying what are going to be the
9 dominant sequence and contributors.

10 CHAIRMAN JACKSON: Did you identify any methods or
11 models that should not be used?

12 MS. DROVIN: No. No.

13 MR. HODGES: I think, you know, we found at least
14 as wide, maybe wider variability in application of a
15 specific model as we did between models on the human
16 analysis.

17 MR. THADANI: I guess one -- I know of one plant
18 IPE, when they first came in, they assumed that the
19 likelihood of human error is zero in recovery acts.

20 MR. HOLAHAN: Yes, I remember that.

21 MR. THADANI: Zero. And of course that required a
22 lot of interaction.

23 CHAIRMAN JACKSON: Say that again.

24 MR. THADANI: There was one IPE that was submitted
25 which was based on -- analysis was based on the fact --

1 their judgment that their operators will not make errors at
2 all, probability is zero. That was a submittal.

3 CHAIRMAN JACKSON: I see.

4 MR. HODGES: That's one of the five that the
5 evaluation is not written yet.

6 [Laughter.]

7 MS. DROUIN: Again, that was sent -- you know, I
8 mean, the way I was focusing on was the actual method. That
9 was not a method; that was --

10 CHAIRMAN JACKSON: I understand.

11 MS. DROUIN: They had an assumption.

12 Okay. Slide 12, please.

13 We were asked to look at the IPE results as they
14 compared to the Commission safety goals. In doing this, you
15 know, there are several concerns or issues. Primarily the
16 IPEs are internal events at full power looking at core
17 damage and containment performance only. So we do not have
18 a level 3 analysis which carries all the way out to risk
19 looking at off-site health consequences.

20 They also don't include lower power and shutdown.
21 They don't include external events. So this is looking at a
22 very narrow part of the risk when we provide the insights
23 here.

24 The first thing we did was to look at the two
25 numerical objectives, the core damage frequency of 1e minus

1 four per reactor year and the conditional containment
2 failure probability of .1.

3 When we looked at the core damage frequency, we
4 saw that the core damage frequencies for the boilers all
5 fell below the 1e minus four. Most of the PWRs fell below
6 the 1e minus four, but there were several plants that were
7 above the 1e minus four.

8 COMMISSIONER DIAZ: Could you say what most means?
9 Ninety percent? Ninety-five percent?

10 MS. DROUIN: I think it was like 10, 15 percent if
11 you look at it on a unit basis.

12 CHAIRMAN JACKSON: When you talk about based on
13 point estimates, this kind of relates to the question I
14 asked yesterday. Is it based on propagating mean
15 probabilities through the, you know, the fault tree, or is
16 it based on carrying forward actual probabilistic
17 distribution?

18 MS. DROUIN: Yes. As far as we can tell from the
19 IPEs, what they reported to us were point estimates.

20 CHAIRMAN JACKSON: So you multiply this .5 by this
21 .4 by this .2 by this .1 as opposed to really carrying
22 forward the full distributions?

23 MR. THADANI: And one would not call these mean
24 values.

25 CHAIRMAN JACKSON: Okay.

1 MR. THADANI: They're not really --

2 CHAIRMAN JACKSON: They're really -- when you say
3 point estimates, you must mean that, that you multiply point
4 --

5 MS. DROUIN: I think most of them are point
6 estimates. I don't want to say absolutely.

7 CHAIRMAN JACKSON: No, but I'm saying, most of
8 them --

9 MS. DROUIN: But I think most of them are. They
10 didn't tell us differently.

11 CHAIRMAN JACKSON: And so when you calculate a net
12 core damage condition -- core damage frequency, you're
13 multiplying everything along the sequence?

14 MS. DROUIN: That's correct.

15 CHAIRMAN JACKSON: Okay.

16 MS. DROUIN: That's correct.

17 CHAIRMAN JACKSON: Yes, Commissioner McGaffigan.

18 COMMISSIONER MCGAFFIGAN: If you were to do a 95
19 percent confidence interval, your guesstimate, knowing that
20 they haven't done it, how many plants would have part of
21 their 95 percent confidence interval below 1e ten to the
22 minus four?

23 MS. DROUIN: I think that you will certainly see
24 some of these above -- I'm going to answer a little bit
25 differently -- above the 1e minus four because you saw quite

1 a few of them that are right at the line.

2 COMMISSIONER MCGAFFIGAN: So an awful lot right at
3 the line, so therefore if you have any sort of normalized
4 distribution, part of it's going to be below the line.

5 MR. HOLAHAN: It's a little dangerous to guess.
6 My guess is that most of the PWRs, the 90 percentile, the
7 95th percentile, would be able ten to the minus four. The
8 boilers might be below, but most -- it's hard for me to
9 think that most of the PWRs are in the middle or upper range
10 of ten to the minus fives and that the tail of that curve is
11 not above ten to the minus four.

12 MR. THADANI: It -- I'm sorry.

13 CHAIRMAN JACKSON: Commissioner?

14 COMMISSIONER DIAZ: I was going to say since, you
15 know, we have, say, ten to 15 percent that do not meet the -
16 - do not go, you know, one times ten to the minus four, did
17 we look at whether there was a generic cause for that?

18 MR. THADANI: Yes.

19 MR. HOLAHAN: Well, I think the presentation in
20 the report puts plants into categories and deals with issues
21 in categories, and I think that's probably the best way of
22 addressing what is it that makes some of the numbers higher
23 than others.

24 MR. THADANI: If you -- well, basically, on --
25 let's talk about PWRs, for example, and I have a class of

1 plants in here. It shows that if you -- by and large, the
2 key contributors are station blackout and transients. And I
3 would expect that means that the auxiliary feedwater system
4 is playing a very important part in those designs. So you
5 could then glean, if you took the next step, glean that kind
6 of information from these.

7 You have --

8 MS. DROUIN: I mean, if you want to compare here,
9 you can see the distribution.

10 If you look -- well, unfortunately I don't have a
11 back-up slide on this, but there's a figure in here that has
12 plotted the 1150 results, the main versus the distribution
13 from the 95th to the 5th, and plotted against it are the IPE
14 results. The IPE results, if I look at the PWRs and if I
15 look at the biggest spread, which is Sequoyah 1150, which
16 goes from about 2e minus seven all the way up to about 2e
17 minus five, you see the spread of the IPE results going
18 outside that spread just on the core damage frequency, and
19 you see the same thing on the boilers.

20 In fact, on the boilers, you see that there's
21 quite a few that are even -- quite a few -- I don't know --
22 at least a dozen that are above the 95 percentile of the
23 highest plant, the boilers in 1150.

24 CHAIRMAN JACKSON: Okay. Why don't you go on.

25 MS. DROUIN: Okay.

1 MR. THADANI: I did want to make a comment, and
2 that was yesterday when you asked us a question about how
3 many plants may be approaching safety goals and we gave a
4 response that there may be some, this is what I would call a
5 fairly crude analysis, and what this says is -- leaving
6 aside the issue of at what confidence level should we
7 discuss this issue of safety goals and so on, what this says
8 is the judgment was made if you had mean values and the
9 frequency of early containment failure is less than ten to
10 the minus five per reactor year, assuming all the analyses
11 are credible and so on, then I think generically enough work
12 has gone on, one could say that in that case, one would not
13 be challenging the safety goals, the early fatality
14 criterion which would be controlling basically.

15 The difficulty here is that what we have got is
16 very, very approximate calculations, and in order to really
17 give a solid answer to a question like that, I think one has
18 to dig a little deeper to be able to say how close are some
19 of these plants or do they exceed these quantitative goals,
20 and that statement then has to be tied with what kind of
21 confidence we have in that particular statement, whatever
22 that confidence level might be, and we don't have that
23 information as yet. And it's very difficult to do at this
24 stage from these studies.

25 MS. DROUIN: And that serves as a great

1 introduction to the next slide.

2 CHAIRMAN JACKSON: Before you go, if I look at the
3 containment failure probability --

4 MS. DROUIN: Yes.

5 CHAIRMAN JACKSON: -- do you have any sense of how
6 the numbers would go if you had a more full scope results
7 where you would explicitly consider seismic events, et
8 cetera?

9 MS. DROUIN: I mean, it's going to be on a plant-
10 specific basis, but, you know, you --

11 CHAIRMAN JACKSON: It's going to drive it that
12 way.

13 MS. DROUIN: Primarily, yes.

14 CHAIRMAN JACKSON: All right. Okay.

15 MR. HOLAHAN: I think you also get into one of the
16 inherent difficulties in using conditional containment
17 failure probability. It's very hard to define what that
18 really means.

19 CHAIRMAN JACKSON: Exactly.

20 MR. HOLAHAN: Which earthquake are we talking
21 about?

22 MR. THADANI: I think by and large if -- based on
23 at least the studies that have been done to date, the early
24 containment failure -- there's some I'd say unique
25 characteristics of severe accidents that tend to challenge

1 containments. If you look at Mark I and Mark II plants,
2 they are inert. They're very -- the containments are very
3 small, and if you had a severe accident and if these
4 containments were not inert, hydrogen would be the real
5 cause for failure of the containment, probably fairly early
6 in the accident.

7 However, for Mark I containments, the most
8 significant challenge early on is a potential for the liner
9 melt through. It's like a light bulb. If you have a corium
10 coming down into the lower cavity, it will spread out, very
11 hot, attack the metal, and it will be the failure of the
12 metal liner.

13 The way to deal with that problem is very simple,
14 actually. A lot of work has been done. One needs to make
15 sure there's a way to get water, a layer of water on top of
16 the corium. Commissioner Rogers remembers this very well.
17 And in the IPEs, I believe, all licensees have now got
18 procedures to find a way to get water in, and that takes
19 care of that early challenge.

20 Similarly, the -- another challenge of great
21 concern for large, dry containments was the direct
22 containment heating issue.

23 Which research seems to show is not a real
24 significant -- I think hydrogen for mark three containments
25 is still a real issue. Mark three containments have

1 igniters but these igniters are powered by off-site power
2 source so there may be a question about some similar
3 accidents, whether the igniters will function or not and
4 could lead to potential for early containment failure.

5 So I guess what I am getting to is that because
6 the challenges are sort of unique of that nature, I am not
7 sure that seismic would be a big issue. Fires could be
8 because fires can cause station blackout or other kinds of
9 scenarios.

10 CHAIRMAN JACKSON: I just used that to capture the
11 generic fires, you know, et cetera. Whatever.

12 MR. THADANI: Fires could be.

13 MR. HODGES: Another bias in some of these IPES is
14 many of them did not take credit for some of the research
15 that has been done on things like direct containment heating
16 so they are getting actually worse results than you would
17 expect.

18 CHAIRMAN JACKSON: Yes.

19 MS. DROUIN: Looking at the quantitative health
20 objectives, you know, we looked at both of them, what was
21 your risk from your latent cancer which is not to exceed .1
22 percent of the total risk within 10 miles and what is the
23 risk from your prompt fatality which is not to exceed .1
24 percent within one mile.

25 When you look at these, both can be translated

1 into numerical objectives looking at the latent cancer,
2 which implies the risk should be less than five e minus
3 seven per reactor year and for the early, which is implying
4 the risk should be limited to below two e minus six per
5 reactor year.

6 So looking at these numerical objectives, was
7 there some way to extrapolate from the IPE results against
8 those numbers? And, again, I want to say we have the same
9 issues and concerns because these were limited analyses
10 again in the sense of just addressing full power internal
11 events and they were not level three analyses, they did not
12 include, you know, the other aspects of risk and we are also
13 dealing with the point estimates. But was there some type
14 of crude screening thing that we could do to try and get,
15 you know, a feel for where we are against these objectives?

16 Well, the first thing we did is that we went back
17 to NUREG 1150 and recognized that the most limiting margin
18 in getting there was going to be associated with early
19 fatality risk. So since we are dealing with early fatality
20 risk, we then went and looked to see what are the dominant
21 contributors and your dominant contributors are associated,
22 you know, with your early containment failure and bypass.

23 Given that, we went back to the IPE results and
24 looked at what they were reporting as the frequencies
25 associated with early containment failure and bypass and see

1 if we could screen at that, what was a threshold level that
2 we could screen at if they were below that level. We could
3 sort of get a feel that they were not going to approach
4 these objectives and looking at that we were able to assume
5 or guess as the threshold of about one e minus five per
6 reactor year. So if those frequencies fell below that, we
7 felt comfortable in screening those plants. At that point,
8 we were able to screen out about 79, 80 of the units fell
9 below that one e minus five and that left us about 29, 30
10 units that were above it.

11 So then we said, well, given that, was there
12 another gross back-of-the-envelope type calculation that we
13 could do real quickly to try and get a feel where these
14 remaining plants fell and there were several things that we
15 did.

16 We first went and looked at the release classes
17 that were reported in the submittals associated with early
18 containment failure and bypass and we looked at the source
19 terms that were associated with the early containment
20 failure bypass release classes in looking at the release
21 fractions that would give rise to an early fatality, looking
22 at what the release fractions were for iodine, cesium and
23 tellurium and then seeing if they were above -- if they were
24 above a certain threshold it could give rise to this early
25 fatality.

1 So then we went and took that information and then
2 we tried to then account for the population. In looking at
3 about one-third of the sector's population out to about one
4 mile, that translated into a certain thing and through our
5 back-of-the-envelope calculation real quickly, what we came
6 out of is that there are another 15 plants we could screen.
7 But it looked like we had about 14 plants using, you know,
8 their source terms and release classes and then doing this
9 crude approximation, we had about 14 that may approach this
10 numerical objective of the two e minus six per reactor year
11 for your early fatality which, as Mr. Thadani was also
12 saying, I'm not trying to say this is very, very crude. It
13 just sort of is a flag to point of where we might need to go
14 look some more in deptn.

15 MR. THADANI: I might just note that what Mary is
16 talking about is discussed in volume two, section 16 and it
17 starts at pages 16-3 and goes on to 16-11, sort of the
18 process that we went through.

19 COMMISSIONER DICUS: Before you go on?

20 CHAIRMAN JACKSON: Sure.

21 COMMISSIONER DICUS: I guess obviously, given even
22 all the qualifiers you put on confidence in these numbers,
23 it is still a little disturbing to have a document that says
24 possibly based upon the staff's extrapolations of uncertain
25 data. I think I have that all right, 14 plants may approach

1 this individual early fatality objective. That is somewhat
2 disturbing to have this and, I guess, go forward and perhaps
3 it is in some of the documents that I haven't reviewed but
4 what are you going to do about this? What's the next step?
5 It might be important to talk a little bit about that at
6 this point.

7 MS. DROUIN: Mr. Holahan is going to talk to all
8 of that.

9 MR. HOLAHAN: Thank you.

10 COMMISSIONER DICUS: Had you planned on that?

11 [Laughter.]

12 MR. THADANI: No, frankly, we do want to make
13 sure. I think there are ways to screen out. I think one of
14 the areas we have discussed, we must follow up on, is all of
15 those plants which are showing frequency of early
16 containment failure of greater than 10 to the minus five, as
17 a way to screen, make sure we are looking at those plants.

18 I would make another note. And if we want to
19 impose the backfit, reduce, we will go through our process,
20 substantial improvement in safety through regulatory
21 analysis guideline and cost/benefit analysis to see how far
22 we can actually go.

23 MR. HOLAHAN: The point that we really --

24 CHAIRMAN JACKSON: Let's wait. If you are going
25 to speak to it, let's, for coherence, let her finish, if you

1 don't mind.

2 COMMISSIONER DICUS: No, that's fine, we may come
3 back to it.

4 CHAIRMAN JACKSON: Then we can come back and have
5 a complete discussion.

6 MS. DROUIN: The next one kind of goes on that
7 same theme in the sense -- well, let me back up. Let's go
8 to slide 14.

9 We were also asked to look at, you know, what we
10 say in terms of the station blackout rule, what kind of
11 impact that it has had on core damage frequency.

12 As we were asked to look at the safety goals, we
13 had problems here too because, again, we were trying to us
14 an analysis. This was not the purpose of it and to glean
15 what we could from it.

16 When you do look across all these plants, you saw
17 a tremendous variety in the coping methods that were adopted
18 as a result of the rule. But now when we are trying to
19 assess, you know, what has been the impact and we are trying
20 to glean this from these submittals, the problem came is
21 that a lot of this information that we needed is simply not
22 in the submittal and we only had about 15 percent of the
23 licensees that told us the before and after picture. You
24 know, here was their core damage frequency before the
25 station blackout rule and here was their core damage

1 frequency after the station blackout rule.

2 In looking at that, you know, you saw an average
3 reduction of two e minus five. And so if you are looking
4 just for the impact, using a very small sample, you do see
5 reduction that has been a result of the station blackout
6 rule.

7 The other thing was to look at, you know, what was
8 the actual credit and what I mean by that is that, although
9 we might not have had the before and after, we had a larger
10 sample in that licensee's totals that they took credit.
11 They might not have told us the before CDF but we knew that
12 the core damage frequency that they reported they told us
13 that they had implemented the station blackout rule and it
14 was credited in there.

15 So when we go back and look at that sample of
16 plants, that was about I think 60 percent of the plants, but
17 don't quote me on that. I am doing that one off the top of
18 my head.

19 You saw that the vast majority fell below the goal
20 of the one e minus five per reactor year but you did see
21 some plants that had implemented the station blackout rule
22 that were still above the one e minus five. I think it begs
23 the same question.

24 Here, and I don't want to preempt Mr. Holahan,
25 because we are working very closely with NRR and trying to

1 identify the selection criteria of what activities we are
2 going to pursue. I think NUREG 1560 serves as the first
3 step in pointing to some things but, you know, how we
4 proceed forward, I think you have to come up and decide, you
5 know, what criteria you are going to use in pursuing based
6 on these insights and perspectives on some of these plants
7 that are coming out of the document.

8 CHAIRMAN JACKSON: How many licensees have, in
9 fact, implemented the station blackout rule?

10 MR. THADANI: I can confirm but I believe it is
11 100 percent.

12 CHAIRMAN JACKSON: All right.

13 MR. THADANI: The rule is --

14 CHAIRMAN JACKSON: I am just looking at what the
15 next-to-the-last bullet said. For those licensees that had
16 implemented --

17 MS. DROUIN: Right because, again, we are basing
18 this on the submittal which is 1990.

19 CHAIRMAN JACKSON: All right.

20 COMMISSIONER ROGERS: Do we have any numbers of
21 the average cost in dollars per person removed averted in
22 achieving that average reduction of two e to the minus five?
23 Can we see what that cost to do that?

24 CHAIRMAN JACKSON: Can you capture? I mean, is
25 that data available?

1 MR. THADANI: We could -- we can approximate it.

2 We have --

3 COMMISSIONER ROGERS: It is just a ballpark number
4 as it is. How does this compare with it?

5 MR. THADANI: We could probably estimate it could
6 be on the order of what I am probably giving I would suspect
7 is a conservative maybe 200 person rem per year per plant
8 because if I -- what I am doing is I am making an assumption
9 here that station blackout is going to lead to a substantial
10 release and I am using some old siting source term studies
11 data to try and estimate. But we can give you a much better
12 estimate.

13 COMMISSIONER ROGERS: I think it would be
14 interesting to see how that works out, you know.

15 MR. THADANI: We can do that. We will do that.

16 MR. HOLAHAN I think the risk part --

17 CHAIRMAN JACKSON: I just want to know, given the
18 station blackout rule, is station blackout still the
19 dominant contributor to core damage?

20 MR. THADANI: It appears to be from most of the
21 studies, still a dominant contributor to core damage.

22 MS. DROUIN: But I would also add, you are always
23 going to have something that contributes to risk and the
24 question is, is it coming down, is it coming down.

25 CHAIRMAN JACKSON: You were about to make a

1 comment?

2 MR. HOLAHAN: I was going to say, I think we have
3 a substantial amount of information about a station blackout
4 analysis but the costs associated with station blackout or
5 reducing risks, I think there is very limited information
6 available.

7 MR. THADANI: We provided the Commission some
8 information on costs a few years ago on station blackout and
9 I thought your question was more on the averted risk in
10 terms of person rem.

11 COMMISSIONER ROGERS: Yes, right. We can convert
12 it to that measure.

13 MR. THADANI: We can try and get that.

14 MS. DROUIN: Slide 15, please.

15 As we said, we did have a workshop back in April
16 in Austin, Texas. We had three objectives that we had
17 stated very clearly at the beginning of the workshop that we
18 had given to all the attendees. What we were trying to
19 achieve was, one, get feedback on the accuracy of the actual
20 information and data that was in the NUREG. Also, get
21 feedback on the perspectives and insights that are discussed
22 and also get feedback on the potential uses of the results
23 and the perspectives that are discussed and that's what we
24 went forward with during the three days and had a lot of
25 discussion on.

1 When you look at the workshop it was attended by
2 various utilities, all the owner groups, EPRI and NEI was
3 there. Tremendous comments we received, primarily focusing
4 on the first objective was what we really got, so the
5 accuracy and information of the data and that led to the
6 third bullet down here where we had a general concern that
7 the information in the NUREG is out of date and what do we
8 plan to do with that.

9 When I look at the second objective, in terms of,
10 you know, what feedback could we get on the perspectives
11 that were in the NUREG, we really didn't get any kind of
12 what I would say negative feedback in the sense that what we
13 had presented was incorrect. It was more, really,
14 associated with information is out of date and then because
15 it is out of date, how does the NRC plan to use this? And
16 those two concerns kind of fed each other.

17 Our plans right now for NUREG 1560 is that we are
18 not going to go back and rewrite this NUREG with the updated
19 information for several reasons. One is that we don't have
20 the information. We have very -- we have a scarcity and it
21 is not as simple as just getting the core damage frequency
22 numbers. You need the core damage frequency numbers, you
23 need the accident sequences, you need the contributors, you
24 need the -- I mean, it goes on and on and on. The only --
25 we did not just look at that bottom line number in coming to

1 the perspectives and insights that are reported.

2 You then go to the next question, is that, you
3 know, these PRAs are going to keep evolving, keep updating
4 and the conclusions that we really have here on a global
5 basis, I think, are still pretty valid. They are not going
6 to be, of course, on a plant-specific basis and that's the
7 regime, the realm we're moving into. It might come back,
8 maybe, years down the road or sooner down the road that we
9 revisit that. But at this point in time, it is not our plan
10 to go and update this with the information.

11 We do plan on citing to a NUREG where we have some
12 updated information in it but we aren't going to disregard
13 that. There is some updated information that has been
14 provided to us and what has been will be cited in there. We
15 will also provide an appendix of the summary of the public
16 comments and our staff responses to it.

17 At this point, I will turn the presentation over
18 to Mr. Holahan.

19 CHAIRMAN JACKSON: Do you have all the questions
20 to ask -- I mean the answers to what the Commissioners just
21 said? We hope you've been keeping the list.

22 MR. HOLAHAN: I did write down some.

23 COMMISSIONER DICUS: Yesterday, it was, you know,
24 "That question will be answered tomorrow."

25 CHAIRMAN JACKSON: That's right. Remember I said

1 we'd come back to you on this.

2 COMMISSIONER ROGERS: I hope you remember those
3 questions.

4 MR. HOLAHAN: Slide 16, please.

5 CHAIRMAN JACKSON: That's the answer, second
6 bullet.

7 MR. HOLAHAN: I thought I would cover some of
8 these through the presentation, then I have a list of things
9 that I don't think are quite covered in the presentation I
10 will try to address, okay?

11 One of the issues is the use and the relationship
12 between 1560 and other ongoing activities, and the insights
13 derived from the IPE program and the review of those IPEs
14 has been used in developing the regulatory guides. Although
15 much of what's in the regulatory guides is really regulatory
16 philosophy, you see a lot of the technology issues are dealt
17 with in the reference document NUREG-1602, and there are a
18 number of sections in 1602 that derive the technical
19 insights directly from the IPE program. So, in fact,
20 there's a lot of overlap between a few of the chapters in
21 NUREG-1560 and sections of NUREG-1602.

22 Not only did it give us ideas of what constitutes
23 state of the art, but it gives us an idea of the various
24 methodologies used by licensees. So that's reflected in
25 1602.

1 Neither 1560 nor 1602 are really the regulatory
2 guide. I think in the long-term, we'll consider 1560 to be
3 the counterpart to the IPE program. It's sort of the one-
4 time snapshot of the licensee's evaluation of those plants
5 and the summary of that activity is what's in 1560.

6 What was learned from that program I think will be
7 preserved in the regulatory guides and its reference
8 document, which is NUREG-1602; and I think as we learn more
9 about the technology and the state-of-the-art expanse, I
10 would expect that not to result in another version of 1560,
11 but perhaps a revision to NUREG-1602. So that -- and I
12 think in the long-term, as was mentioned yesterday by Tom
13 King, the staff is looking at the possibility of developing
14 industry standards on doing PRA type analysis, and that
15 would either take the place or reference a document, a
16 state-of-the-art document like 1602.

17 The 1560 insight document has provided information
18 for the staff for a number of uses, and I think I'll just go
19 ahead and cover that on slide number 17. Because there are
20 a number of follow-up activities.

21 As Mary mentioned, there were a number of plant
22 enhancements identified and modifications made as part of
23 the IPE program. Not all of them are called
24 vulnerabilities, but there were plant upgrades. But not all
25 improvements were made by all plants, and what we see from

1 looking at the document is there was a wide variety of
2 results and a variety of decisions that were made by
3 licensees as to what enhancements to put in place and which
4 ones not.

5 I think this raises the possibility that the staff
6 will look at those areas where some licensees decided that
7 an enhancement was, you know, a valuable contribution to
8 safety, but where the decision wasn't made on a comparable
9 plant, I think we want to back and understand why those
10 decisions were made. So that's one area where the IPE
11 program will be useful in identifying or screening for
12 potential safety issues.

13 I will go on and cover the other regulatory
14 activities as I go on.

15 One of the things we need to do is to take the IPE
16 results and look at them and identify what sort of areas do
17 we want to follow up on. I think you've heard a number of
18 discussions today that there's sort of the natural tendency
19 to say, well, if a plant is above ten to the minus four,
20 maybe we should look at it. But we've identified a slightly
21 different approach, which is -- and this is still on the
22 development, and I think we owe the Commission a paper on
23 how we're going to do this later in the summer. I think
24 it's August, July or August.

25 MS. DROUIN: September.

1 MR. HOLAHAN: Or even September.

2 And one of the things we've begun to think about
3 is since the reason we're looking at this is for potential
4 improvements to the plants, those improvements are really
5 made in specific areas and on specific issues. So the fact
6 that the core damage frequency, the total is high really
7 doesn't tell you what you want to know about whether an
8 improvement would be cost beneficial.

9 So what we decided to do is to pick a screening
10 criteria which is much closer to the regulatory analysis
11 guidelines for what you really want to know and what the
12 regulatory analysis guidelines say is if you can identify a
13 given issue or a given change to the plant which would
14 produce a ten to the minus five improvement, that would be a
15 substantial improvement. So that's the first screening
16 test.

17 So what we thought we would do is go back and
18 identify individual sequences above ten to the minus five
19 rather than a plant above ten to the minus four, because
20 those sequences might identify given pieces of equipment or
21 given procedures or activities where you might be able to
22 make improvement to drive the risk down.

23 Now, obviously the further above ten to the minus
24 five, the more potential for improvement there is. So
25 that's one of the places we'll start looking.

1 The others are in addition to using the numbers
2 that are in your report, I think we have to ask ourselves,
3 do I believe all of the numbers and should I be just using
4 those answers? So one of the things we'll be looking at is
5 the distribution of results. And when you page through the
6 insights report, you'll see on a class of plant sort of
7 basis, there's quite a lot of variability, one plant to
8 another, on both the risk and the large early release
9 frequencies.

10 So we will be looking at those outlier plants more
11 than those that tend to be sort of in the center of the
12 distribution and what we want to know is why the ones that
13 are high are high, are there really physical differences in
14 the plant or plant activities that are making it different
15 from other plants, because if there are things that many
16 plants can do and a few plants are not, then at least we
17 know that there are feasible changes or potentially
18 practical changes that could be made to those plants to make
19 them look like the others. So at least it's a screening
20 criteria to get a collection of plants and issues that can
21 be looked at.

22 Really what we're interested in is using this
23 information to make potential safety improvements if they
24 meet the backfit rule requirements for being substantial
25 improvements and justified by cost.

1 In addition to looking at the plants that appear
2 to be sort of higher than their counterparts, we're also
3 going to look at those that are quite a bit lower, and I
4 think what we hope to learn from that is either they have
5 some brilliant solutions to safety issues which I think we
6 would like to understand, or else there's something unusual
7 in their analysis that says maybe I ought not to believe
8 that they really are that different.

9 So I think we're going to look at the outlier
10 plants and the issues that are above ten to the minus five.

11 CHAIRMAN JACKSON: But it also implies, does it
12 not, that in looking at the outlier plants, you really have
13 to have an updated -- I mean, what you -- you know, if
14 you're relying on analysis that you told me is seven years
15 old, that presumably there could have already been changes
16 and updates to the analysis that would not have them be such
17 outliers.

18 MR. HOLAHAN: Yes.

19 CHAIRMAN JACKSON: Look at them as a crude screen
20 to start.

21 MR. HOLAHAN: Yes. Well, unfortunately, it's the
22 only database we have at the moment.

23 CHAIRMAN JACKSON: No, no, no. I agree with that.
24 When I say crude, I mean coarse screen.

25 MR. HOLAHAN: Yes. So I think we do understand

1 that.

2 CHAIRMAN JACKSON: Okay.

3 MR. HOLAHAN: What that means is that really it is
4 only the first step in the screening process.

5 CHAIRMAN JACKSON: Sure.

6 MR. HOLAHAN: And then I think, rather -- one of
7 the things we talked about was the difficulty of going back
8 to all licensees and asking for all of this information over
9 again, but, in fact, if there are a handful of plants and a
10 handful of issues, then we can go to the licensees and say,
11 "Does this really reflect your current understanding of the
12 plant?" And we can deal with a much smaller set of
13 information.

14 There is an additional item that we're interested
15 in following up on, and frankly we haven't cited exactly how
16 to deal with it, but we realize that the IPE program has
17 produced something I think somewhat unusual, which is the
18 plants that started this process meet their regulatory
19 requirements. The enhancements that they are making are
20 really beyond the minimum regulatory requirements, and
21 almost by definition, those are not controlled by any
22 regulatory process. In fact, there's nothing in the process
23 that says a licensee couldn't remove the enhancement they
24 put in a few years ago if they get tired of doing it next
25 year.

1 So what we see is we have a situation in which
2 there may be enhancements put in the plant which both we and
3 the licensees think were very worthwhile doing, and yet they
4 are possibly or maybe likely not to have been captured in
5 any way in the current licensing basis of the plant. So the
6 first step we want to do is go back and understand the
7 status of improvements put into the plant, and then I think
8 we have a regulatory decision to make or maybe even a policy
9 decision for the Commission to say once we understand what
10 these are, and if they are important safety issues, should
11 they be controlled by some sort of regulatory process?
12 Should they be listed in the FSAR, for example, and so
13 they're controlled by the 5059 process? Should the
14 Commission in fact require licensees to continue to provide
15 those enhancements?

16 So it's -- I think that's an issue that we're
17 going to need to come back to. It isn't clear at this stage
18 what we should do with it, but I think it's an important
19 issue that we need to follow up on.

20 Can I go to slide 8? In addition to finding
21 plants for which some safety enhancements may be worthwhile,
22 we may find some potential safety issues of a generic nature
23 that need attention.

24 Now, I think this is less likely than the plant
25 specific issues by the very nature of the IPE program. It

1 was by its nature the search for plant specific information
2 and we are more likely to find that it is plant specific
3 variations or plant specific features that are important or
4 should be required than we are likely to find, you know,
5 broad generic issues that need to be addressed.

6 Now, the reactor coolant pump seal issue I think
7 is a possible exception to that, although it's possible that
8 it may be more important on some plants than others and, in
9 fact, could be dealt with on a plant-specific basis. But it
10 is an example of an issue that does come up in a number of
11 the analyses, that it shows up to be important, and not just
12 in one place in IPE, but it shows up as being important in
13 the station blackout analysis and in a number of transients.
14 So it's one of the subject matters that we'll probably be
15 following up on.

16 COMMISSIONER DIAZ: Can I ask a question?

17 CHAIRMAN JACKSON: Please.

18 COMMISSIONER DIAZ: I'm just crying to understand
19 the depths of this. For example, you talk about BWR reactor
20 coolant pump seals. Are issues like, you know, stress
21 corrosion, cracking in recirculation lines in BWRs, which
22 used to be, you know, an issue we always talked about, will
23 that show up in this analysis?

24 MR. HOLAHAN: I don't think so. But it won't show
25 up because the analysis doesn't show it to be important. If

1 the analysis showed that this was a dominant issue on
2 boiling water reactors, then it will say -- well, I think
3 it's sort of the same as the station blackout issue. We
4 dealt with this years ago, but why is it still dominant?
5 But to the extent that things are not dominant, I think they
6 will pass by.

7 COMMISSIONER DIAZ: Okay.

8 MR. THADANI: I think that is a very important
9 question, I think, because it raises some other types of
10 issues because of the way the risk studies are actually
11 done, experiential database, and we've talked a little bit
12 about in-service inspection yesterday.

13 And since we're on the station blackout issue, as
14 you know, in the BWRs, the steam generator tube capability
15 at certain temperature and pressure conditions is also a
16 concern, an issue that is being studied currently as part of
17 the steam generator activity, and to the best of my
18 knowledge, and maybe Mary can correct me, I don't believe
19 any IPE or PRA has addressed that sequence potential for a
20 steam generator tube failure given high pressure, high
21 temperature conditions in the primary system.

22 CHAIRMAN JACKSON: Are you looking at ATWS?

23 MR. THADANI: ATWS is also one of the issues that
24 we're reassessing besides station blackout, yes.

25 COMMISSIONER DIAZ: But I think it is clear that

1 there are certain issues that are laying out there that have
2 not been addressed.

3 MR. THADANI: That's right. Yes.

4 COMMISSIONER DIAZ: Thank you.

5 MR. HOLAHAN: In addition to the potential
6 regulatory uses that I've discussed of the IPEs, I think
7 it's an important area where we can learn about issues that
8 need some research activities, and when something is
9 important in the IPEs, I think that -- in the PRAs that go
10 along with those, then I think those are areas where we may
11 want to make improvements and push the state of the art.

12 I think all these PRAs say that human analysis is
13 important and it's an important contributor to the
14 uncertainties as well. I think the research program already
15 recognizes that and I think this just reinforces, you know,
16 that additional work in that area is important.

17 Core damage prevention strategies -- for example,
18 the use of this information in severe accident management
19 guidelines or improving PRAs, I think as you mentioned
20 earlier, the -- for example, how core damage is modelled, I
21 think these are potential areas for research both sort of in
22 the basic research, understanding the phenomenon better, and
23 also in the modelling sense of including these in sort of
24 the state of the art of probabilistic risk assessment.

25 COMMISSIONER DIAZ: Excuse me. Does this mean

1 that the early containment failure you feel like has been
2 a "so" red and doesn't need to be considered as one of these
3 issues?

4 MR. HOLAHAN: Well, I think it depends on which
5 mechanism for early containment failure we're talking about.
6 I think some have -- some have been resolved fairly
7 convincingly, but I also go back to what Wayne Hodges
8 mentioned earlier in that in the level 2 analysis, I think
9 these analyses are not quite state of the art, and so I'm a
10 little bit reluctant to -- I think you want to draw what
11 information you can from them, but I would be a little bit
12 reluctant to have these analyses, which I think are behind
13 the state of the art, directing the research program. In a
14 sense, I think the research program has led our
15 understanding of core melt progression and containment
16 performance, and there probably isn't a lot from the IPES
17 that the research community doesn't already know.

18 COMMISSIONER DIAZ: Okay.

19 MR. THADANI: I think the only point I would make
20 would be the idea -- the two key elements: first,
21 prevention of core damage is fundamental; and second, do we
22 understand accident management enough to try and see if
23 molten material can be retained in vessel. I think those
24 are -- if we can come to some conclusion on that, that would
25 indicate the actual risk of public health and safety is much

1 lower than what we are calculating today with these models.

2 COMMISSIONER DIAZ: It certainly will relieve the
3 containment damage, yes.

4 MR. HOLAHAN: The last prepared section is the
5 fact that IPE results can be used to prioritize inspection
6 activities, not just in a broad sense, but also on a plant-
7 specific basis where there are sequences, equipment and
8 activities on a given plant that the licensee has identified
9 as important. I think these are clearly candidates for
10 increased inspection activity or focusing the existing
11 inspection activities.

12 CHAIRMAN JACKSON: Well, with respect to these two
13 bullets, I mean, to what extent have inspection activities
14 already been prioritized by risk?

15 MR. HOLAHAN: Well, I think as Mr. Callan
16 mentioned earlier, I think it's an ongoing process. I think
17 we've begun doing that.

18 CHAIRMAN JACKSON: Is there a guidance out there
19 to that effect? Is that part of some core -- I mean, how -
20 - what do you mean when you say you --

21 MR. HOLAHAN: Well, there is -- in the PRA
22 implementation plan, there is -- a folding of risk insights
23 into the inspection program is one of those activities, and
24 I think some of it has been done, but I think there is more
25 being planned, also.

1 CHAIRMAN JACKSON: Let's hear from Mr. Callan.

2 MR. CALLAN: Several of the major inspection
3 procedures, what I would call kind of the bread and butter
4 procedures that, for example, that the residents use, direct
5 residents, inspectors, to use risk insights to select smart
6 samples when selecting maintenance activities. Given the
7 range of maintenance that may be going on in a day, they
8 only have resources to look at maybe one or two items.
9 Operational activities. Every day, they have to triage what
10 they look at, what they get involved in, and risk insights
11 are used.

12 Of course, the issue is what I mentioned earlier,
13 Chairman, and that is that that presupposes that they have
14 the expertise, the sophistication to make wise choices.

15 CHAIRMAN JACKSON: In what they are making use of
16 in making those selections.

17 MR. CALLAN: Right.

18 CHAIRMAN JACKSON: What tools they're --

19 MR. CALLAN: Right.

20 CHAIRMAN JACKSON: Aside from their own
21 sophistication. Are they using PRAs or insights from IPES
22 or what?

23 MR. CALLAN: I'm going to have to give you
24 somewhat of a parochial perspective, a Region IV
25 perspective, but I think this is representative. I would

1 say essentially all the inspectors, all the residents and
2 region-based inspectors have undergone at a minimum the
3 three-day PRA course, most of them the one-week course, and
4 several the two-week. So they've all been trained and they
5 all -- I won't say all -- most residents' offices will have
6 the IPE on their bookshelf available to them.

7 CHAIRMAN JACKSON: Five years old though it may
8 be.

9 MR. CALLAN: Yes. But I suspect, though, that
10 most savvy residents tap into the licensee's risk process.
11 Some have risk meters, as you know, and other similar types
12 of methods for monitoring risk day to day and during
13 outages, and I think most inspectors will in a sense
14 plagiarize or use that information. It's --

15 CHAIRMAN JACKSON: But at this point, we can't --
16 in the sense of the bullets on the slide, we haven't started
17 doing it totally systematically and there's not consistent
18 guidance out there.

19 MR. THADANI: That's correct. Initial guidance
20 has been provided through our inspection branch in NRR
21 actually, and the two activities underway, as Gary
22 mentioned, one is revision of manual chapter 1145 that's
23 going to include what I would call much more detailed
24 guidance on the use of risk insights. In parallel, AEOD is
25 working on training aspects and there is a pilot course

1 that's being developed. I believe it's going to be -- it's
2 going to be resource intensive, I think, about two-and-a-
3 half weeks long probably. That pilot I believe is within -
4 - it's either this month -- later this month, I think, and
5 by the end of September, I think, we're supposed to finalize
6 that course and start giving it to people.

7 I think that will go a long way towards at least
8 addressing the concern that Joe, Joe Callan raised. One has
9 to be savvy. You can't just give insights.

10 CHAIRMAN JACKSON: You're going to focus it on
11 inspectors?

12 MR. THADANI: Yes. That's part of the objective
13 of the course.

14 CHAIRMAN JACKSON: Okay.

15 MR. THADANI: And it will include reviewers as
16 well, yes.

17 MR. CALLAN: Let me give you a candid perspective,
18 and it's somewhat parochial, as I said. In general, though,
19 the licensees that the inspectors deal with are more
20 sophisticated than the inspectors are and more -- in terms
21 of use of PRA, and so in a sense, the NRC is at a
22 disadvantage in using this methodology and engaging
23 licensees on issues. They can bring more resources to bear,
24 more expertise to bear in rebutting an NRC perspective, and
25 that's a source of frustration. You know, you all visit the

1 regions and interact with regional staff; you probably sense
2 that from your interactions. There is that -- something
3 that may be approaching an inferiority complex in this area.

4 COMMISSIONER ROGERS: On the other hand, they have
5 the licensee's PRA as a working document to look at and
6 guide their own inspection activities and leave it to --

7 MR. CALLAN: That's right, but there are, what, 75
8 stations or something like that, and each one of them
9 probably has in-house PRA capability that equals that of the
10 NRC. Each one of them.

11 COMMISSIONER ROGERS: Oh, yes.

12 MR. CALLAN: And exceeds that of any given region
13 by far. So --

14 CHAIRMAN JACKSON: Well, I think that it's a
15 comfort level, too, that I'm hearing and until and unless
16 people, particularly the inspectors, have this systematic
17 baseline training, there's going to be an extent to which
18 the comfort is not going to be there.

19 MR. HOLAHAN: I'll just summarize to say that what
20 I've given you is some examples of the use of the follow-up
21 on the IPE program. I guess the bottom line is really staff
22 intends to use the IPEs like other PRA information to focus
23 our activities on what's most important in a number of
24 areas.

25 Now, I did write down one question earlier and

1 we'll see how far we can go in addressing it, and that is -

2 -

3 CHAIRMAN JACKSON: You've got two minutes.

4 MR. HOLAHAN: Two minutes? Okay. Good.

5 How far will we go towards answering the question
6 of whether these plants exceed the safety goal or not, and I
7 think we will be addressing that at least in an indirect
8 way, and it's not exactly clear to me whether what we're
9 doing will completely answer that question.

10 When we look at plants that might have some
11 outlier issues, clearly plants that have large early
12 releases above ten to the minus five as Mary mentioned as a
13 sort of a screening tool, those will be captured. I think
14 it's pretty clear that plants there and the issues that
15 drive them there will be captured for our screening
16 analysis.

17 That will force us to go through additional
18 analysis. If you recall how the regulatory analysis
19 guidelines are established, there's a screening test that
20 looks at core damage frequency and conditional containment
21 failure probability. Those two together are somewhat
22 comparable to large early release frequencies. I think
23 these 14 plants will be captured as -- the issues that drive
24 them I think will pass that screening criteria.

25 The next stage is to do a value impact analysis.

1 That is, after you go back to the licensee, to say, are we
2 really dealing with the right set of facts today? Then
3 after that comes a value impact analysis, and that value
4 impact analysis goes all the way to dose, and in that sense
5 it is a level 3 analysis capable of comparison with a safety
6 goal.

7 What I would think is that it's likely that plants
8 that have large early releases which result in doses as high
9 as, you know, some early fatalities will be candidates for
10 some improvements. If those improvements can be made at a
11 small or moderate cost, then I think the staff will just --
12 we'll deal with those on a plant and an issue basis.

13 Now, it seems to me that it is possible that there
14 will be some plants which are found to exceed the safety
15 goal but for which the staff and the licensee can't identify
16 any let's say what's obviously cost beneficial or cost
17 justified remedy to that situation.

18 Now, I think those are situations that might have
19 to be brought back to the Commission to decide what does it
20 really mean to have a plant which, you know, through further
21 analysis appears to exceed its goal but for which the staff
22 doesn't have any obvious remedy to the existing
23 requirements.

24 I think partly that's a policy question because
25 the original safety goal policy of the Commission was not

1 that all plants should meet this, but that the industry as a
2 whole. And I think it may -- perhaps it shouldn't be too
3 surprising that, you know, some of the students are below
4 average. But I think that may be a situation that we'll
5 have to deal with sort of at a later stage of this follow-
6 up activity.

7 MR. THADANI: In fact --

8 CHAIRMAN JACKSON: Thirty seconds.

9 MR. THADANI: I think, in fact, it's very
10 important to know that the Commission gave strict direction
11 to the staff when we were looking at advanced lightwater
12 reactors that the staff should not impose requirements
13 beyond what could be justified in meeting the safety goals.
14 So on advanced lightwater reactors, while the real risk is
15 lower, but the staff requirements were based on not going
16 beyond the safety goal for advanced lightwater --

17 COMMISSIONER ROGERS: Well, there was some body
18 language in that and there was an expectation.

19 MR. THADANI: That's right.

20 COMMISSIONER ROGERS: There was an expectation
21 that the design would lead to results which were --

22 MR. THADANI: Yes.

23 COMMISSIONER ROGERS: -- about an order of --

24 MR. HOLAHAN: Yes.

25 COMMISSIONER ROGERS: -- magnitude better than the

1 current designs without explicitly referring to the safety
2 goals.

3 MR. THADANI: That's how containment performance
4 goal was derived, actually.

5 CHAIRMAN JACKSON: Any further questions?

6 COMMISSIONER ROGERS: Do you mean on the whole
7 thing?

8 CHAIRMAN JACKSON: Yes. We're about to --

9 COMMISSIONER ROGERS: Yes. Sure.

10 CHAIRMAN JACKSON: We've been here for two hours.

11 COMMISSIONER ROGERS: A couple. I'll try not to
12 take too much longer.

13 You brought up the observation that the scope and
14 boundary conditions were really very important in giving
15 rise to differences between plants that were otherwise
16 perhaps rather similar to each other in terms of the -- I
17 mean, that's what I read into what you were saying, that
18 because the licensees picked the scope and boundary
19 conditions in doing the PRAs, therefore you get somewhat
20 dissimilar results, somewhat dissimilar results for
21 otherwise similar plants.

22 So I wonder if the next -- what thinking there is
23 in trying to go back and encourage some kind of uniformity
24 on that basis if PRAs are going to be used for other
25 purposes in the future so that we're taking a step or

1 encouraging a step to go towards a more standardized
2 approach? It wouldn't totally standardize how they did
3 their PRAs, but at least those key items of scope and
4 boundary conditions might be -- might help to bring things
5 into much closer conformity.

6 MS. DROUIN: And I certainly think it would, but I
7 think, you know, you also have to ask the question, you
8 know, given what application and everything, how much of
9 that you really want to do.

10 The other thing I would also -- trying to
11 translate what you said, I don't want you to be misled that
12 the variability is completely driven by the scope.

13 COMMISSIONER ROGERS: No, I understand.

14 MS. DROUIN: You will not -- you will always see
15 variability in these results because the plants do look
16 different.

17 COMMISSIONER ROGERS: Yes.

18 MS. DROUIN: I just didn't want to say that it's
19 completely caused by plant design differences.

20 COMMISSIONER ROGERS: But it may be very important
21 in trying to arrive at something that's a little closer to a
22 common approach in getting at a bottom-line number.

23 MS. DROUIN: Right. But I just think you're going
24 to have to start thinking about, you know, the application
25 and the uses in determining what that standard should be or

1 if it should be one.

2 COMMISSIONER ROGERS: Yes.

3 MR. HOLAHAN: I think in the guidance documents,
4 we tried to have some balance between the obvious desire for
5 high quality, consistent analysis and to allow licensees the
6 flexibility to use what they currently have as opposed to
7 having to wait until they have something else.

8 COMMISSIONER ROGERS: Yes.

9 MR. HOLAHAN: One would hope that licensees sort
10 of figure out that the reviews are simpler on the staff's
11 part and they're going to get more benefit from having a
12 more of the state-of-the-art analysis tool, but, you know,
13 we didn't draw our line in the sand to say if you don't have
14 this tool, you can't play.

15 COMMISSIONER ROGERS: Well, I just would remind
16 everybody that when we started out with the safety goals,
17 what they were designed to do, to make a very important
18 statement about average expectation; and now if we
19 substitute a surrogate for a safety goal, for a health
20 effect safety goal, and then start to look very carefully
21 and get very concerned if somebody doesn't quite meet that,
22 that's a change in point of view. I think that the
23 Commission ought to keep that in mind in looking at how far
24 we want to go, because the safety goals were regarded as a
25 definition of how safe is safe enough. That was really

1 where we came down on that issue.

2 The other point is a rather small one, but I just
3 think that in talking about numbers, we ought to be a little
4 bit more careful about how we throw them around. I happen
5 to disagree with you when you say 4.1 -- I mean, I can't
6 disagree with what you said as to how you would interpret
7 it, but, you know, to me, 4.1 times anything tells me that
8 in general practice, that's probably between 4.06 and 4.14
9 and not something else.

10 I think that there's a sloppiness here, not just
11 on our part, but there's an inconsistency with respect to
12 how we state these numbers and then how we look at
13 uncertainties and, you know, it's really quite sloppy. I
14 think that it would be well to try to exercise some
15 influence on a uniform approach to stating numbers.

16 You know, there are standards that people do apply
17 in this business -- maybe not in PRA, but in other
18 scientific endeavors -- where when you state a number and
19 it's got no decimal point after it, it means something, and
20 when it's got a decimal point after, it means something
21 else, and the number of figures after the decimal point
22 means something else.

23 I think we ought to revert back to standard
24 scientific practice here and try to see that there aren't a
25 lot of numbers floating around that really don't make a lot

1 of sense when you consider the uncertainties in them.

2 CHAIRMAN JACKSON: I agree with you, Commissioner
3 Rogers, completely, but I think the only way that one is
4 going to get at it in a realistic and honest way is to
5 finally grapple in the best way we can, with the state of
6 the art being whatever it is, with the uncertainty issues
7 and the confidence issues. They come up, Commissioner
8 McGaffigan raises them, I raise them in every meeting, but
9 the numbers in and of themselves don't mean anything if you
10 don't know something about the probability distributions on
11 which they're based, how those uncertainties and so forth
12 have been propagated through the calculation and that you
13 come out with a number that you can say with some certainty,
14 with a certain degree of confidence. If you don't do it
15 that way, none of the discussion makes sense.

16 So, you know, you can multiply .41 times .25 times
17 whatever and you can come out with a number. It doesn't
18 make any sense in this kind of context except in some very
19 generalized way. And, you know, I'm sure that Mr. Holahan
20 needs no defense, but I think that is the sense in which he
21 gave the wide range in terms of what he thought a particular
22 number meant.

23 COMMISSIONER ROGERS: Well, I certainly quite
24 agree with you, but I think the point is that, you know,
25 your final observation that, you know, it -- those numbers

1 don't make a lot of sense only within a certain kind of
2 range and we have to say that. I mean, that has to be part
3 of the statement.

4 CHAIRMAN JACKSON: I think that is, in fact,
5 covered, I hope, you know, at least in words, in your guides
6 document subject to more fleshing out in the public comment
7 process.

8 MR. THADANI: It is covered in the guides.

9 Yes, I do want to comment. There are certain
10 elements that one can develop distributions about, one can
11 talk about confidence levels. There are certain types of
12 uncertainties that you can quantify; others you cannot
13 quantify.

14 COMMISSIONER ROGERS: Yes.

15 CHAIRMAN JACKSON: That's right:

16 MR. THADANI: I think the comment you're making is
17 whatever the scope and the level of analysis when you're
18 describing a quantitative measure, you have to say it at the
19 same time with those boundary conditions around that.

20 CHAIRMAN JACKSON: That's correct.

21 MR. THADANI: And I think we need to --

22 CHAIRMAN JACKSON: I think that's what --

23 MR. THADANI: We're trying to do that.

24 CHAIRMAN JACKSON: That's why Commissioner
25 McGaffigan keeps asking you what do you mean by the

1 difference between 4.0 ten to the minus five and 4.1 ten to
2 the minus five.

3 MR. THADANI: We're making -- that's an effort
4 that's reflected I think in the guides. We're trying to do
5 that.

6 COMMISSIONER ROGERS: Yes.

7 MR. HOLAHAN: I think we have a -- we have a real
8 notation problem.

9 COMMISSIONER ROGERS: Yes.

10 MR. HOLAHAN: I think normally two digits are
11 carried in PRAs not because you believe, you know, plus or
12 minus that second digit, but it's not unusual to come to a
13 circumstance where you want to subtract one number from
14 another, and without two digits, you sort of don't know
15 where you are.

16 The other thing is without that rounding the
17 numbers off, some -- it sometimes makes it difficult to
18 understand exactly where the number came from. And to a
19 certain extent, in my view, that second and sometimes even a
20 third digit are just a way of telling you, well, it's these
21 two numbers added together. You say, ah, okay, now I
22 understand how you got that number. So it's an identifier.

23 COMMISSIONER ROGERS: That's a fair comment.

24 MR. HOLAHAN: But the idea that we don't express
25 --

1 CHAIRMAN JACKSON: Okay. I think we've said
2 enough.

3 Commissioner Dicus?

4 COMMISSIONER DICUS: No questions.

5 CHAIRMAN JACKSON: Commissioner Diaz?

6 COMMISSIONER DIAZ: Let's see. There's a quote
7 from a philosopher that says the road to knowledge always
8 crisscrosses the unknown, and I can't remember who wrote
9 that, but it's a very old thing. I think the staff has made
10 a very deliberate attempt this week to provide us with
11 information, what they know, and also what they don't know,
12 and I think that's very important and I want to thank you
13 for that.

14 I think everybody realizes and keeps commenting
15 that all these issues are linked together. I think we need
16 to recognize the fact that, before my time, at least, the
17 Commission has recognized the importance of this issue, has
18 accelerated the process to bring them to some closure, and I
19 think the staff has captured that guidance and that drive.

20 Saying that, I would like to say that I think it's
21 important that in every one of these projects, we come to
22 some closure, even if it's step-wise and even if it
23 recognizes that it is, you know, a step, because if not, you
24 know, we can go on and continue forever and never, never
25 stop. So I think it's important that we --

1 CHAIRMAN JACKSON: That's right.

2 COMMISSIONER DIAZ: -- close the issues.

3 I have one comment which I don't know whether it's
4 appropriate or not. When we put this database in the
5 Internet and so forth and the fact that the information has
6 not been updated, it might not be a bad idea to suggest to
7 the licensees that on a voluntary basis, they can access
8 their own information and update it. It might be a very,
9 very simple way of getting additional information. You
10 know, we'll protect our own database, but if they can
11 actually go in there, they -- probably people that love to
12 cruise the web might be able to give us some information on
13 that.

14 The last point, I want to express some concerns,
15 and this has been something that has been mounting, is on
16 the capabilities of the regions to practice these issues,
17 and I think that we must realize that no matter what
18 technique we develop, unless they are, you know, implemented
19 at the region, we're just really a lot of bang -- a lot of
20 noise and no bang. So I would like to stress that we need
21 to move almost in parallel.

22 CHAIRMAN JACKSON: I agree with that completely.

23 COMMISSIONER DIAZ: Thank you.

24 CHAIRMAN JACKSON: Commissioner McGaffigan.

25 COMMISSIONER MCGAFFIGAN: I have expressed my

1 uncertainties about the uncertainties often enough. I think
2 I'll just pass.

3 CHAIRMAN JACKSON: Thank you.

4 COMMISSIONER MCGAFFIGAN: They have a very
5 difficult job ahead of them.

6 CHAIRMAN JACKSON: Exactly.

7 And I would like to thank you very much for a very
8 informative and candid briefing on the insight program, and
9 I think you've heard all of us commending you for the
10 progress you've made.

11 I'm pleased that you've identified a number of
12 follow-up activities related to the IPE program bearing in
13 mind what Commissioner Diaz had to say about coming to
14 closure on step-wise basis, and I'm particularly interested
15 in the use of IPE results to assess the regulatory
16 effectiveness of major safety issue resolution or at least
17 what the crossing has been, and just to get a readout and
18 understand where we are.

19 I think it's very important, the issue of
20 prioritization with respect to inspection activities,
21 including the training of the inspectors and the development
22 of the other regional capabilities on an expedited basis.
23 You mentioned having the senior reactor analysts and sort of
24 some wrinkles with getting them out, but if there's a need
25 -- if there's a way to accelerate and get a bigger bench to

1 start with, then we need to think about that.

2 You mentioned the station blackout rule today and
3 we talked about some others, and I believe you're also
4 considering the regulatory effectiveness of the ATWS rule.
5 I would expect that the regulatory effectiveness
6 organization, including the Office of Research, will be
7 involved in these activities?

8 MR. THADANI: We will be in all the activities
9 we've been talking about.

10 CHAIRMAN JACKSON: And from the standpoint of
11 regulatory effectiveness, I would encourage your continued
12 focus on, you know, this particular aspect of the use of IPE
13 insights as we transition into the risk informed framework
14 and in terms of what you might contemplate. I think it
15 would be appropriate for you to inform the Commission of
16 your scope and schedule of activities.

17 Then the last area I wanted to look -- and it does
18 relate again to the closure and it overlaps with the others.
19 You know, it's one thing to talk about using the IPE
20 insights in a regulatory effectiveness framework; another is
21 what -- a separate is what I'd call regulatory creep in the
22 use of IPEs.

23 Now, I'm interested in this tracking of all the
24 regulatory uses we've made of IPE insights and how we intend
25 to move from that to the risk informed framework based on

1 the newer guidance documents, because you have heard the
2 admonishment from Commissioner Rogers repeatedly that the
3 IPEs have a certain purpose.

4 The PRAs were a tool for achieving that purpose,
5 but now we've laid out some guidance relative to PRAS and
6 their regulatory use, and we want to ensure that that's
7 where we're going and that we don't misuse what we started
8 with, but what we do is referenced even as we look at what
9 else we can glean.

10 So unless there are any further comments, we're
11 adjourned.

12 [Whereupon, at 4:20 p.m., the briefing was
13 adjourned.]

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CERTIFICATE

This is to certify that the attached description of a meeting of the U.S. Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON IPE INSIGHT REPORT -
PUBLIC MEETING

PLACE OF MEETING: Rockville, Maryland

DATE OF MEETING: Wednesday, May 7, 1997

was held as herein appears, is a true and accurate record of the meeting, and that this is the original transcript thereof taken stenographically by me, thereafter reduced to typewriting by me or under the direction of the court reporting company

Transcriber: Rosalie Johnson

Reporter: Mark Mahoney



*United States
Nuclear Regulatory Commission*

INDIVIDUAL PLANT EXAMINATION PROGRAM: PERSPECTIVES ON REACTOR SAFETY AND PLANT PERFORMANCE

NUREG-1560, Draft Report for Comment

Commission Briefing

May 7, 1997

Ashok Thadani
Office of Nuclear Regulatory Research

Gary Holahan
Office of Nuclear Reactor Regulation

Mary Drouin
Office of Nuclear Regulatory Research

OUTLINE

- Background and History
- IPE Program and Status
- IPE Insights Report (NUREG-1560)
- IPE Insights Report Public Workshop
- NRC IPE Follow-Up Activities

BACKGROUND AND HISTORY

SEVERE ACCIDENT POLICY STATEMENT (August 8, 1985)

- *"Commission concludes....that existing plants do not pose an undue level of risk to the public."*
- *"Commission plans....an approach for a systematic safety examination....to determine whether.... particular vulnerabilities are present and what cost-effective changes are desirable."*

GENERIC LETTER 88-20 (November 23, 1988)

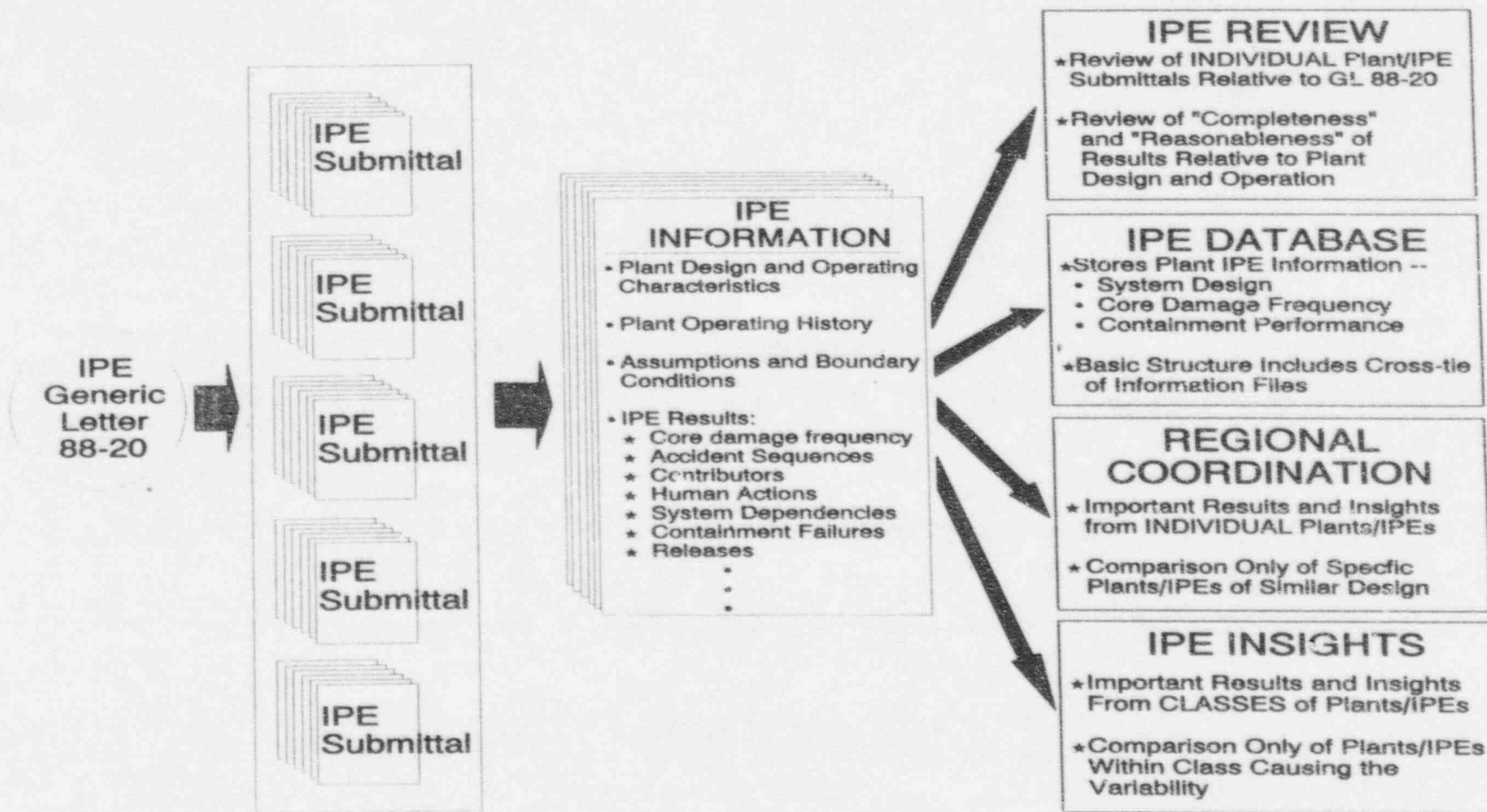
- Each plant to look for vulnerabilities to severe accident and cost-effective safety improvements that reduce or eliminate the vulnerabilities and report the results to the Commission

BACKGROUND AND HISTORY (continued)

Four Specific Objectives Provided for Each Utility:

- (1) Develop an appreciation for severe accident behavior
- (2) Understand the most likely severe accidents
- (3) Gain a more quantitative understanding of probabilities of core damage and radionuclide releases
- (4) Reduce probabilities by modifying hardware or procedures

IPE PROGRAM



IPE PROGRAM STATUS

- **IPE REVIEW** — Staff evaluation reports issued (to NRR) on all IPE submittals except five,
- **IPE DATABASE** — Database complete and available to public (on NRC Web page), Federal Register notice issued
- **IPE REGIONAL COORDINATION** — Briefings performed on over 50% of IPEs, and detailed briefing on global insights at each region
- **IPE INSIGHTS REPORT (NUREG-1560)** —
 - Draft published for public comment (October 1996)
 - Comments received from over a dozen utilities, each owner's group, Nuclear Energy Institute and other members of the public
 - Public workshop held in April 1997 with an attendance of approximately 100
 - Final report to be issued in 1997 (public comment period ends May 9, 1997)

NUREG-1560 -- PERSPECTIVES PROVIDED ON

- (1) The impact on reactor safety
- (2) Reactor design, containment performance and operational significant features versus significant analytical factors relative to core damage, containment performance, radionuclide releases
- (3) The different methods and models developed and quantified in performing the IPEs
- (4) The implication of the IPE results relative to the Commission's Safety Goals and the Station Blackout Rule

SCOPE AND LIMITATIONS OF NUREG-1560

- Perspectives presented on a per unit basis, 75 IPE submittals covering 108 units
- Perspectives based on scope of IPEs (Level 1/2 PRAs at full power considering internal events)
 - ⇒ Level 3 (offsite health effects), low power and shutdown conditions, and external events not usually addressed
- Perspectives based on original licensee submitted information (updated licensees' analyses not included)
- "Accuracy" of information not addressed in staff reviews or NUREG-1560

NUREG-1560: PERSPECTIVES ON REACTOR SAFETY

- Among the licensees, few "vulnerabilities" identified
 - All licensees identified plant improvements
 - Majority of plant improvements address loss of power concerns
 - Approximately 50% of improvements implemented (at time of IPE submittals)
 - Licensees generally developed in-house capability with an increased understanding of PRA and severe accidents
 - IPE Program served as a catalyst for further improving the overall safety of nuclear power plants
- ⇒ IPE results and insights serve as input to Accident Management

NUREG-1560: PERSPECTIVES ON REACTOR DESIGN, CONTAINMENT PERFORMANCE AND HUMAN ACTIONS

- Plant-specific design features play a major role in the variability
 - ⇒ Plant-specific support systems determining contributors
- Differences in scope, boundary conditions and assumptions also play a significant part
- Station blackout and transients the dominant contributors
- Identification of important human actions more subject to analysis rather than plant design
- Manual depressurization (BWRs) and switchover to recirculation (PWRs) the top human actions

NUREG-1560: IPE MODEL/METHODS PERSPECTIVES

- Analytical methods well established, for example:
 - Systems analysis
 - Accident sequence analysis
 - Data and common cause analysis
 - Plant damage state analysis
 - Containment event tree analysis
- **However**, Implementation of the methods inconsistent, for example:
 - Systems analysis — Large variability in analyst's scope, boundary conditions and assumptions
 - Data and common cause analysis — Large variability in data identification and definition, and therefore, data collection and quantification
- Human Reliability Analysis —
 - Inconsistency in identification and selection of human actions
 - Inconsistency in implementation of the current methods
 - Certain types of errors not covered by the current methods

NUREG 1560: IPE RESULTS COMPARED TO COMMISSION'S SAFETY GOALS

*IPEs — Internal Events at Full Power Looking at Core Damage and
Containment Performance Only, Based on Point Estimates*

Subsidiary Objectives —

- Core damage frequency for all BWRs and most PWRs fall below the $1\text{E-}4/\text{ry}$
- Conditional containment failure probability
 - For early failure: for most PWRs falls below the 0.1 and for most BWRs is above the 0.1
 - For containment bypass for most plants falls below the 0.1

NUREG 1560: IPE RESULTS COMPARED TO COMMISSION'S SAFETY GOALS (continued)

*IPEs — Internal Events at Full Power Looking at Core Damage and
Containment Performance Only, Based on Point Estimates*

Quantitative Health Objectives — *[Based on staff extrapolation]*

- Risk levels for all plants below the latent cancer objective (risk not to exceed 0.1% of total within 10 miles)
- Risk levels for most plants below the early fatality objective (risk not to exceed 0.1% of total within 1 mile)
- Fourteen plants may approach the individual early fatality objective

NUREG-1560: IMPACT OF STATION BLACKOUT RULE ON CORE DAMAGE FREQUENCY

- Variety of coping methods used (e.g., adding diesel or gas turbine, extending battery life)
- Only around 15% of the licensees reported the station blackout frequency before and after implementing the rule
 - Average reduction of $2E-5/ry$
- For those licensees that had implemented the Station Blackout rule, most plants meet the station blackout goal
- For a few plants, the station blackout core damage frequency is above the $1E-5/ry$ goal (at the time of the IPE submittal)

NRC-IPE PUBLIC WORKSHOP

- Attendance by various utilities, all the owner's groups, EPRI, and NEI
 - General consensus that NUREG-1560 contains a wealth of information, was comprehensive and thorough
 - General concern that the information in NUREG-1560 is out-of-date since many utilities have updated their PRAs
 - General concern relative to what and how the NRC plans to use NUREG-1560
- ⇒ NUREG-1560 will be revised based on "editorial" comments and appendices added addressing:
- (1) Source of IPE information
 - (2) Citing updated information provided by licensees
 - (3) Summary of public comments and staff response

STAFF USE OF IPE INFORMATION INCLUDING NUREG-1560

- NUREG-1560 —
 - Supported development of risk-informed regulatory guides
 - Not regulatory guidance
 - Provide information source for staff in plant-specific reviews
- IPE Follow-up

NRC IPE FOLLOW-UP ACTIVITIES

- Potential Safety Enhancements
 - Evaluate for potential safety enhancements or other regulatory follow-up actions
 - Identify selection criteria (e.g., plants with core damage frequency sequences greater than $1\text{E-}5/\text{ry}$)
 - Perform formal backfit analysis (50.109)
- Determine status of plant improvements described by licensees in the IPE submittals
- Consider appropriate regulatory follow-up (e.g., relationship to current licensing basis)

NRC IPE FOLLOW-UP ACTIVITIES

- Potential Safety Issues (e.g., PWR reactor coolant pump seal LOCAs)
- Assess Potential Areas for Research
 - Improved modeling of human actions
 - Core damage prevention strategies
- Prioritize inspection activities based on risk significance
 - Identify component and human actions with high impact on core damage frequency
 - Identify systems with poor reliability that impact core damage frequency