

ACRST-2094
Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Joint Meeting: Materials and Metallurgy &
Severe Accident Subcommittees

Docket Number: (not applicable)

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Location: Rockville, Maryland

Date: Wednesday, March 5, 1997

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Work Order No.: NRC-1034

Pages 263-390

9703100287 970305
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1 UNITED STATES OF AMERICA
2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

6 JOINT MEETING

7 MATERIALS AND METALLURGY

8 AND

9 SEVERE ACCIDENT SUBCOMMITTEES

10 + + + + +

11 WEDNESDAY

12 MARCH 5, 1997

13 + + + + +

14 ROCKVILLE, MARYLAND

15
16 The Subcommittees met at the Nuclear
17 Regulatory Commission, Two White Flint North, Rom T2B3,
18 11545 Rockville Pike, at 8:30 a.m., Robert L. Seale,
19 Chairman, presiding.

20 MEMBERS PRESENT:

21	ROBERT L. SEALE	CHAIRMAN
22	MARIO H. FONTANA	MEMBER
23	THOMAS S. KRESS	MEMBER
24	DANA A. POWERS	MEMBER
25	WILLIAM J. SHACK	MEMBER

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1 ACRS STAFF PRESENT:

2 Noel Dudley

3 Richard P. Savio

4 Sam Duraiswamy

5 Michael Markley

6 Paul Boehnert

7

8 ACRS CONSULTANT PRESENT:

9 Ivan Catton

10

11 ALSO PRESENT:

12 Jack Strosnider

13 Brian W. Sheron

14 Joseph Donoghue

15 Steve Long

16 Tim Reed

17 Jim Myer

18 Rick Mullins

19 Joram Hopenfeld

20

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A-G-E-N-D-A

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P-R-O-C-E-E-D-I-N-G-S

(8:34 a.m.)

CHAIRMAN SEALE: The meeting will now come to order. This is the second day of the meeting of the ACRS Joint Subcommittees on Materials and Metallurgy and Severe Accidents. I'm Robert Seale, Chairman of the Subcommittee.

The ACRS members in attendance are: George Apostolakis, Mario Fontana --

MEMBER FONTANA: George is not here yet.

CHAIRMAN SEALE: That's right. George isn't here. I'm sorry.

Tom Kress, Dana Powers, and William Shack. The ACRS Consultant in attendance is Ivan Catton. That's an old echo, isn't it? Eight years old.

The purpose of this meeting is to hold discussions with representatives of the NRC staff to gather information concerning the technical basis and regulatory analysis associated with the steam generator tube integrity rule and related regulatory guide.

The subcommittee will gather information and analyze relevant issues and facts and formulate proposed positions and actions as appropriate for deliberation by the full committee.

Noel Dudley is the Cognizant ACRS Staff

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1 Engineer for this meeting.

2 The rules for participation in today's meeting
3 have been announced as part of the notice of this meeting
4 previously published in the Federal Register on February
5 14, 1997. A transcript of the meeting is being kept and
6 will be made available as stated in the Federal Register
7 notice.

8 It is requested that the speakers first
9 identify themselves and speak with sufficient clarity and
10 volume so that they can be readily heard.

11 We have received no written comments from
12 members of the public. One individual has requested time
13 to make an oral statement at the end of the meeting.
14 Today the committee will hear from the staff and its
15 contractor regarding the regulatory analysis.

16 As I indicated to the members of the
17 subcommittee yesterday, we have a reprise of prior
18 comments in this general area based on our letter -- or
19 our report of November 20th and other -- well, the minutes
20 of the January 9, 1997 subcommittee meeting, and the
21 November 5th and 6th subcommittee meeting, and a meeting
22 back in June 3rd and 4th; also some comments from
23 discussions of SCDAP/RELAP5 code.

24 We want to go over those comments today toward
25 the end of the meeting to determine which ones of them are

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1 still appropriate. Some of them, I think, are moot as a
2 result of the position that the staff has outlined to us.
3 We'd also like to get a little bit more specificity as to
4 where the staff expects to go from here from them later on
5 today.

6 We don't have a meeting with the full
7 committee scheduled for this -- for later this week.
8 There is a meeting scheduled -- or presentations scheduled
9 in the April meeting of the full committee. So we won't
10 be having a letter coming out at this time, but we will be
11 having one shortly.

12 With that, I'll call on Mr. Tim Reed, the
13 Office of Nuclear Regulation, to give us the second half
14 of his marathon, I guess, after the presentation that Joe
15 gave us yesterday.

16 MR. REED: Yes, I guess actually I had
17 finished my presentation yesterday, but there were some
18 comments from Dr. Powers. So what I plan to do is go back
19 to the real guts of the presentation. And the contractor
20 is here today; hopefully can answer your questions.

21 Get you back -- rebaseline you here. This is
22 where we started getting into the details of it. This is
23 the general net value equation that was used with the five
24 values and the two costs.

25 As I mentioned, three costs -- three values

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1 dominated the calculation, those involving avoided public
2 risk, avoided offsite property risk, and avoided onsite
3 financial risk. And then the two costs -- of course, the
4 cost to the licensee is dominant in that equation.

5 The real questions then started with slide
6 number 11.

7 I believe, Dr. Powers, your question was with
8 regard to the use of the SST1 value and, you know,
9 basically how we were using it to take the Surry answer
10 and translate it into the other 73 PWR's. I'll just let
11 you -- if you want to go through your questions, I have
12 Jim here to --

13 MEMBER POWERS: Well, if you were calibrating
14 the consequences against the analysis for a particular
15 plant, you would just take source term divided by source
16 term and not multiply by the ratio of the power level.
17 If, on the other hand, SST1 sub Surry is some arbitrary
18 source term applied to the Surry site compared to the same
19 source term applied to the Ith site, then you need to put
20 the power ratio in.

21 MEMBER KRESS: If the source term is presented
22 as fraction of inventory. That's what they meant by
23 source term.

24 MEMBER POWERS: No, it's consequences
25 actually. These are -- in fact, I think they said in the

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1 presentation yesterday they were latent fatalities which a
2 little bit surprised me because I thought that prompt
3 fatalities were more limiting.

4 But be that as it may, the question really
5 boils down to what's the first ratio and why does it have
6 to be multiplied by the power ratio?

7 MR. MYER: This is Jim Myer from Sciencetech. I
8 think I can answer that question.

9 The original NUREG/CR-2239 was an analysis at
10 each site at a given -- I believe it was 3,500 megawatt
11 power level.

12 MEMBER POWERS: Jim, that's the siting study?

13 MR. MYER: That's the siting study. It was
14 done by Dave Aldrich at Sandia.

15 And we normalized the analysis at each site
16 assuming a conditional consequence at Surry and then going
17 to that document to determine the ratios both of power
18 level and of site characteristics to properly accommodate
19 the fact that the SST1 study was done for a nominal 3500
20 megawatt plant.

21 And then properly ratio'd it for each unit,
22 the difference in power level which, of course, is then a
23 radiation source term and the difference in the
24 demographics and the weather and the population.

25 MEMBER POWERS: So my understanding is that

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1 the first ratio really speaks to the characteristics of
2 the site, and the second ratio speaks to the
3 characteristics of the reactor?

4 MR. MYER: That's correct.

5 MR. REED: Did you have any other questions
6 from yesterday that I can go through?

7 MEMBER POWERS: Not on that ratio.

8 MR. REED: Okay. Let me just draw up the next
9 equations and see if -- several slides and see if that --
10 if you recall. I'm actually today not recalling any
11 questions on these.

12 Same ratios being used here to take averted
13 offsite damage in dollars and translate into those 73
14 PWR's again by this siting ratio and this source term
15 ratio.

16 MEMBER FONTANA: This discounted life time, is
17 that -- that's a present value calculation?

18 MR. MYER: Seven percent -- assuming a seven
19 percent?

20 MEMBER FONTANA: Yes. Now if you've got a
21 plant life extension, because that's on the tail end, that
22 --

23 MR. MYER: Relatively small addition. But we
24 did not accommodate that.

25 MEMBER FONTANA: Okay.

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1 MEMBER POWERS: There's a question that comes
2 up in regard to this calculation, and we know what the
3 bottom line on this calculation is. So it's a little bit
4 unfair to bring it up here because I don't think there's
5 any way we can easily change your final conclusion by
6 manipulating these equations.

7 It's a fairly robust equation. But when you
8 look at a thing like delta LERF and the way it is
9 calculated for a general PRA, you're looking strictly at
10 the internally initiated accidents. And you're not
11 looking at the incremental effect due to externally
12 initiated reactor accidents.

13 Or are you looking at shutdown? And I don't
14 think shutdown enters into this particular calculation,
15 but in a general calculation it will. I do know even that
16 the external events will enter in here. And even if they
17 do, all they're going to do is double your LERF, it seems
18 to me, roughly. Double it.

19 And that's not enough to change your equation
20 conclusions. But there's a problem approaching it this
21 way with LERF. And the problem comes about because in the
22 external events, delta LERF, the way it's calculated
23 especially in the shorter methodology, moves out a group
24 of accidents that can have high consequences because you
25 can't evacuate in a seismic event.

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1 And of course, if you don't calculate the
2 external event probabilities, it's not reflected at all.

3 MEMBER KRESS: You're saying when you define
4 the sequences you use to determine LERF for seismic
5 events, you ought to use a different set of them because
6 of the -- your relationship between warning time and
7 evacuation changes?

8 MEMBER POWERS: That's right. And if you
9 recall the shortcut methodology, that they went through
10 and they said -- they looked at all the sequences and they
11 said what fraction of these sequences result in early
12 release.

13 MEMBER KRESS: Right.

14 MEMBER POWERS: And only that fraction was
15 included in the definition of the LERF.

16 MEMBER KRESS: That's right, right.

17 MEMBER POWERS: Okay, the trouble is that that
18 fractionation now changes if you have a seismic event. It
19 changes in ways that are probably site specific. Changes
20 in ways that are not obvious from the internal sequence of
21 events.

22 MEMBER KRESS: Sure sounds like a bit tough
23 thing to try to --

24 MEMBER POWERS: Well, I think that's one of
25 the flaws in the shortcut methodology is it's very

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1 attractive for internal events.

2 MEMBER KRESS: When Level 3's are done to
3 calculate risk using the full Level 3, is that taken care
4 of in seismic events? Is that factored into the --

5 MEMBER POWERS: I think it depends on the
6 skill of the analyst.

7 MEMBER KRESS: I see.

8 MEMBER POWERS: Now, you clearly can. Because
9 in the usual consequence approach, you have an evacuation
10 time. You have evacuation routes that are at the input --
11 at the disposal of the --

12 MEMBER KRESS: So you could just change that
13 evacuation time?

14 MEMBER POWERS: And so you can -- and in fact,
15 there are accommodations built in for earthquake type of
16 things that allow the user to specify a certain category
17 of things and then the code takes care of the rest of the
18 formula. It's not been an area of great deal of
19 discussion because it is true that if you influenced those
20 evacuation routes and evacuation capabilities very much,
21 the fact that you're having a nuclear power reactor
22 accident may not be your biggest concern.

23 CHAIRMAN SEALE: But that goes back to this
24 whole question of the quality of the PRA.

25 MEMBER POWERS: Yes. I mean, --

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1 MEMLER SHACK: But in this calculation, I
2 mean, it wasn't done with the 1061 method. And I don't
3 think they threw those -- they didn't eliminate those
4 sequences in this analysis.

5 MEMBER KRESS: Well, that was the question I
6 was going to ask. Did they use the 1061 definition?

7 MEMBER POWERS: They have used a strictly --
8 an internal events calculation that's available for Surry.

9 CHAIRMAN SEALE: There's another --

10 MEMBER POWERS: Actually, to be perfectly
11 honest, what they did was they used the -- as I understand
12 it; correct me if I'm wrong here -- is they used Surry
13 multiplied by all the factor to get it -- the number up a
14 little bit from 3.9 to 4.5 or something like that times
15 10^{-5} .

16 CHAIRMAN SEALE: There's another -- as I
17 understand it anyway -- difference in the offsite damage
18 calculation. And that is that you're -- as you pointed
19 out earlier, the externals of the site. That is, the
20 demographics and the meteorology are in the SST ratios.

21 And that ratio I cite to Surry for source term
22 is not necessarily -- that is for fatalities, in the
23 earlier -- in the V1 calculation is not necessarily the
24 same ratio when you start talking about property damage
25 because, in that case, it's meteorology and long term

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1 value of the -- of accessibility to the property.

2 It's not population distribution. So corn
3 fields are different from desert or whatever.

4 MR. MYER: That's correct.

5 CHAIRMAN SEALE: So that's a kind of a squishy
6 -- but again, it's not enough to make any difference in
7 the answer.

8 MR. MYER: What we did here is a relatively
9 simplistic approach to the issue.

10 CHAIRMAN SEALE: Yeah, sure.

11 MR. MYER: And we had done some sensitivity
12 analyses that show that it isn't a big impact on the final
13 conclusions.

14 MEMBER KRESS: I'd like to return to your
15 earlier question, Dana, about why use the latent effects
16 as opposed to the prompt. I'm not sure I know the answer,
17 and I'd like to know if --

18 MR. MYER: Well, the 50 mile latent person rem
19 that was used is, as you're aware, a standard measure of
20 consequences. And again, it was the streamlining -- it
21 was efficiency on our part to use that value -- use that
22 metric and then always have available to us the ability to
23 do sensitivity analyses by determining impact of such
24 things as some of these other things that come into play.

25 MEMBER KRESS: Does that metric maximize the

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1 offsite costs that you would divert?

2 MR. MYER: Well, no. And it's quite right
3 that if we, for example, included external events and
4 included early fatalities, that number would go up.

5 MEMBER KRESS: Well, no; I mean as opposed to
6 using some other metric like the early fatality cost.

7 MR. MYER: Generally they'd be about the same.
8 I don't think that -- if anything, I think they would be a
9 bit smaller. But, I mean, the guidelines recommend the 50
10 mile person rem as the metric.

11 MEMBER KRESS: That's built into the
12 regulatory analysis guidelines?

13 MR. MYER: I believe it is.

14 MEMBER KRESS: I see.

15 MR. MYER: I'd have to double check.

16 MEMBER KRESS: I guess I didn't remember that.

17 MEMBER POWERS: I continue to have concerns
18 about the metrics for consequences that get used when you
19 use a single metric. And one of my concerns is that --
20 for instance, here where they use the latents, they use
21 latent fatalities. I think that that may be an under
22 estimate of the risks.

23 That it may be useful also to look at not only
24 latent fatalities, but latent injuries as well. And I'm
25 reminded of that because when we look at the Chernobyl

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1 accident, we have a substantial amount of latent injury
2 that are not classed as fatalities.

3 And that's all the thyroid cancers. They're
4 not going to result in fatalities, but they're injuries
5 that are not -- that are costly to address. That's a
6 different issue from this, but it's an issue that we need
7 to think about when we think about risk informed
8 regulation when we're not using more risk; we're using
9 these subsidiary measures.

10 Again, you're not expected to respond to
11 these.

12 MR. REED: I understand.

13 MR. MYER: These are valid points. And like I
14 said earlier, we did a very straightforward analysis. And
15 it is a measure. And as long as we understand what the
16 implications of that measure are, we feel comfortable.

17 DR. CATTON: They resulted from a human error,
18 didn't they, Dana? They resulted because the mothers
19 continued to suckle the babies when they were told not to.
20 That's human error.

21 MEMBER POWERS: I don't have that intimate
22 knowledge of what went on.

23 But, Jim, one of the questions that arose
24 yesterday was we -- we will in a few slides here get down
25 to a -- the 700K per plant positive value with all the

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1 appropriate constraints on it and limitations to it.

2 And the question I asked was, at what higher
3 value would you have said that it was worthwhile to go
4 through and do a more detailed analysis? You've got a
5 relatively low value for the benefit here in a fairly
6 generous calculation, and you saw that there was no value
7 in going in trying to refine the calculation.

8 And I was curious at what level would you have
9 said a refinement would have been needed?

10 MR. MYER: Well, if it came out that per plant
11 the value was in the range of two to three million
12 dollars, four million dollars, I think that procedural
13 fixes -- range of about a million dollars or five hundred
14 thousand to a million.

15 On any hardware fix, as I'm sure you're all
16 aware, this is upwards of three, four million dollars and
17 beyond. So that would be kind of a very rough, coarse
18 measurement of that threshold.

19 CHAIRMAN SEALE: Could we do that a little bit
20 later?

21 MEMBER POWERS: No.

22 CHAIRMAN SEALE: Richard, they were in the
23 middle of a conversation.

24 Go ahead.

25 MR. MYER: I was done.

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1 CHAIRMAN SEALE: Well, I don't think Tom heard
2 all of what you said.

3 MR. MYER: A very rough estimate of the
4 threshold, more detailed analyses would be appropriate.
5 In my opinion, it would be -- if you're talking procedural
6 fixes, in the range of five hundred thousand to a million
7 dollars per plant. And if you're talking hardware fixes,
8 anything upwards of two million dollars a plant -- two or
9 three million dollars.

10 And again, it's a rough call, but a reasonable
11 measuring point.

12 MR. REED: Just to remind the committee that
13 this calculation came out with a positive 700 with the
14 exclusion of a major cost there, so the actual net value's
15 certainly much smaller. If you came out with a net value
16 then. That's what Jim's talking about.

17 MEMBER POWERS: Now again, I think you're
18 probably right about that and that your conclusion is
19 relatively robust. We haven't found anything that -- I
20 can find things that move things by factors of two. I
21 can't find this factor of ten and it's probably necessary
22 to have more like a factor of 20 or 30 before you can make
23 any change or refinement.

24 There's just nothing there to be found.

25 MEMBER SHACK: Just out of curiosity, what

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1 happens when you are dominated, as you appear to be here,
2 by a relatively small number of reactors? Suppose this
3 had come out that you had a net benefit, that it was
4 really due to high risk reactors?

5 MR. REED: My first -- probably of the top of
6 my head is I would go back and look at the assumption. We
7 made a pretty bounding assumption for those ten. First
8 thing comes to mind is, you know, you wanted to look at
9 the top worst ten. We didn't throw in the bottom -- the
10 good guys.

11 You know, if you really want to look at a
12 spectrum of what the reactors are out there, you want to
13 try to look at the entire range, what it really is. I
14 would try to refine that assumption and try to more
15 directly model what's actually out there.

16 MEMBER SHACK: I guess my question was can you
17 really impose a backfit on everybody?

18 MR. REED: You can impose backfits on a subset
19 of plants.

20 MEMBER SHACK: I mean, would you use these ten
21 as an excuse --

22 CHAIRMAN SEALE: A large enough sample.

23 MEMBER SHACK: -- as a justification for a
24 backfit on everybody when really everything was dominated
25 by the ten.

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1 MR. REED: By an assumption for ten, yes.

2 DR. SHERON: No, I think quite honestly that
3 we would --

4 MEMBER SHACK: You would single out the
5 subset?

6 DR. SHERON: If we thought the ten plants, for
7 example, were really driving it, okay, my guess is that
8 even if we went forward with a backfit, you know, for a
9 public comment process, we would hear a lot of kicking and
10 screaming from the industry and the like.

11 What we found over the past years is that
12 there's no such thing as a generic backfit. And that's
13 been difficult because then you have to deal with each
14 plant on a plant specific basis and what might be the best
15 solution for a particular plant.

16 There's a lot of ways to address this. You
17 know, as we pointed out -- I think I pointed out in my
18 presentation yesterday was that one way to do it is you
19 drive the frequency down. If the event that's driving
20 this is a station blackout, obviously if you can improve
21 reliability of your AC power sources, that might be one
22 way to solve the problem.

23 MEMBER SHACK: Okay, a guy that already has
24 his frequency down has already essentially complied with
25 the requirement?

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1 CHAIRMAN SEALE: But that raises a very
2 interesting question. And that is, why not go ahead and
3 do a risk benefit on the ten high risk PWR's here? You
4 have most of the numbers. And if indeed these plants have
5 some opportunity to disqualify themselves from that list,
6 that might not be a very bad thing to push for.

7 MR. STROSNIDER: This is Jack Strosnider from
8 the staff.

9 I guess one comment I'd make that I think you
10 need to consider in that is that the plants that might
11 contribute to this risk are changing with time. As a
12 plant replaces their steam generators, they're less of a
13 concern as another plant as their generators age and
14 degradation begins to occur. So it's not always the same
15 ten plants at any given time.

16 And this was just sort of an estimate of how
17 many plants at one point in time might be in a high risk
18 category. I think that's a fair characterization. But
19 that does add some bit of difficulty to that sort of
20 assessment.

21 CHAIRMAN SEALE: I appreciate that. But on
22 the other hand, this is certainly potential ammunition for
23 the operators of those plants to help them make those
24 decisions that might move them out of that list somewhat.

25 MEMBER SHACK: I mean, since the 700K is

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1 averaged over everybody, I mean you get a very different
2 value, if you will, if you stuck with the ten.

3 MR. REED: That's right. This assumption
4 results in -- you know, most of the 700K come from the ten
5 guys that you assumed had almost nothing. If you're an
6 average plant out there, you have almost nothing even with
7 the bounding delta LERF.

8 So, you're right. What I think we'd have to
9 do is go back and actually start looking closely. I mean,
10 we did a rather brief survey of the IPE's and where they
11 stood. And then you have to look and say well, where are
12 these guys really in terms of large early release; and do
13 these guys have bad generators and start thinking about
14 where they stand and looking a lot closer at those plants.

15 MEMBER SHACK: I'd go back to Brian's
16 statement that it's really very hard to come up with a
17 generic backfit. There's enough -- look at that scatter
18 in those plants on that bar curve. I mean, you know --

19 MEMBER FONTANA: If that's ten out of 70
20 plants, just multiply it at 700 by seven and you get 1.4
21 million, and that's not going to change your conclusion, I
22 don't think.

23 MR. REED: Yeah, it will be probably a couple
24 million, I mean, per site for those ten and nothing for
25 the rest of the guys.

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1 DR. CATTON: That's why you want risk based.

2 DR. SHERON: As I said before, any hardware
3 fix, I think, is going to be in the tens of million dollar
4 range. And even to fix procedurally, as I said -- you've
5 got to look at the down sides of something, for example,
6 like a depressurization scheme. Okay, a lot of analysis
7 is involved.

8 It may not even come out. It may even show
9 that there are negatives that would offset, you know, any
10 positive benefits. So I think -- and even if you're up in
11 a couple million dollar range, you could eat that up just
12 in the analysis that would be required.

13 MR. REED: In this particular circumstance, --

14 MEMBER POWERS: Seems to me that this -- what
15 you're addressing here are the risk dominant accidents for
16 large classes of PWR's and you've taken kind of a bounding
17 estimate on that risk. And you come back and conclude
18 that you can't make a hardware fix. And I think that that
19 conclusion has wider implications.

20 It means that there probably -- that for
21 plants that currently meet the safety goals, you're just
22 not going to find hardware fixes for them. They are, by
23 definition, safe enough.

24 MR. REED: Even in the low 10^{-6} 's. That's the
25 number out here just in this one piece.

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1 MEMBER POWERS: And unless you find something
2 that is a flaw not only during normal operations, but a
3 flaw during shutdown operations and a flaw during external
4 events, which -- and I don't think your steam generator
5 falls in that category because I think it has limited
6 application to the shutdown situations.

7 MR. REED: That's right.

8 MEMBER POWERS: But unless you find something
9 that is a flaw that has impact through all modes of
10 operation, you're never going to find a hardware fix. You
11 may find some procedural fixes, but you're not going to
12 find a hardware fix.

13 DR. SHERON: Just for a calibration point, you
14 know, I was on the CRGR for four years when I was in the
15 Office of Research. And I would probably -- I would guess
16 that about 99 and nine-tenth percent of all of the issues
17 that came to CRGR were compliance backfits and not
18 enhanced safety, recognizing that the enhanced safety
19 backfit requires the cost benefit analysis -- the
20 compliance backfit doesn't.

21 It just says that there's existing regulations
22 and we think you need to do some more to maintain your
23 compliance with those regulations. Very, very difficult,
24 okay, given the -- not only the guidance on, you know,
25 what constitutes, you know, roughly \$2,000 a person rem to

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1 go forward with any kind of a backfit.

2 But most plants meet the safety goal, okay.

3 MEMBER POWERS: And we've got a consistent set
4 of regulations. I mean, our backfit calculation is
5 consistent with our safety goals.

6 DR. SHERON: The other way to look at this too
7 is that we're saying that the risk associated with steam
8 generators from a severe accident standpoint is not
9 excessive from the standpoint that we need to do
10 something. It's saying that it's still in an acceptable
11 range.

12 MEMBER FONTANA: It's not dominated by what
13 you could do with the steam generator because the severe
14 accident that clears the loop seal could also damage the
15 pristine tubes like we said yesterday.

16 DR. SHERON: Yes. And the only thing we're
17 saying now is that there's still a question mark if a
18 licensee decides to do some -- wants to use a management
19 scheme that involves the relaxation, okay, and where they
20 may increase their flaw distribution of deep flaws and so
21 forth.

22 That could have an impact on risk, okay; and
23 they need to make sure that before they go ahead and do it.
24 Because remember, you know, we still are dealing with not
25 only the primary system pressure boundary, but the

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1 containment boundaries. And that's really what's making
2 this a unique item here.

3 MEMBER FONTANA: Yes. If you don't change
4 anything, would the licensees have to plug tubes on
5 detection?

6 DR. SHERON: Unless they have --

7 MEMBER FONTANA: I mean, if you don't change
8 anything at all?

9 DR. SHERON: It depends. If a licensee has
10 developed the qualified method for sizing cracks and can
11 demonstrate, for example, that they can size a crack, and
12 they can show that a crack is either less than the 40%
13 through all criteria, and that it won't grow to beyond an
14 acceptable structural limit by the end of its cycle, then
15 yeah, they could leave those cracks in service.

16 They're not required to plug. But if they
17 can't make that demonstration, then they have no choice.

18 MEMBER FONTANA: Well, that's quite a thing to
19 have to demonstrate because --

20 DR. SHERON: Some licensees have already done
21 it.

22 MEMBER FONTANA: But the thing that I haven't
23 seen is the linkage between what the crack looks like and
24 the vulnerability of that tube under certain kinds of --
25 various temperature and pressure loads on it. That data

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1 base looks kind of sparse to me.

2 DR. SHERON: Well, that's what they've been
3 doing at Argonne is looking at, you know, how these tubes
4 behave with various forms of degradation to see how they
5 would perform under a severe accident condition and see
6 how well our models predict.

7 MEMBER FONTANA: Where I was leading is on
8 this -- if they have to end up plugging a lot of tubes,
9 isn't it to their advantage to take the initiative to
10 either -- well, either take the initiative to run with a
11 flawed steam generator or buy a new one?

12 And I guess there's a real incentive there to
13 take the initiative so that they could operate with more
14 flawed tubes.

15 DR. SHERON: Right. A lot of it depends on
16 how they manage their generators. In other words, if they
17 see accelerated degradation -- okay, and let me take the
18 case of Byron and Braidwood. Okay, there's two plants
19 that have generators that I think they're in a race
20 between when they get to a point where they just plug
21 everything, okay, to when they can get the new generators
22 on site.

23 And they've tried to, you know, move up their
24 schedule for the replacement and the whole bit. They're
25 in mid-cycle outages now and they're seeing -- every time

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1 they go in and look they find a lot of degradation, new
2 indications.

3 One of the things that we're trying
4 desperately to do is to demonstrate, for example, on
5 circumferential cracks at the top of the tube sheet that
6 they could correlate those to a voltage and thereby leave
7 in service. That was one approach they were trying to get
8 the staff to approve.

9 The voltage based criteria we use for the
10 older generators, the Westinghouse generators, at the tube
11 support plates. That was a case where cracks could
12 actually be a through wall crack, okay, and thereby
13 violate their current tech spec criteria, yet not pose any
14 kind of a risk from the standpoint of a structural defect
15 that would fail.

16 And what they did is they did a lot of testing
17 and a lot of tube pulls and demonstrated that you could
18 correlate with the voltage to a burst pressure and a
19 leakage. And they demonstrated that it's totally
20 independent of depth now.

21 Okay, so there's a case where they said I'm
22 not going to worry about depth. I'm just going to
23 correlate to a voltage, and I will show you that -- you
24 know, and I think the committee was a little concerned
25 that there was no physical relationship there.

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1 But the fact is, it worked.

2 MEMBER FONTANA: Did it get approved?

3 DR. SHERON: Yes.

4 MEMBER FONTANA: Yeah, okay.

5 DR. SHERON: Yeah, now they'd like to go to
6 higher voltages. And we said fine. You know, I mean, if
7 you submit the data that supports it, you know, we'll be
8 glad to look at it.

9 MEMBER POWERS: You were going to discuss
10 turning the equation around.

11 MR. REED: Well, actually I was going to --
12 that's what I was leading into actually when you -- you
13 know, when you go from trying to impose risk on somebody
14 to saying okay, now if you relax something, you need to
15 consider risk, economic motivations are completely
16 different.

17 And you know, some guy who finds his generator
18 falling apart -- thousands of indications suddenly pop up
19 on him in an outage; at that point, he can't get a
20 replacement generator obviously very quickly. He's
21 probably looking at years. He's going to want an
22 alternate repair criteria.

23 And at least the structure that we build into
24 this enables him to at least try to pursue that approach.
25 Develop an alternate repair criteria and then do something

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1 with the risk. And you know, my own experience, my own
2 past experience at one time in my history in this industry
3 being aux. feedwater system engineer, I look at it and
4 say, you know, that these problems get solved with water
5 on the generator.

6 Every single transient that's out there goes
7 away, poof. So if you can improve the -- for example,
8 your reliability of water and keeping water there,
9 whatever you have to, with more batteries or whatever,
10 improving the liability of the AFW, what you've done is,
11 in fact, you've reduced the frequency of these events.

12 You've driven them down and you can get --
13 address the risk in that manner. Now, I guess you'd still
14 have to go through and crunch through the numbers and
15 large early release and show in fact that you did make the
16 change. So it's still not a trivial effort.

17 But at least the structure is there for the
18 guy to pursue that. And his economic motivations in that
19 are obviously -- can be very large. I mean, he could be
20 looking at losing his site -- shutting the site down if
21 he's got to plug everything on detection.

22 So I think that's an -- I mean, that's
23 certainly good that we've built into the process. You
24 know, at least he's able to pursue alternate repair
25 criteria by allowing this guy to do something in terms of

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1 risk so that he can hopefully be successful in that.

2 But, you know, I think as you said a little
3 bit earlier, Dana, when it's on us, when we decide we're
4 going to pose a regulation on somebody, we have a whole
5 different set of criteria. And the \$2,000 per man rem, it
6 just doesn't come out.

7 When the guy's looking at tubes that each
8 one's so many megawatts or whatever, you know, that's a
9 lot of money. And he's willing to do a lot in terms of
10 spending money if he has to unfortunately.

11 DR. SHERON: I was just talking with Jack.

12 Just for your -- we think right now the two
13 areas where if this rule were -- or not the rule, but this
14 regulatory approach were in place where a utility might
15 have to deal with it is in circ. cracks at the top of the
16 tube sheet and free span cracking if they wanted to go
17 beyond the current 40%.

18 One thing they might do is for free span is
19 just say we can qualify probes to depth size to our
20 current tech specs. But if they wanted to use some
21 alternative type of criteria, at that point, we would
22 probably say you need to look at the risk associated with
23 whatever you're going to propose.

24 So these are the two areas we think there will
25 probably be most interest in, you know, in the immediate

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1 future. Because that's really what seems to be where the
2 problem areas are today.

3 MR. REED: Is there any additional questions
4 on the regulatory analysis from yesterday while we have
5 Jim here?

6 MEMBER FONTANA: You've got a minor typo here.

7 MR. REED: Because I wanted to start up. I
8 know you had several questions that we couldn't answer
9 yesterday. I think that's all that I can -- I don't have
10 any more written on my slides actually, so the rest of it
11 was talking about the implications for the rule and how we
12 deal with it.

13 If not, I guess we can -- Chairman Seale, I
14 guess we can get onto the next item.

15 CHAIRMAN SEALE: Sure. Well, you have
16 certainly done violence to our schedule. I would suggest
17 that -- you're going to be talking to us next June?

18 DR. SHERON: Well, I have a list of -- I think
19 we had decided that maybe what we could do at this point,
20 rather than me summarize, would be to go through the list
21 --

22 CHAIRMAN SEALE: Yes.

23 DR. SHERON: -- of remaining issues.

24 CHAIRMAN SEALE: Okay, that's fine.

25 DR. SHERON: You know, if we could discuss

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1 those and see what more the staff needs to do to address
2 them.

3 CHAIRMAN SEALE: If you want to go ahead and -
4 - you have a list, you say? Is it a compilation of
5 concerns?

6 DR. SHERON: Actually, I have your
7 compilation.

8 CHAIRMAN SEALE: All right, fine. Well, we
9 were getting some stuff -- a viewgraph made or two, but
10 that's all right.

11 The list starts off with difficulty in
12 reaching agreement on the performance criteria. That is,
13 the list I have. Does that agree with your list?

14 DR. SHERON: Yes.

15 CHAIRMAN SEALE: All right. And there were
16 four topics under that, the comparative risk status of the
17 new rule versus the existing rule; the accident leakage
18 criteria as a limit in gallons per day of capacity for the
19 charging pump.

20 These are pretty scattered topics, as you can
21 tell.

22 NRC approve or inspect the methodologies used
23 to verify compliance with the criteria; and the level of
24 detail in the regulatory guide. These were all concerns
25 that were identified back at the -- in our earlier

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1 meetings.

2 MR. STROSNIDER: Yes, this is Jack Strosnider
3 from the staff, and maybe I could summarize the status of
4 this issue at least from the staff's perspective.

5 The first item under there with the
6 comparative risk status of the new rule versus existing
7 rule -- hopefully in the presentations that you heard
8 yesterday and today, you've seen the approach that we've
9 taken. I think the original question had to do with are
10 you doing a before and after comparison of risk.

11 And I think what you can see, there's a little
12 -- perhaps a little bit different approach here
13 recognizing that we -- it's very difficult for us to
14 assess the risk that might be associated with some
15 alternate repair criteria that we haven't yet seen.

16 But the approach we've laid out is that that's
17 something that would need to be looked at at the time it
18 were proposed. So we have looked at the current risk, and
19 you've seen the results of that, the conclusions.

20 With regard to -- let me go to the last two
21 because I think I can say something about those. The
22 approved -- we had raised, I think, during one of our
23 meetings these issues where we were requesting some comments
24 from the committee on the need for NRC to approve or
25 inspect the methodologies used to verify compliance with

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1 the criteria and also the level of detail in the
2 regulatory guide.

3 And I think one of your letters in fact did
4 response to those. And my recollection is that the
5 committee felt it was appropriate to provide sufficient
6 detail in a regulatory guide to make sure that the
7 performance criteria are in fact being measured properly
8 and monitored properly.

9 And I guess, quite frankly, I don't recollect
10 exactly what your conclusion was with regard to the need
11 to review these; but I would point out that the framework
12 we've presented in the last day or so here would --

13 CHAIRMAN SEALE: Yeah, I think you've largely
14 responded to those issues.

15 MR. STROSNIDER: Okay, see I -- okay.

16 CHAIRMAN SEALE: What you did yesterday.

17 MR. STROSNIDER: Actually though, when I go
18 back, there was this agreement on performance criteria.
19 One of the issues that came up was the factors of safety
20 that we were proposing for the deterministic performance
21 criteria.

22 Since we had that meeting -- that's a factor
23 of safety of three on normal operating pressure and 1.4 on
24 postulated main steam line break. Since we had that
25 meeting and discussion with the committee, we've received

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1 a submittal from the industry with their thoughts on that
2 subject.

3 And we're actually having an independent
4 review done by some people with expertise and experience
5 in the code. So we recognize there's still an issue there
6 that we want to follow up on, and we will do that if not
7 before this -- we're able to get something out for public
8 comment, at least during that period.

9 And obviously we'll have to resolve that.
10 With regard to the accident leakage criteria being tied to
11 the capacity of the charging pump, I think the point that
12 we've made in the past is that the intent there was when
13 you're limiting potential leakage under accident
14 conditions, you want it to minimize challenges to the
15 operators and getting into actually accidents or scenarios
16 that were beyond what was in the -- I believe in the
17 current operating procedures.

18 But perhaps someone from DSSA -- Joe Donoghue
19 could make a few comments on that.

20 MR. DONOGHUE: Yes, Joe Donoghue from staff.

21 Just echo what Jack said. We just don't want
22 to have a LOCA complicating a tube leak situation. That
23 was the basic premise for that.

24 CHAIRMAN SEALE: Now, I want to remind all the
25 members what we're really concerned with here is to

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1 identify any of these issues where we wish to get
2 additional information from the staff before we get our
3 presentation to the committee of your proposed
4 recommendation to the commissioners at the April meeting.

5 Is there any additional information that we
6 would like to receive before that meeting to help us write
7 the letter at the April meeting in support of -- about
8 what it is you're going to be proposing to the staff?

9 MEMBER POWERS: I guess I'm a little confused
10 about the next step that they're going to take on this
11 rule. Is what we have in writing now in the reg. guide
12 what is going to be operative?

13 CHAIRMAN SEALE: Well, you're still in the
14 process of dropping the last shoe, aren't you?

15 DR. SHERON: Yes. The steps that have to be
16 taken next -- okay, one is that, as I said yesterday, we
17 need -- we are preparing a Commission paper. Hopefully
18 that will go up within the next few weeks which will
19 inform the Commission of the result of our risk assessment
20 and regulatory analysis and propose what approach we would
21 like to take now with regulating steam generators.

22 The next step would be to put together the
23 entire package which would include -- as I said, there
24 would be a generic letter that would go out. There would
25 be a reg. guide. There will be a report that addresses

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1 Dr. Hopenfeld's concerns.

2 This reg. guide -- there will also be an
3 overall -- you know, make the linkage to inform the
4 industry of how we would use Draft Guide 1061, for
5 example, and the like.

6 This would all go out for public comment.
7 Okay, at which time the industry, as well as the public,
8 would have their opportunity to comment on what we are
9 proposing. We would then receive public comments, take
10 them into consideration. My guess is at some point we
11 would be back down here to the committee to discuss, you
12 know, the results of the public comment process and what
13 changes we made, if we made any, to deal with those
14 comments.

15 Right now, I think what -- obviously what we
16 would like is an endorsement by the committee at some
17 point to go forward with this draft regulatory approach at
18 least for the public comment process. And for that, I
19 think we would like to know exactly what further concerns
20 you need more information on.

21 And you know, I think the best mechanism to
22 get you that information is to have -- to schedule one
23 more meeting. And we will have the right staff here to
24 present the information that you're looking for.

25 CHAIRMAN SEALE: And what we want to do now is

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1 to define what it is we'd specifically like to have them
2 present at that meeting.

3 MEMBER POWERS: And in this -- in all these
4 packages of information, I'm not sure where, but in the
5 package of information, will you include a description of
6 what this understanding you've developed on if you try to
7 use risk to justify anything, what kinds of things the
8 staff will be looking for in those risk assessments?

9 And you develop that understanding and we
10 heard about it yesterday to a fair level of detail where
11 you understand what the -- what topics should appear in a
12 risk assessment and what the difficulties are with using
13 available data bases to support the analysis.

14 DR. CATTON: Dana, is this Reg. Guide 1570?

15 MEMBER POWERS: I think so.

16 DR. CATTON: Or NUREG-1570. It is? Okay.

17 DR. SHERON: What we had proposed -- I think I
18 had it in my slide yesterday -- was we would add a section
19 to the current draft reg. guide that Emmett Murphy has
20 prepared that would provide that guidance in terms of if a
21 licensee were to go forward and propose, say, relaxed
22 criteria and therefore had to address the risk associated
23 with it.

24 This would provide the guidance on the kind of
25 things we would expect the licensee to consider.

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1 Is that what you're referring to?

2 MEMBER POWERS: Yes, I think that's what --

3 DR. SHERON: You haven't seen that yet because
4 we haven't written it.

5 MEMBER POWERS: I know. But we saw the basis
6 of it, and I think that would be one of the topics that --

7 CHAIRMAN SEALE: We'd like to confirm that
8 that in fact does the job.

9 MEMBER POWERS: I'd like to see how they
10 summarized their learning and how they interpreted it.
11 Because I think we could -- I think we could help them
12 give a good scrubbing on that. Because they've done a lot
13 of work, and they could probably provide some real useful
14 insights not only for this PRA application, but for a lot
15 of PRA.

16 Because we're working on the risk dominant
17 accidents here. So what they learn has a pandemic
18 applicability here so that that summary should clearly
19 represent some fraction of the presentation.

20 CHAIRMAN SEALE: Now we have a problem. When
21 will that document be available?

22 DR. SHERON: Excuse us.

23 CHAIRMAN SEALE: I mean, we've got a real
24 problem here.

25 MEMBER POWERS: Everyone turned around and

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1 looked at one individual who looked down at his shoes.

2 DR. CATTON: Bob, I missed yesterday.

3 MEMBER POWERS: You missed a good one.

4 CHAIRMAN SEALE: It was a good one.

5 DR. CATTON: So I'm kind of wondering, this
6 list, what kind of comments do you want and -- for
7 example, I think Chapter 3 which deals with the thermal
8 hydraulics didn't really get at the question of
9 uncertainty. And is that a part of what you want to hear
10 about now?

11 CHAIRMAN SEALE: Well, we didn't really hear
12 about the thermal hydraulics at all yesterday.

13 MEMBER POWERS: Well, the subject came up and
14 we conceded we didn't have our expert here.

15 CHAIRMAN SEALE: Yeah, right.

16 MEMBER POWERS: But they were certainly able
17 to answer my questions. And the questions had to do with
18 how you go -- how much significance do you ascribe to the
19 Westinghouse experiments when they relate to heat up of
20 the -- and radionuclide deposition in the steam generator
21 tubes since the Westinghouse experimental tubes were scale
22 distorted.

23 And I think we came away from that discussion
24 arguing for the heat up that they were integrating over a
25 sufficiently long portion of the inlet region that

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1 sensitivity studies amounting to 20% of the heat transfer
2 coefficient, if I recall, were adequate -- that I felt
3 that 20% was a little small.

4 DR. CATTON: Well, my concern was a little
5 different. They either raised all of the heat transfer
6 coefficients or the lowered them all. That's not an
7 uncertainty evaluation. The heat transfer coefficients
8 can be plus or minus something that needs to have a basis.

9 I would have picked roughly the same range as
10 they did maybe for -- but I think it should -- they should
11 have had a reason. There should be a basis. Why do I
12 choose plus or minus 20%? I know damn well I can't
13 measure it any better.

14 And then there are other phenomena that come
15 in that may make you want to spread it. That's just a
16 part of it. The uncertainty comes -- or where you get in
17 trouble is if heat transfer coefficient's low and the
18 other is high because we're talking about a race in time.

19 Now I may have read the report incorrectly;
20 but from my reading and looking at the tables, they either
21 raised the heat transfer coefficient so everything goes in
22 the same direction, and I couldn't figure out what the
23 hell they did with the mixing because there were three
24 things that they varied.

25 And in the middle of it is some adjustment of

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1 the -- of how they treat the plenum in the code. If this
2 1570 is supposed to be an example for others to use, I
3 think it's far off the mark. This is a relatively simple
4 problem to deal with. But you do have to deal with plus
5 and minus.

6 MEMBER POWERS: Now just as a calibration, you
7 also said shut down risk was a relatively simple problem.

8 DR. CATTON: That's different.

9 MEMBER POWERS: I just want everybody to
10 understand what the word simple means here.

11 DR. CATTON: The calibration is really have
12 you done this kind of thing before. No, it just looks
13 easy.

14 MEMBER POWERS: But you still said it was
15 easy.

16 DR. SHERON: If I can answer the question.

17 CHAIRMAN SEALE: The first question.

18 DR. SHERON: The first question which Dana
19 asked. We will need to get back to you on a schedule. We
20 had a little robust discussion here. We're not of one
21 mind yet in terms of how long it will take to get that
22 section put together.

23 We need to go back. We will let you know and
24 fairly shortly.

25 CHAIRMAN SEALE: But it may well be then that

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1 that's not something that we would be able to address in a
2 letter we would propose to write in April.

3 DR. SHERON: Right. I mean, we'll have to see
4 how soon we can get the package down here.

5 MEMBER POWERS: Incidentally, Brian, I think
6 that for the April meeting in this particular area, the
7 conclusions you've reached rather than all the verbiage
8 you have to decorate it would be of interest.

9 CHAIRMAN SEALE: Yes.

10 MEMBER POWERS: And I think I could write
11 those conclusions on what the sticky points of the
12 analysis are and what elements should appear in the
13 analysis. I could write that right now based on what was
14 presented yesterday because I think it was fairly
15 transparent.

16 Now the details that Ivan's discussing on
17 where the -- how you treat some of the mechanistic heat
18 transfer and what not in there are among the sticky
19 points. And I'm intrigued by what he has to say.

20 DR. CATTON: Well, my concern primarily is
21 that if that's to be the guide for other people to use,
22 and you say this is an uncertainty evaluation, that's the
23 problem. The choice of plus or minus values is not.

24 MEMBER POWERS: It was certainly portrayed
25 yesterday as a sensitivity analysis.

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1 DR. CATTON: And even sensitivity, you should
2 look at the sensitivity to moving one thing up while you
3 move the other down, not everything going in the same
4 direction.

5 MEMBER FONTANA: There's a sentence in here
6 that seems to imply that the field of sensitivity and
7 uncertainty are the same thing, and they're not.

8 DR. CATTON: No, they're not.

9 MEMBER FONTANA: But what came across
10 yesterday is that the sensitivity analysis showed that
11 within the ranges that they were varying things, that
12 other factors would swamp it. And the main thing that
13 would swamp it that I came across to me is the potential
14 for clearing the loop seal and getting hot fluid through
15 all the tubes.

16 And that just wipes out all the other things.

17 DR. CATTON: Sure it does. There's no
18 question. You clear the loop seal and you're in trouble.

19 MEMBER FONTANA: Yeah.

20 DR. CATTON: But in the other -- see, what you
21 have is a race in time. If I increase the horsepower of
22 both, I stretch both times. What you really need to do is
23 say okay, you're at the bottom of your distribution and
24 you're at the top. Then ask what happens.

25 MEMBER FONTANA: Well, the impression I got

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1 from looking at this is that this race in time really is
2 pretty close.

3 DR. CATTON: That's why you --

4 CHAIRMAN SEALE: That's the problem.

5 DR. CATTON: That's the problem. That's why
6 you need to look at both directions, not just increase
7 everybody's capability or decrease everybody and ask what
8 happens. All you're going to do is stretch things out or
9 shrink things down a little.

10 DR. SHERON: I would just like to add that
11 we're not simply looking at the NUREG as the definitive
12 role model for the industry here. This was a calculation,
13 you know, that we did for our own work here. We're not
14 putting this out to the industry to say if you follow
15 this, you know, the staff will bless it off and say it's
16 great.

17 The industry, you know, depending upon their
18 unique circumstances, their generators and stuff, they're
19 responsible then for doing that assessment. Like I said
20 -- I think Tim may have said it too, and that is that my
21 guess is that most licensees are going to try and avoid at
22 all costs trying to get into this level of detail and
23 justify why, you know, they don't have some sort of an
24 unacceptable risk based on trying to do these detailed
25 calculations.

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1 My guess is they're probably going to go for
2 the first option, which is try and demonstrate that the
3 initial frequency is low enough and the like. But, you
4 know, we're not trying to say that the calculation we did
5 is the role model, okay?

6 DR. CATTON: I understand that. It's just I
7 don't think it's a good idea to have a bad example out
8 there. It would be better just to take it out.

9 DR. SHERON: Okay, well we can certainly
10 consider that.

11 MEMBER POWERS: I think it was -- I think it
12 was a good educational opportunity, and a lot of the
13 things that came out -- a lot of the education that came
14 out of it was they took and compared failure criteria that
15 they would define from data against failure criteria that
16 other people had defined from the data and they found
17 reasons to take exception to what other people had done,
18 areas of controversy.

19 I thought that was some of the most useful
20 information that came out. Because you get people saying
21 well, these valves are incredibly reliable except when you
22 don't want them to be reliable, and then they're
23 incredibly unreliable.

24 MEMBER FONTANA: It's got to be one way or the
25 other.

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1 MEMBER POWERS: I mean, you will have people
2 arguing that gee, this valve sustained damage, therefore
3 it's unreliable when I don't want it to be reliable. And
4 on the other hand, in another circumstance, they'll come
5 back and say yes, the valve suffered damage, but it's
6 perfectly capable of doing its function even at massive
7 amounts of damage.

8 And they were able to show that that had real
9 consequences in their case and there was substantial
10 reasons to doubt those. On the other hand, they were able
11 to find -- they were able to look at data bases and find
12 areas that people thought things were quite reliable.

13 True enough in the laboratory, but you have
14 industrial experience that says maybe not so true. I
15 think those are very useful. Not definitive, but very
16 useful to alert people they're problems that you've got to
17 confront in doing these analyses.

18 CHAIRMAN SEALE: Okay.

19 MEMBER SHACK: Just a procedural question.
20 Under the new approach, would the reg. guide look much as
21 it is and you'll identify in the generic letter those
22 sections which are backfits and those sections which are
23 part of the alternate repair criteria, or will it be
24 somehow rewritten to make it really two separate
25 documents?

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1 DR. SHERON: Well, first you have to
2 understand what the nature of a generic letter is. Okay,
3 it's really a 50.54(f) letter, and there's two kind of
4 50.54(f) letters the staff can issue. One is where we
5 just ask for information. Okay, basically, as Mr.
6 Moraglia always says, to determine whether we're going to
7 bend, fold, spindle, or mutilate your license.

8 We can ask for the information. We don't tell
9 them how to get it. That's what I usually call a straight
10 50.54(f) request for information. The other type which we
11 normally refer to as a generic letter basically tells the
12 licensee, for example, we don't believe you're in
13 compliance with the regulations.

14 Here is a program or here is a way that we
15 think you need to improve your design, whatever, through
16 procedures, through additional commitments, etc., in order
17 to come into compliance. Please tell us whether or not
18 you intend to follow what the staff is telling you to come
19 into compliance.

20 Or if not, tell us what you're going to do to
21 address the concern. This generic letter would probably
22 point out that we think that you need to do more to come
23 into compliance with the current regulations regarding the
24 management of your steam generators. Okay, here's a reg.
25 guide that provides an acceptable program for managing

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1 degradation in your steam generators, okay.

2 One approach would be to commit to that reg.
3 guide the tech spec amendment. Another approach would be
4 if you want to adopt the reg. guide but make certain
5 changes to it, that's fine; come in and tell us about what
6 parts of it you want to change and do differently.

7 Or, what other approach would you propose to
8 demonstrate you're remaining in compliance with the
9 Commission's rules and regulations in this area. And they
10 could come in and say we're going to rely on some industry
11 document. Okay, and then we would look at that and
12 determine whether that document, okay, addressed the
13 concerns that we had.

14 We would also be providing guidance with
15 regard to what to do if you want to use relaxed criteria -
16 - if you want to change your criteria. At that point, we
17 would be pointing out that they would need to do an
18 assessment of risk. Okay, the reg. guide would contain a
19 section which would provide the kind of information we
20 would expect them to consider in doing that assessment.

21 I'd also point them to Draft Guide 1061 or --
22 if that's out final at the time -- to also consider in
23 terms of looking at what kind of changes in risk the staff
24 would find acceptable versus not. So this is the
25 implementation process.

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1 Now, the licensees could come back and tell us
2 to pound sand, which is a blunt term. Then we have to
3 decide if we want to take further action which could be
4 orders or could be well, okay, you know, the generic
5 letter approach didn't work; now we will go to rule
6 making.

7 Okay, but at that point, we'd have to decide
8 what further regulatory action we wanted to take -- what
9 other tools we had available to us. Hopefully, the
10 industry -- you know, by the time we get this package in
11 final form and we've got their comments and everything,
12 we'll all be of the same mind.

13 Therefore, hopefully, you know, we'll have
14 agreement that everyone will, you know, when they get the
15 generic letter, will make a commitment.

16 MEMBER SHACK: I guess I'm still confused
17 because to me there are elements of this reg. guide which
18 are really -- the performance criteria, at least as I
19 understood it from yesterday, would be really part of an
20 alternate repair criteria and would no longer be operative
21 if you only chose to go with the compliance.

22 But the notion that you had to do condition
23 monitoring and the operational assessment would be
24 essentially mandatory. And so there are pieces of this
25 that are compliance backfits and pieces that are optional,

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1 and they're almost intermingled paragraph by paragraph at
2 this point.

3 MR. STROSNIDER: This is Jack Strosnider from
4 the staff.

5 I would add to what Brian said. Our current
6 thinking and preliminary discussions is that a generic
7 letter would include some sample technical specifications.
8 And there will probably be two different sample technical
9 specifications.

10 One would be here's what we think you need to
11 do as a minimum to address those compliance based issues,
12 and that would include things like qualification of NDE.
13 It would include condition monitoring. And there would be
14 some performance based -- some performance criteria in
15 there.

16 So it would be a performance based tech spec.
17 But there would be another set of technical specifications
18 that say if you want to pursue, you know, alternate repair
19 criteria, then here's the technical specifications that
20 would fit that or at least some guidance, and that needs
21 to be worked out.

22 But we do recognize, as you point out, that
23 the regulatory guide has issues in it which we feel would
24 be implemented through a compliance backfit and then other
25 ones that would be optional, and we'd have to separate

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1 those and make it clear in the letter which are which.

2 And that would probably be done through
3 reference to the various sections of the regulatory guide.

4 MEMBER SHACK: And now when we say we're going
5 to do the risk assessment a la 1061, the risk assessment
6 we've talked about so far and focused on is the severe
7 accident induced part of the risk. That is, you know, a
8 piece of the risk.

9 Would you accept from the licensee him coming
10 back and taking your structural performance criteria based
11 on his risk analysis and proposing new performance
12 criteria based on the risk -- or when you say risk
13 analysis, do you mean just this piece of it after the core
14 damage has occurred and the sort of thermally induced --

15 MR. STROSNIDER: Well, we're always -- I mean,
16 the licensees can always come back and propose an
17 alternate performance criteria. I mean, that's part of
18 the process. They can do that if they want. What we're
19 trying to do in the regulatory guide and with our
20 interactions with the industry is come up with some
21 performance criteria that we agree to.

22 We have made it clear --

23 MEMBER SHACK: So the risk analysis then would
24 be confined strictly to this portion that we've been
25 talking about, sort of 1570 kind of thing?

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1 MR. STROSNIDER: I think that's the right
2 answer. And one of the things -- and this gets into some
3 philosophical discussions we've had before. If you look
4 at the performance criteria, you know, they are intended,
5 from our point of view, to address some of the other
6 things in the regulations in terms of defense in depth and
7 meeting general design criteria and those sort of things.

8 And we've had discussions with the industry
9 and I think maybe even with this committee about some of
10 those performance criteria and saying well, you know,
11 perhaps some of those -- the probabilistic criteria could
12 be -- you could get higher probabilities of conditional
13 failure, for example.

14 But at some point, we feel you're losing the
15 defense in depth and the GDC philosophy when you do that.
16 So, you know, our risk informed approach has been to show
17 that the numbers are in there providing acceptable level
18 of risk.

19 Going to prior failure probabilities as an
20 example, although a risk based approach might say that's
21 okay, you know, you end up putting all your eggs in one
22 basket in some cases when you do that, and that's
23 something we want to avoid.

24 So I think from a practical point of view, our
25 real objective is to get some performance criteria that

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1 the industry and the NRC agree to and that they would
2 hopefully be fixed. People can always propose something
3 different, but we would go through those considerations
4 more than just risk analysis in deciding whether we
5 thought they were appropriate.

6 DR. SHERON: One thing I just would add that
7 -- you know, the Commission has told us in a recent SRM,
8 and that is that when we move toward plant specific safety
9 goals, which is really what Draft Guide 1061 does -- okay,
10 it's an application of the safety goals on a plant
11 specific basis.

12 And if you remember, the safety goals were
13 really applied to a class of plants when they were first
14 promulgated. And one of the things that I think both the
15 Commission as well as the senior management in the agency
16 has been concerned about is that when you do that, you
17 don't want the industry to use the safety goals as speed
18 limits.

19 Okay, in other words, if 10^{-4} is the core melt
20 -- you know, you don't want -- a plant that has a 10^{-6} core
21 melt, okay, to all of a sudden say well, I can do this,
22 this, and this and as long as my core melt's still at 10^{-4}
23 or less, I'm okay.

24 And that's what we're trying to prevent too,
25 is we don't want the industry to go ahead and start making

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1 wholesale changes just and use all this stuff as a speed
2 limit. So we're trying to make sure that when they do use
3 risk, okay, it's one piece of a number of considerations.

4 MR. STROSNIDER: Excuse me. This is Jack
5 Strosnider.

6 Steve Long was just saying that, you know, I
7 might want to go back and explain something to make sure
8 I'm not misleading you.

9 The major contribution to risk from the
10 studies that we've done is not just -- it's not coming
11 from the thermally induced portion. In fact, when you
12 look at that, that's just some percentage. And the risk
13 assessment would have to address more than just that area.
14 It would have to address the pressure induced failures
15 and, you know, the --

16 MEMBER SHACK: No, but what I meant was this
17 risk analysis starts with the core damage and marches
18 onward. There's another risk analysis that goes back to
19 the 0844 kind of argument that starts with the steam
20 generator tube failure leading to core damage.

21 CHAIRMAN SEALE: Yes.

22 MR. STROSNIDER: Yeah, I think it's fair to
23 say that the focus of this assessment is the large early
24 release containment bypass. That's what you really want
25 to be focused on. And you could build upon prior

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1 evaluations certainly to get you to that point.

2 MR. LONG: This is Steve Long with the NRC
3 staff.

4 Just to try to make this as clear as I can,
5 when we looked at the risk for the study, we looked at all
6 the pieces of the risk. There's an appendix in the 1570
7 that points out some of that, but there's a companion
8 report that came from INEL that looked at the secondary
9 depressurization induced core damage and release.

10 The risk that's going to come out of any sort
11 of a change in the plugging criteria or the repair
12 criteria is really going to be from the inability to
13 precisely determine what it is that you have now in the
14 way of a flaw and what that will be at the end of the next
15 cycle.

16 So there's a lot of statistics that goes into
17 trying to assess what you have and projecting it forward.
18 What we've tried to do with the structural criteria is say
19 that your target when you project this forward is that it
20 will be able to withstand these challenges.

21 But the statistics will tell you that you may
22 be wrong. And the probability of being wrong is what it
23 really ends up being part of the risk equation. So that's
24 what we're going to have to focus on in the description of
25 how to take the structural criteria and come up with a

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1 plan for showing that you have a high enough probability
2 of succeeding at the end of your cycle.

3 MR. STROSNIDER: I think in fact a lot of that
4 particular issue's already addressed in the regulatory
5 guide with what we require in terms of NDE qualification
6 to support an alternate repair criteria. As we've
7 indicated previously, where you get into some additional
8 risk here is where you start having a large distribution
9 of deep flaws.

10 That's what would have to be assessed.

11 MEMBER POWERS: What do you do when someone
12 comes in and says look, I want to have a little relief on
13 my flaw distribution here, and I justify it based on the
14 risk argument that goes somewhat like this. My
15 probability of a spontaneous failure and temperature
16 induced failure go up a little bit.

17 But, in contrast to what you've done in past
18 risk assessments, I've taken credit for source term
19 reduction on the secondary side of the steam generator.
20 So in fact, my risk is -- calculated risk, you know, is
21 just a little bit lower than what it was before I made any
22 changes.

23 DR. SHERON: You're saying a licensee, you
24 know, somehow finds a way to reduce the source term on the
25 secondary side through, what, some pencil sharpening or --

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1 MEMBER POWERS: Yeah, he sharpened his pencil.

2 DR. SHERON: And the like.

3 I think we'd have to look at it on a case by
4 case basis. See what it really meant. I mean, it's hard
5 to kind of prejudge how we would, you know --

6 MEMBER POWERS: Well, I've gotten the
7 impression that you have in mind a criterion for the
8 frequency of spontaneous rupture that you're going to find
9 tolerable based on GDC-16 or whatever it is. And that up
10 until it starts violating that sensibility, you will
11 entertain things.

12 But once he starts violating that sensibility,
13 then he's got a problem. You've got a defense in depth
14 issue that comes to your mind. But you're going to try to
15 quantify that sense?

16 DR. SHERON: I guess it depends if it could be
17 quantified, you know, in any sort of a fashion that we
18 could believe it.

19 MEMBER POWERS: I think -- I mean, for
20 instance, --

21 DR. SHERON: -- flaw distribution and one of
22 the biggest things I think we said is that the flaw
23 distribution is a very elusive thing. And to say somebody
24 can come in and say I want to change my flaw distribution
25 and I understand it, okay -- I mean, the flaw distribution

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1 is a dynamic thing. It changes with time.

2 You know, as the plant operates, it keeps
3 changing and the like. So I'm not sure a licensee right
4 now -- I won't say the word is smart enough, but actually
5 has enough information to be able to accurately
6 characterize the flaw distribution and be able to
7 characterize the way it change with time such that, you
8 know, they could say, you know, I want to go to a
9 different one or something.

10 MEMBER POWERS: I can imagine a licensee
11 coming in and saying look, the problem is the 40%. I
12 can't tell whether this flaw that I've got an indication
13 is 40%, but I can sure tell whether it's 60% or more.
14 Okay, so what I'm going to say is that all my indications
15 are less than 60% because I can do that fairly
16 confidently.

17 And I'll fix anything that's more than 60%.
18 And I've got a lot of information that says that they --
19 the flaws that are less than 60% won't exceed 60% in one
20 cycle. They may in two, but not in one cycle. And it's a
21 persuasive case.

22 And as a result of going to this -- letting me
23 operate with these less than 60% flaws, I calculate that
24 my spontaneous rupture frequency is now .04 per year. A
25 little bit bigger than the 5×10^{-3} , but it's up.

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1 MEMBER SHACK: It's a PRA cut a little bit.

2 MEMBER POWERS: That's right. It's a PRA cut
3 a little bit because I'm going to come back and say but I
4 have found that the source term coming to the outside has
5 been reduced by two orders of magnitude when you look at
6 decontamination on the secondary side.

7 So even though my spontaneous rupture
8 frequency is up a little bit, my risk is in fact down by a
9 factor of 20.

10 DR. SHERON: There's a lot of other
11 parameters, I think, that need to be assessed in addition
12 to just those. I mean, I would guess a licensee now would
13 have to say what is my NDE capability; what is the
14 likelihood that even though I'm telling you I'm taking
15 stuff out of service if it's greater than 60%, what's the
16 likelihood I would leave something in that's now greater
17 than 60%?

18 And what's the probability that might grow to
19 some unacceptable level to the point, and how does that
20 affect risk?

21 MEMBER POWERS: But he's got a good story
22 here.

23 MR. STROSNIDER: Let me --

24 MEMBER POWERS: Okay, I mean, all of those
25 things are addressed. The operative question is he's

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1 moved from 5×10^{-3} , 4×10^{-2} , and he's made a risk argument
2 on the other side. And I made that jump big enough that
3 it starts causing the hair on the back of defense in depth
4 heads to get itchy anyway.

5 MR. STROSNIDER: Let me first comment that
6 with regard to, say, for example, a deeper repair
7 criteria, the framework that's laid out in the regulatory
8 guide allows for that. Okay, given the information that
9 you discussed, that could be implemented. And in fact, it
10 could be implemented if a licensee chooses to go to a
11 shorter operating cycle, which is an economic decision on
12 the licensee's part.

13 They could plug at a deeper level and, you
14 know, shut down more frequently. Those things are already
15 allowed in the framework. But I think to try to respond
16 to your broader question, say it as simply as I can, it is
17 our intent to have -- to maintain defense in depth and to
18 have criteria that we are comfortable will maintain
19 primary coolant pressure boundary integrity.

20 That is in the GDC that we need to maintain
21 that. We believe that's a very important thing to do.
22 Right, and if a licensee comes in and wants to challenge
23 that primary coolant system integrity based on some
24 mitigating factors such as operator action or changes in
25 dose calculations or other risk discussions, they're going

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1 to have a hard time selling that to us, quite frankly.

2 That's what I believe is the case. Because
3 the further you go out in that sort of analysis, the more
4 and more uncertainties you're putting into it, and that's
5 what we've seen. And that's the reason you need to
6 maintain defense in depth. That's the reason you need to
7 follow -- have some confidence that you're satisfying GDC
8 in terms of low probability of primary coolant pressure
9 boundary failure.

10 So that's our intent.

11 MEMBER KRESS: But you've already compromised
12 the defense in depth. You've already done that. You've
13 already compromised it. And Dana's just asking do you
14 have criteria on how far --

15 MEMBER POWERS: I'm just arguing over price,
16 Tom.

17 MEMBER KRESS: That's right, you're arguing
18 over the price.

19 MR. STROSNIDER: The point he was making is if
20 we establish some performance criteria, say a conditional
21 probability of failure for steam generator tubes and
22 someone comes in and says I'm an order of magnitude higher
23 than your performance criteria but the -- you know, the
24 release is going to be scrubbed in the steam generator; is
25 that okay?

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1 And the answer I'm giving you is I don't think
2 it is. We need to maintain primary coolant pressure
3 boundary at some level that we feel is consistent with the
4 regulations.

5 DR. CATTON: What if they argue that it's with
6 95% assurance. In other words, you do a full uncertainty
7 analysis and you go out on the edge and make the same
8 statement.

9 MR. STROSNIDER: As we indicated before, we'll
10 look on it a case by case basis. But you look at the
11 analysis that's been done which doesn't even go past the
12 release into this issue you're talking about and all the
13 questions and uncertainties that can be raised, right.
14 And I think it's a long way to get to where you're going
15 to be comfortable in that providing the level of
16 confidence that you want.

17 MEMBER POWERS: But let me come back and ask
18 you again. Are you going to try to quantify this comfort
19 level on the integrity of the reactor coolant system, or
20 is it the situation, this 5×10^{-3} number is your
21 quantification?

22 MR. STROSNIDER: The regulatory guide has
23 quantified performance criteria in it now. And we're
24 looking at some of the questions that have been raised on
25 that, but that is our current thought.

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1 MEMBER POWERS: And this is a canon. You're
2 not going to give -- there's no relief available in this 5
3 $\times 10^{-1}$?

4 DR. SHERON: Well, obviously, if it's not
5 specified in the regulation in which someone has to
6 request an exemption, then anything is fair game. Our
7 feeling right now is no, we would not be willing to just
8 willy-nilly grant relief to it because someone had, you
9 know.

10 But we'd have to see the specifics of the
11 argument. Okay, if somebody said I have a magic bullet --
12 if you let me increase this number, as a consequence, the
13 risk -- you know, and the public health and safety goes
14 down by ten orders of magnitude, we may say well, you
15 know, maybe that's a good trade off. That's a good
16 compromise.

17 Okay, but if somebody just says I've sharpened
18 my pencil, okay, and therefore I want to take advantage of
19 it, okay; the answer's probably no, all right?

20 CHAIRMAN SEALE: Steve had a -- I think he had
21 something he wanted to throw into this.

22 MR. LONG: Dana, going back to your question
23 which I think is really getting at defense in depth
24 because you've asked a question about how to shave
25 something thin with sort of a stone ax in PRA, it's not

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1 very -- you can't do that.

2 (Laughter.)

3 CHAIRMAN SEALE: It's easier to thin it by
4 mashing it than it is to shave it.

5 MR. LONG: But I think the way we've tried to
6 approach this sort of thing is, rather than go all the way
7 to the bottom line and say the consequences -- and you
8 notice we already had trouble picking which consequence or
9 how to weigh the various consequences -- we've tried to
10 say we have -- we need some confidence in each piece of
11 the PRA because we don't have a lot of confidence in the
12 bottom line.

13 If we could look at the release from a steam
14 generator tube rupture and come to the conclusion that it
15 really was more in the nature of the kind of release you
16 have when you have a core damage accident inside
17 containment and have some sort of minor leakage through
18 the containment, I think you could then start changing the
19 criteria you use to accept the frequency of the core
20 damage accident from steam generator tube rupture.

21 So, in that sense, there's sort of a change in
22 watershed that you'd have to accomplish, I think, with the
23 release calculation. Similarly, if you could in some way
24 look at the frequency of release against the probability
25 of mitigation. We do that all the time where you think

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1 you're really trading off with some additional mitigation
2 capabilities so you don't get the core damage.

3 But when I heard you ask your question, it
4 sounded more like you were asking do we accept core damage
5 accidents with a fairly high frequency if we were pretty
6 confident nothing would get out of the containment. And I
7 think there are lots of social reasons why we don't think
8 that's a good idea.

9 So I really think the answer to your question
10 is if we become confident that there is either some
11 additional mechanism for scrubbing or that the scrubbing
12 as it would naturally occur is really much better than we
13 think it now is, that, you know, we could make that kind
14 of change.

15 Otherwise, I don't think we can trade off the
16 way you're suggesting.

17 MEMBER POWERS: What I'm trying to understand
18 in reality is what the role of defense in depth is here.

19 MR. LONG: That's what I figured.

20 MEMBER POWERS: And I think there are two
21 schools of thought. There are two schools of thought, by
22 the way, on this committee. What we have called the
23 structuralists who say I don't care about your PRA
24 calculational capability.

25 Defense in depth is the safety structure and

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1 it's there to handle all those things that you guys cannot
2 handle very well in PRA and all the things you haven't
3 thought about, and I'm going to not let you violate my
4 safety structure which is defense in depth. And I'm going
5 to say I want this containment boundary to be -- have a
6 reliability, and I don't care what risk you calculate.

7 There are other that we would call the
8 rationalists at their insistence. I had another name for
9 them. It says oh, no, no; defense in depth is there to
10 handle uncertainties in the PRA. And if the uncertainties
11 get too big, that's when we impose defense in depth. It's
12 to keep the uncertainties from getting out of hand.

13 And I think all we've heard here is that
14 indeed this -- that Brian certainly has what I would call
15 a structuralist point of view on defense in depth and
16 wants to maintain the allegiance to Appendix A. And I
17 think that's fine. I think you need to be firm in your
18 beliefs on this because you're going to run into questions
19 from the rationalists.

20 DR. SHERON: If there's enough information
21 that's presented across the boards, let's say, that says
22 that 5×10^{-3} number should be changed, okay, fine. I
23 mean, it's in the reg. guide. Okay, it can be changed.
24 Okay, but we'll do it in a structured fashion and we'll do
25 it in an open public forum with appropriate debate and so

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1 forth.

2 We'll be down here again telling you we want
3 to change that number. Okay, and if we do change it, it
4 will be done on a collective basis. It's not going to be
5 done by the staff on a, you know --

6 MEMBER POWERS: On a case by case example.

7 DR. SHERON: Where you were sitting at their
8 desks deciding whether they're going to do it. The answer
9 is going to be this is the number, this is what we expect
10 you to meet. The industry wants to present a basis that
11 says we should change that number because it's not the
12 right number, then we're willing to listen and we'll do it
13 in a structured open forum.

14 Does that --

15 MEMBER POWERS: I think that's what I wanted
16 to hear.

17 DR. SHERON: Okay.

18 CHAIRMAN SEALE: I think we've beaten this
19 horse pretty well. I want to make two comments, and then
20 --

21 MEMBER POWERS: You're going to get to beat
22 this horse for years.

23 CHAIRMAN SEALE: I know. I just want to make
24 two comments and then I'm going to call a 15 minute
25 recess.

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1 First comment is that in the case that you
2 listed, that 10⁻² or whatever that number was you gave for
3 the scrubbing in the secondary was always there. It's not
4 something that you did procedurally or anything else to
5 get it. And an element of defense in depth has always
6 been the conservatism in some of the assessments or some
7 of the things that we analyzed.

8 The other comment is more a matter of personal
9 privilege. When I started in my technical career, there
10 were still arguments about the systems of units that were
11 to be used in various things. And I always thought that
12 one of the most devastating public relations or selling
13 jobs that was ever done was by the group of professors at
14 MIT who decided that their set of electromagnetic units
15 would be called the rational set; implying, of course,
16 that everyone else was irrational.

17 So your categorization has been given its due
18 worth.

19 So we'll come back at 10:15.

20 (Whereupon, the foregoing matter went off the
21 record at 10:05 a.m. and went back on the
22 record at 10:25 a.m.)

23 MEMBER FONTANA: Where are we at, Mr.
24 Chairman?

25 CHAIRMAN SEALE: I thought we would try to run

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1 on down -- well, maybe I should suggest a course of action
2 and if we agree with that, we can work from there.

3 The staff has indicated that they are
4 presenting a -- or they are preparing a Commission paper
5 that will submit to the Commission their proposed approach
6 for resolving all of these issues and they will be in a
7 position to present that paper to us at the April meeting
8 with the intent of or with the hope then that we would be
9 able to write a letter on that subject for the Commission
10 to consider at that time.

11

12 MEMBER FONTANA: A letter at the April
13 meeting?

14 CHAIRMAN SEALE: At the April meeting on the
15 Commission paper that the staff is preparing.

16 MEMBER FONTANA: That means another meeting
17 before April?

18 CHAIRMAN SEALE: No. We would have a
19 presentation on the Commission paper at the April meeting.

20 MEMBER KRESS: Then write the paper in the May
21 meeting?

22 CHAIRMAN SEALE: Yes.

23 MEMBER FONTANA: Oh, write the letter in the
24 May meeting?

25 CHAIRMAN SEALE: No, we can write the letter

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1 in the -- if we get it two weeks before.

2 MEMBER KRESS: If we get it two weeks before
3 we hear the presentation.

4 CHAIRMAN SEALE: Yes, yes.

5 MEMBER KRESS: And the presentation will be at
6 the May --

7 CHAIRMAN SEALE: Yes, at the April meeting.

8 MEMBER KRESS: May meeting?

9 CHAIRMAN SEALE: April meeting.

10 MEMBER POWERS: Bob wants the presentation and
11 the letter to be done in the same month.

12 CHAIRMAN SEALE: Yes.

13 MEMBER POWERS: And presumably that's because
14 the letter --

15 CHAIRMAN SEALE: Is largely --

16 MEMBER POWERS: We at least know what the
17 outline is going to be.

18 CHAIRMAN SEALE: Yes.

19 MEMBER POWERS: And presumably it would go to
20 the Commission shortly after our April meeting?

21 CHAIRMAN SEALE: Yes. So it's available to
22 them at the time when they're considering the proposal
23 from the staff.

24 MEMBER POWERS: And if we want to have
25 additional discussion on it, we have enough information

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1 now on what this outline is going to look like to discuss
2 it at least in a philosophical sense.

3 CHAIRMAN SEALE: During the March meeting.

4 No, we don't have any time -- well, we have letter writing
5 time, yes.

6 The other thing we could do is to ask the
7 staff to give us a presentation on the Commission paper on
8 the day before there's going to be another thermal
9 hydraulics meeting on a whole bunch of generic letters
10 that we're talking about which is -- what is that, the
11 28th?

12 There's a meeting scheduled on the 28th of
13 March and we could ask you to make a presentation on the
14 27th on the Commission paper. Now that's just a week
15 before the April meeting, because the April meeting is the
16 Thursday and Friday of the following week.

17 MEMBER POWERS: Are we going to have any
18 significant comments to make on this approach?

19 I mean is this going to be a letter that says
20 looks good to us.

21 CHAIRMAN SEALE: Well, it's hard to judge what
22 the Committee is going to decide.

23 MEMBER POWERS: I'm asking you to define the
24 oracle here and --

25 CHAIRMAN SEALE: That's an impossible chore.

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1 I feel that there are so many issues that -- let's say
2 there is a decision on so many issues that is implicit in
3 this position, the staff recommendation to the
4 Commissioners that we're likely to have some things we
5 want to say.

6 MEMBER POWERS: But it seems to me the
7 Commission paper is simply going to outline an approach.

8 CHAIRMAN SEALE: Yes.

9 MEMBER POWERS: That the implementation of
10 that approach comes to us again.

11 CHAIRMAN SEALE: Yes, it does.

12 MEMBER POWERS: And it is -- it strikes me
13 that it is more likely in the details of the
14 implementation that we would have comments than the
15 overall philosophy. Because it seems to me the overall
16 philosophy has been dictated for them by 50.109.

17 MEMBER SHACK: But the Commission paper will,
18 for example, suggest sending this stuff out for public
19 comment.

20 CHAIRMAN SEALE: Oh yes.

21 MEMBER SHACK: So is this ready for prime time
22 here.

23 MEMBER POWERS: Yes.

24 MR. SHERON: Well, no actually, the Commission
25 paper we were following the path of rulemaking, okay and

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1 we had explained that there were certain pieces all
2 associated with the rulemaking. There's a statement of
3 considerations, but a lot of the stuff is the same.
4 There's still the reg. guide. There is still, I think
5 there is a generic letter we were talking about for also
6 to implement the tech. specs and the like and there's
7 still the report which addresses the DPO concerns. And
8 that's all still on-going and doesn't change.

9 The only thing the Commission paper and again,
10 I'm prefacing this, I'm assuming that the management
11 reaches agreement on it. We haven't really briefed them
12 on it, but under the assumption that they agree with it,
13 then the Commission paper would basically go through what
14 you've heard today and it would say we've done the risk
15 assessment. We've done the regulatory analysis and as
16 Dana said, based on the conclusion then, the fact that we
17 can't really justify any cost enhanced backfits or
18 anything, our feeling is that we can implement a
19 regulatory framework or a regulatory approach for dealing
20 with steam generators within the current regulatory
21 framework that does not necessarily involve a rule.

22 See, the Commission right now thinks that
23 we're going forward and we're going to present them a rule
24 and what we're saying now is that it looks like we don't
25 really need to have a rule to do what we want to do.

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1 MEMBER SHACK: Okay, but when are you
2 proposing to send this stuff out for public comment,
3 presumably not -- that will be -- there's the generic
4 letter, the whole bit.

5 That's still months away then, right?

6 MR. SHERON: The original schedule was to send
7 a package in May to the Commission with the proposed rule.
8 So we're following 1061 so that's on its own schedule.
9 We've got to look right now and see what we would support,
10 but I would not think that we're going to have anything
11 ready to go out for public comment before May.

12 MEMBER SHACK: So it will be really on this
13 approach then, rather than anything else?

14 MR. SHERON: Yes, and if there's anything else
15 that is still that you think is problematical or anything,
16 obviously that's up to you whether you want to tell the
17 Commissioner if you think we're doing a great job. You're
18 always welcome to tell the Commission.

19 But we would really like as a letter in terms
20 of whether or not I think the Committee either agrees or
21 disagrees with this revised approach, based on what you've
22 heard here today.

23 We are willing to come down, obviously, on the
24 27th, if you need more information. I would hope that the
25 Commission paper would be out by that time.

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1 MEMBER POWERS: It seems to me more likely
2 that we would like to look at the package that goes out
3 for public comment than -- as a subcommittee --

4 CHAIRMAN SEALE: Than look at the Commission
5 paper.

6 MEMBER POWERS: Than the Commission paper. I
7 think that's -- I think we've seen all they have to offer.

8 MR. SHERON: You won't hear anything
9 different, if they come down on the 28th and present to
10 you what's in the Commission paper. You won't hear
11 anything different than what you heard today.

12 MEMBER POWERS: I'm sure that the Commission
13 paper will be a little more structured and certainly less
14 interrupted than the presentations here, but I don't
15 anticipate anything different.

16 I think that in thinking about the package
17 that goes out for public comment that we do have to
18 confront this detail question that seems to come up in
19 these things all the time, too much or not enough. And my
20 feeling is that the current approach that they're adopting
21 is one that better justifies the level of detail in the
22 existing reg. guide than more risk-based, risk-informed --
23 God help me if I've said the wrong word here, risk-
24 informed approach did. I mean it becomes much more
25 understandable now.

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1 CHAIRMAN SEALE: Yes.

2 MR. SHERON: I think if there's any other
3 areas that we need to discuss more, for example, the
4 section we would add to the reg. guide with regard to
5 considerations a licensee would need to take in looking at
6 risk. If they would relax a criteria. I think we owe you
7 a presentation on that once we write up the section. That
8 might be something towards the end of April, the
9 subcommittee meeting might be an appropriate time to go
10 through that.

11 And if there's any other areas again from your
12 list that you feel you need more information on we can
13 also either do it on the 28th, March 28th, if that's a
14 convenient time or else we would have just a larger
15 meeting maybe some time in April.

16 MEMBER POWERS: It looks to me like, if I had
17 a vote that I'd say that any additional subcommittee
18 meeting comes in April and even that's contingent upon on
19 some examination of the material.

20 CHAIRMAN SEALE: Of the material, yes. I just
21 don't anticipate anything dramatically different than what
22 we've seen. This is not even a complete cross section of
23 the ACRS, let alone the complete ACRS.

24 We do have people with different interests and
25 views, but if I had to bet, I'd bet that that would be the

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1 efficient use of our time and efficient use of staff
2 resources as well, because it's not easy for them to come
3 in and do the marathon presentations.

4 Well, that sort of complies with what I had in
5 mind, that we would expect to get a presentation of
6 appropriate length, hour, hour and a half, something like
7 that on the Commission letter and we would write a
8 probably fairly short letter endorsing and or taking
9 perhaps some exception, but not probably much we can think
10 of now.

11 MEMBER POWERS: I think it's more likely that
12 we would offer caveats.

13 CHAIRMAN SEALE: Yes, comments. And then when
14 the paper, when the full package is available for public
15 comment, we'd like a chance to look at it and ask for a
16 presentation on certain parts of it or perhaps all of it
17 at that time. So that's kind of the way I think we ought
18 to go from here and I suggest that to the subcommittee

19 MEMBER POWERS: I would suggest in this more
20 complete presentation on the final package that thought be
21 given to walking through the reg. guide with an idea
22 toward communicating why the elements are there from a
23 necessary and sufficient to insure quality point of view.

24 This has been area that you get this very
25 nebulous criticism. There's too much detail and not much

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1 help on what's the appropriate level of detail and I think
2 you must need to confront that. And say there's something
3 that bothering people and they don't understand why it is
4 necessary and sufficient to have each of these sections in
5 the reg. guide, less so on the technical justification,
6 but more on the necessary and sufficient kind of
7 viewpoint.

8 CHAIRMAN SEALE: Uh-huh.

9 MEMBER POWERS: Because it looks, when I read
10 it I think you've had a necessary and sufficient kind of
11 viewpoint. Here are the things we think it's necessary
12 for the licensee to do and if he does it, this is
13 sufficient to satisfy our need and if you can communicate
14 then when you describe this and I think you get rid of
15 this nebulous criticism.

16 CHAIRMAN SEALE: And it would be, in a sense,
17 be the kind of thing that -- the kind of evaluation that
18 the licensee would have to do in making the decision as to
19 whether or not they wanted to invoke this process.

20 MEMBER POWERS: I think so.

21 CHAIRMAN SEALE: In the skeleton form, not the
22 detail, but just okay, I need this and this is why ad this
23 is the kid of detail I would have to get into in order to
24 satisfy that requirement and build that structure to make
25 a decision as to whether or not it was worth the honor, so

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1 to speak.

2 Okay, well, I think that kind of puts us in
3 perspective. I would suggest -- I'm sorry, I would suggest
4 that we ask the people from industry if they would like to
5 make a few comments. I understand they've expressed an
6 interest in doing so.

7 MR. MULLINS: Yes sir. I'm Rick Mullins from
8 Southern Nuclear Operating Company, a member of the NEI
9 task force on the steam generator rule. And I had a few
10 brief comments that I wanted to make.

11 The first comment is realize that the industry
12 has not had the benefit of seeing the risk analysis, not
13 had the benefit of seeing the regulatory analysis. We
14 haven't had the benefit of seeing the draft guide 1061, so
15 the first time that we have heard any of these concepts
16 and approaches was yesterday.

17 Consequently, we don't expect a whole lot of
18 detail comments today and we would ask that those
19 documents be provided to the industry so that we can
20 review them and have adequate time to look at these
21 approaches and develop a better understanding of the tack
22 that's trying to be taken.

23 With that said, a couple of comments on the
24 regulatory analysis. It was characterized yesterday as I
25 guess two parts, one is a compliance backfit and one that

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1 has to do with alternate repair criteria, only to point out
2 that there are significant requirements in this draft
3 regulatory guide which the industry is not following
4 today, has never followed, that we have difficulty in
5 accepting as a compliance backfit.

6 A couple of points in case, NDE requirements
7 for inspection techniques not associated with risk of
8 severe accidents. The requirements in the reg. guide
9 greatly exceed anything that the industry is doing today.
10 To characterize that as a compliance backfit, I guess is a
11 stretch in my opinion.

12 Along the same lines, performance criteria.
13 The industry and the staff have not agreed on any of the
14 performance criteria, but yet we'
15 re having to meet those performance criteria and to say
16 that we have to meet these new performance criteria in
17 order to comply with regulations again seems to be a
18 stretch from where we are today.

19 Discussion that was held this morning was that
20 the operational assessment conditioning monitoring would
21 be required from an industry standpoint, but the
22 performance criteria are optional. We've been doing
23 operational assessments and conditional monitoring at
24 Farley longer than anybody i the industry and I have
25 difficult in understanding how you can separate those

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1 concepts.

2 How do you do an assessment without having a
3 criteria to meet?

4 Again, on the risk analysis, again yesterday
5 was the first day we had seen a lot of that. We do not
6 understand some of the conclusions that were reached. We
7 had asked that those analyses be provided to the industry
8 so that we can review those analyses and compare them to
9 the ones that have been performed by EPRI.

10 MEMBER POWERS: Could you tell us what
11 conclusions you have troubles with?

12 MR. MULLINS: There were specific PRA numbers
13 which came up that I guess the difference in implementing
14 the rule as it was proposed was like .7 to 10 to the minus
15 6 and yet we're going to require detailed risk analysis
16 for the utility which wanted to implement something that
17 would cause that change, doesn't seem consistent with
18 parts of that analysis.

19 That's just one comment. Thank you.

20 CHAIRMAN SEALE: Very good, thank you very
21 much for sharing your reactions to this. We appreciate
22 that you haven't had the opportunity to really look over
23 this material in detail and certainly after you've had a
24 chance to do so we look forward to hearing from you again.

25 MEMBER POWERS: And in fairness to ourselves

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1 and all concerned, today's meeting and yesterday's meeting
2 were focused much on the parts of the rule that were not
3 the compliance backfit, compliance issues.

4 CHAIRMAN SEALE: So in thinking about a
5 presentation for prior to going out for comment, I think
6 we have to address why things are compliance and not a
7 backfit.

8 MEMBER POWERS: Okay. Thinking of this
9 necessary and sufficient arguments for the reg. guide and
10 the generic letter, you need to think about why it's - and
11 articulate why it's a compliance issue and not a backfit
12 issue.

13 CHAIRMAN SEALE: How do you justify this?

14 MEMBER POWERS: It really wasn't the subject
15 here, but I mean it's a legitimate concern.

16 CHAIRMAN SEALE: Very definitely.

17 Well are there any other comments. Mr.

18 Hopenfield is supposed to be here at 11. We called him
19 about 11. Perhaps we should go back to our list then of
20 concerns and we can elaborate on those further.

21 There was the incomplete -- one of the topical
22 areas was incomplete and sometimes perfunctory analyses
23 required to provide an assessment of relative risk. I
24 think you addressed that pretty well in the presentation
25 you made. If you hit any ball, that was it.

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1 So that -- I think we're in better shape.

2 MEMBER POWERS: In a strict definition, the
3 incompleteness may still exist, but perfunctory went out
4 the window.

5 CHAIRMAN SEALE: Yes, that's right. Reliance
6 on core damage frequency alone is an indicator of risk.
7 Well, that's not true any more. You have looked at the
8 LERF as a
9 -- in making the assessments in your value, whatever that
10 VI, assessment.

11 We talked quite a bit about defense-in-depth
12 and I think we understand each other a little bit there, a
13 little bit better there based on the discussion that Dana
14 stimulated earlier.

15 And then we have our recommendations and those
16 are largely imbedded back in the concerns.

17 MEMBER POWERS: In our previous meeting there
18 were a set of what I recall nitty-gritty type issues where
19 there was dissension between the staff and industry. they
20 were very specific sorts of things, factor of 3 safety
21 factors versus 2.7 and some discussion on leakage rate and
22 things like that. Have those been resolved?

23 MR. STROSNIDER: This is Jack Strosnider from
24 the staff. As I indicated earlier, no, they have not been
25 completely resolved. Since that last meeting at least

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1 with regard to the deterministic factors of safety, the
2 factor of safety 3 and 1.4 that you mentioned, we did
3 receive an analysis of evaluation of that from the
4 industry and we're currently reviewing that. We're having
5 some independent review done of that, to try to get some
6 objective view of those criteria.

7 It's not been resolved yet, but we recognize
8 we need to come to some conclusion on that and we would
9 plan on doing that as we proceed through this process,
10 hopefully, we could have something before this goes out
11 for public comment, but certainly if not, we would treat
12 the paper that we got as part of the public comments and
13 resolve --

14 MEMBER POWERS: Oh, okay, so it counts in the
15 public comments and if you haven't resolved by the time
16 you go out --

17 MR. STROSNIDER: Oh, certainly and it would
18 be. Before it's vitalized. It obviously has to be
19 resolved.

20 MEMBER POWERS: Remind me again what the
21 leakage controversy was.

22 MEMBER SHACK: Whether it indicated failure of
23 the program.

24 MEMBER POWERS: At, that's right that's right.
25 Yeah, whether it indicates as Dr. Shack indicated, a

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1 failure of the program.

2 Basically, should it be -- currently, the
3 technical specifications have a limit on primary,
4 secondary leakage which, if exceeded, drive the licensee
5 to perform additional inspections. We're proposing a
6 performance criteria of a similar leakage value which if
7 exceeded, it would indicate that you need to go back and
8 reassess your program and see if any corrective actions
9 were necessary and there's some question about the
10 legitimacy of that as a performance indicator.

11 MEMBER POWERS: Yes, it was more whether there
12 should be injected in there an assessment step where
13 immediately moved to that.

14 CHAIRMAN SEALE: Yes

15 MR. STROSNIDER: I think that's the case, yes.

16 MEMBER POWERS: That seems like an easy one to
17 resolve.

18 CHAIRMAN SEALE: The questioning of the basis
19 of the .05 tube failure per year criteria, I guess you've
20 discussed that somewhat.

21 MR. STROSNIDER: It's a fairly straight
22 forward response, I think. Whether you accept it or not
23 is a different question. Basically, if you go back to the
24 prior risk assessments that have been performed,
25 specifically NUREG 0844, the assumption in there was that

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1 there was a .05 conditional probability of failure and
2 that resulted in an acceptable level of risk. So from our
3 risk-informed perspective, it provides an acceptable level
4 of risk. Now the staff also looked at it and there's been
5 discussion with the industry about perhaps that number
6 could be even higher. We've looked at it and said no, we
7 don't want to see it higher than that based on our
8 arguments of defense-in-depth and satisfying GDC and other
9 considerations in the regulations.

10 So we think it's an appropriate value based on
11 those arguments. I would also point out that the risk
12 assessment that's been performed most recently when they
13 went back and looked at these pressure induced failures,
14 again, concluded that that was an acceptable conditional
15 failure probability.

16 So that's where the conditional probability
17 main seam line break comes from. The performance criteria
18 for spontaneous ruptures, there were numbers for that
19 assumed also in 0844. This is actually a little bit lower
20 number which is based on current operating experience and
21 it's basically saying let's keep things consistent.

22 MEMBER SHACK: It's like a little bit lower.

23 MR. STROSNIDER: Yes. but it's basically
24 saying let's strive for performance criteria to maintain
25 something that is consistent with what we're seeing today.

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1 CHAIRMAN SEALE: What about the multiple tube
2 failure problem where single tube induced failures?

3 MR. STROSNIDER: That's an interesting point
4 because there are, as you're pointing out some numbers
5 from probability conditional failure probabilities of
6 multiple tubes. Some of the recent work that was done is
7 indicating that perhaps those numbers may not be necessary
8 or they may not be necessary to be the numbers that are
9 there. I think it's based on some of the thermal
10 hydraulic analyses and work that's been done, so we need
11 to take a look at that also.

12 CHAIRMAN SEALE: It's interesting to me, there
13 are two cases now where we have the blessing and the
14 utility has the difficulty of common design and that Duke
15 is now replacing the steam generators at Catawba and
16 McGuire and then you mentioned that we have the Braidwood,
17 Byran set. That's statistically enough tubes between in
18 each case and are they similar systems?

19 MR. STROSNIDER: Yes.

20 CHAIRMAN SEALE: So there's really four plants
21 there with essentially the same steam generator basically.
22 So that you should begin to be able to get some pretty
23 good statistical information and I would think that the
24 question of whether or not the failure mechanisms in the
25 different plants are really that similar or whether

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1 they're different difficulties depending on whatever, you
2 know. Are the Catawbas similar to the Byrons, for
3 example?

4 MR. STROSNIDER: There are certainly trends
5 with regard to vendor and model numbers or designs of
6 steam generators. If you look at the design features such
7 as the type of roll at the top of the tube sheet. We know
8 pretty much based on the data that are out there what sort
9 of degradation to expect at that location.

10 CHAIRMAN SEALE: Yes.

11 MR. STROSNIDER: So it's true that you
12 anticipate to some extent what type of degradation, at
13 least you know what's happened in the past.

14 The difficult part of it is that the time at
15 which this degradation might show up and the rate at which
16 it increases is different from plant to plant and that
17 gets into some very plant-specific situations as regards
18 water chemistry and maybe the heat of the material that
19 was in the tubing. And as I mentioned yesterday, even
20 between generators in a plant, you can see differences in
21 the time or rate at which degradation shows up.

22 We do look at that and I think some of the
23 staff has a pretty good handle.

24 CHAIRMAN SEALE: It might be interesting,
25 entirely aside from this discussion to find out what AEOD

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1 plans to do in by way of assessing that information or
2 whoever does that kind of assessment to look at those sets
3 of data now because they do give you statistics presumably
4 there's some statistics there we've been wanting to get.

5 MR. STROSNIDER: And materials and chemical
6 engineering branch in NRR, my branch, basically does most
7 of that. AEOD is putting out a report, I think. I don't
8 know if it's out yet. A NUREG report, summarizing some of
9 the steam generator operating experience.

10 One thing I would mention in this regard is
11 that we are in the process of putting together a data base
12 of steam generator operating experience that includes
13 design features, different, what types of degradation are
14 seen in different generators and at what locations in the
15 generator, in order to help us look at this kind of
16 trending.

17 CHAIRMAN SEALE: When you're ready to talk
18 about that, I'm sure we would be very interested to hear
19 what your plans are and what you expect to get out of
20 that.

21 MR. STROSNIDER: I should also mention that
22 the industry maintains a data base and we're trying to
23 make them complementary.

24 MEMBER POWERS: Is there somebody in this
25 world that looks at a better material?

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1 MR. STROSNIDER: Well, and of course, if you
2 look at the replacement steam generators, particularly
3 those -- they've gone to Inconel 690, higher chromium
4 content, better corrosion resistance and even some of the
5 600 thermally treated materials, if you look at the
6 replacement generators which go now back to the early
7 '80s, there's been much better operating experience,
8 partly due to materials, partly due to design changes and
9 support plates and fabrication methods and also due to
10 water chemistry control.

11 So the good news of this is that the
12 replacement generators do up to this point seem to be
13 operating much better than what we've seen in the past.

14 MEMBER POWERS: It just strikes you that
15 there's mileage to be made in a little corrosion research
16 here. but I'm reminded as my corrosion friends point out
17 to me that the national expenditures on corrosion and
18 corrosion failures is in the multiple billions of dollars
19 every year.

20 MEMBER SHACK: Ziebart them.

21 (Laughter.)

22 CHAIRMAN SEALE: I recommend you maybe do a
23 reassessment on the quality of the advice you're getting.

24 (Laughter.)

25 MEMBER SHACK: Do you continue to disagree

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1 about the 20 percent allocation to each mechanism?

2 MR. STROSNIDER: No, we need to assess that.
3 The issue here is performance criteria of 5 times 10 to
4 the minus second and what's in the regulatory guide is
5 that it indicates that no one vote of degradation should
6 account for more than 20 percent of that.

7 That really came frankly from the approach we
8 took in generic letter 95-05 in which the acceptance
9 criteria in that letter is 10 to the minus fifth. It was
10 purely judgment that well, we know there's other
11 degradation mechanisms going on so we don't want to eat up
12 all that additional probability with this one mode of
13 degradation. Maybe there's five, four or five modes of
14 degradation going on in a generator.

15 It obviously has some drawbacks to it. It's a
16 very judgmental --

17 MEMBER SHACK: It would make more sense in
18 that context because you were considering all of the
19 degradation mechanisms.

20 MR. STROSNIDER: Right.

21 MEMBER SHACK: But in this context where you
22 are presumably considering everything, then it's total
23 performance, it seems like.

24 MR. STROSNIDER: Right, and the other comment
25 that the industry has made and that we're looking at is

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1 that there's other approaches to this which would be, for
2 example, that the total probability should be five times
3 10 to the minus second. When you sum it over all the
4 active degradation modes.

5 The one thing that we're trying to come to
6 grips with there is the modes of degradation that you
7 don't know about that show up during the cycle. And so
8 again -- and then we look at it and say well, you know, do
9 we say it's 20 percent for the mode of degradation we
10 don't know about so we end up with a performance criteria
11 that's four times 10 to the minus second instead of five?
12 It's kind of splitting hairs.

13 But we recognize the point that's been made
14 and we're -- we've been having discussions and trying to
15 look at what's the most rational approach. The overall,
16 the objective, I agree though is that the overall
17 probability should be 5 times 10 to the minus second and
18 how you allocate it is something that we need to probably
19 take a harder look at based on the comments we receive.

20 CHAIRMAN SEALE: That's always an interesting
21 rule. Sophistry you get into when you start allocating
22 from that direction. You have to go find another
23 mechanism in order to be able to give out the list.

24 MR. STROSNIDER: Right.

25 CHAIRMAN SEALE: Any other of the concerns

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1 that anyone would like to reemphasize as being active?
2 Mr. Hopenfield is supposed to be here momentarily. I hate
3 to hold everybody in abeyance.

4 Would you tell us what you plan to do with
5 this? You are preparing a separate report specifically
6 addressing the difference in professional opinion?

7 MR. SHERON: Yes, there's I believe two
8 letters, Dr. Hopenfield has submitted to the EDO.

9 CHAIRMAN SEALE: There's also a letter we
10 prepared, I think.

11 MR. SHERON: Right, and the EDO has responded
12 to Dr. Hopenfeld, explaining that the staff would be
13 addressing these as part of the rulemaking package.

14 We are preparing a separate report. It will
15 address each one of the issues that Dr. Hopenfeld raised.
16 I'm not claiming that its going to satisfy him, but th
17 staff is assessing the concern, looking at it from the
18 safety significance and the like and whether or not we've
19 dispositioned it properly as part of the rule making. And
20 that report, I don't know if we have a schedule, Tim, but
21 we would make it available to the Committee, as well as
22 Dr. Hopenfield when we finish it.

23 CHAIRMAN SEALE: But you are attempting to
24 respond to all the questions that were on his --

25 MR. SHERON: Yes sir.

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1 CHAIRMAN SEALE: Well, does anyone want to
2 play music or something?

3 (Laughter.)

4 MEMBER POWERS: Let's exercise our legs a
5 little bit.

6 CHAIRMAN SEALE: Well, we'll stand by for --

7 MEMBER FONTANA: For an entrance.

8 CHAIRMAN SEALE: For an entrance.

9 (Off the record.)

10 CHAIRMAN SEALE: I believe we've got --

11 MR. HOPENFIELD: I thought I was scheduled for
12 11:30. I'm sorry.

13 CHAIRMAN SEALE: No, no, it was, but we
14 managed to converge or to agree to disagree or whatever it
15 is we did quicker than we had thought, so we appreciate
16 your accommodating us.

17 MR. HOPENFIELD: I appreciate you giving me
18 the time.

19 CHAIRMAN SEALE: Certainly.

20 MR. HOPENFIELD: And as a matter of fact, the
21 reason I'm here I'd like to point out to you that there is
22 a thermal hydraulic analysis that is invalid and --

23 (Microphone is being adjusted.)

24 MR. HOPENFIELD: I don't think you would need
25 him, we already talked about this last time. I run

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1 through a little bit more details in this packet.

2 CHAIRMAN SEALE: We need him because we feel
3 insecure otherwise.

4 MR. HOPENFIELD: You're welcome to throw all
5 the darts you have at me.

6 CHAIRMAN SEALE: Just one moment, we have
7 asked the staff what the status is on this and they've
8 indicated that they have two letters that you have written
9 and they are preparing a report which responds to all of
10 the questions that are in your two letters and also to a
11 letter that we have written to them requesting that
12 information.

13 So they are in the process of putting together
14 a report that they believe is responsive to your concerns.

15 MR. HOPENFIELD: Okay.

16 CHAIRMAN SEALE: With that comment, we'd like
17 to hear what you have to say.

18 MR. HOPENFIELD: Okay. I don't know which
19 letters you're referring to. No, that's okay. We'll see
20 when they come up.

21 CHAIRMAN SEALE: Okay.

22 MR. HOPENFIELD: Again, the reason I'm here is
23 to discuss, make a few comments regarding the thermal
24 hydraulic analysis in that NUREG, because the conclusions
25 strongly depend on it.

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1 Four years ago, five years ago, as part of the
2 DPO, I made a very quick analysis and concluded that the
3 surge line will fail after the tubes fail because of the
4 degraded tubes. Five years later, four years later, the
5 NUREG report indicates that that's not the case, that in
6 most cases the steam generator tubes will fail after the
7 surge line.

8 What the implication to the severe accident --
9 and that's the bottom line, that's what you're interested
10 in, I wasn't given the opportunity to take this further,
11 so any questions you may have regarding the containment
12 bypass frequency you may address to Mr. Boslik. I asked
13 him because I'm not familiar with the risk analysis or
14 with these numbers.

15 The reason for the differences and that's
16 really what I'd like to talk about is the -- in the NUREG
17 analysis there is a mixing in the inlet plenum and the
18 analysis that I have made I ignored any mixing and I
19 assumed the steam comes out of the hot leg, just hits the
20 tubes as it is. And that is the basis, that's not the
21 only one, but it's the major basis for the differences
22 between the results.

23 As you look at a steam generator, partial cut
24 of it, I think it's the Model F, you look at the plenum,
25 the inlet plenum, you have various streams. Is there a

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1 pointer that I could use?

2 (Pause.)

3 You have a counter flow in hot leg and then
4 you have a plume that will be rising because of buoyancy
5 effect. On top of it you also have first convection flow
6 due to the leakage of the tube. You have thousands and
7 thousands of cracks of unknown dimensions and size.
8 There's a finite probability that some of those will leak.
9 The basic assumption here there's one crack that's going
10 to leak. That's the reason for the stream that you have
11 on the right hand side of the top.

12 The other streams that you have are the normal
13 streams that you have mixing in a room where you have
14 walls that are at different temperature than the major of
15 the bulk of the fluid. So when you look at this kind of
16 configuration you want to model it, but the first thing
17 what you do you see what is governing it. Well, how do
18 you look at that? You start comparing values. You
19 compare different intensities of the flow. Well, if you
20 do that, you find that the leaking tube is on the order of
21 10 to 250 pounds and - which I will discuss in a little
22 more detail in a minute -- and the conduit flows on the
23 order of 4 pounds. So you've got this huge flow going
24 through there. It doesn't know that -- or how you know
25 that there's four pounds of convection in there.

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1 Now what was done in the NUREG report was to
2 assume that this flow is insignificant compared to the
3 counter flow. Now the reason it neglected it is because
4 the whole analysis in this SCDAP or RELAP analysis is
5 based on the mixing of the 1/7th scale model that was
6 conducted some time at Westinghouse. Now the basic
7 difference here is that that model didn't have any leaking
8 tubes. Now there are other differences, the question
9 about deposits which will affect the flow distribution,
10 but I just focus on one and that is the first convection
11 flow that you have when you have 2500 pounds difference
12 between the pinhole somewhere in the tube and you're in an
13 inlet plenum.

14 So if you look at the mixing process in this
15 kind of configuration, the mixing is going to be
16 drastically different when you had this flow here which
17 not only affects the flow here, it also affects the heat
18 transfer on the secondary side. So the entire pattern of
19 mixing, it's just not applicable. The whole question of
20 mixing in plenums and rooms, anybody who has done any
21 firing modeling would know this is an art. It's hundred
22 percent art.

23 MEMBER KRESS: Could you give me some idea of
24 what sort of analysis you went through to arrive at this
25 10 to 250 pounds were second?

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1 MR. HOPENFIELD: That's my next slide.

2 MEMBER KRESS: Okay, I'm sorry.

3 MR. HOPENFIELD: So you have a situation where
4 you cannot take this data that was generated at
5 Westinghouse and say I'm just going to perturb the thing
6 and run some sensitivity studies because you're running
7 sensitivity studies on an entire different model.

8 There were the certain mixing ratio that was
9 relevant for these particular tests. It's completely
10 irrelevant to what you're going to have here.

11 Now --

12 MEMBER SHACK: Your second bullet really
13 should be where there was no leakage?

14 MR. HOPENFIELD: Well, I thought I said that.

15 MEMBER SHACK: You did state --

16 MR. HOPENFIELD: We're at analysis based on
17 1/7th scale test where there was no mixing.

18 MEMBER SHACK: You mean no leakage, don't you?

19 MR. HOPENFIELD: No leakage, I'm sorry.

20 MEMBER SHACK: Thank you very much.

21 MR. HOPENFIELD: You are right. I apologize.

22 Okay, I'm going to give you plenty of opportunity to take
23 shots at me.

24 Let's take a look at what happened when you
25 have a pin hole and I picked up the .001 through the wall

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1 crack. Anybody that has some experience with cutting with
2 torches or working with torches, you realize that you have
3 the center of the jet, you have a high intensity region
4 and that as you go away the air is being -- the jet
5 entrains the air from the outside and you have a spread of
6 the jet besides the expansion of the jet itself.

7 Now the problem gets a little bit complicated
8 because in addition -- it's not a pure jet that you have.
9 You have a lot of particles that are really like sand
10 particles that really cut through the material. So what
11 you really have you have a region, if you look at a thing
12 across the jet, you have a region of different
13 intensities. In the center you'll cut through faster and
14 as you go away, you'll be less severe.

15 So it really amounts to what kind of material
16 you're talking about. A soft material would probably have
17 a larger spread. A harder material would be narrower and
18 obviously it also depends on the distance from the work
19 place, upon the work piece, so to speak.

20 Now there is no data in the literature on this
21 kind of project that you have, that you're going to have
22 in the case --

23 MR. CATTON: What kind of jet is this? I mean
24 you have a .001 inch hole. You have a pressure ratio
25 that's what, about 2,000?

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1 MR. HOPENFIELD: Correct.

2 MR. CATTON: There's information on this kind
3 of a jet.

4 MR. HOPENFIELD: Steam. Yes, there is.

5 MR. CATTON: What is it that I don't have
6 information on?

7 MR. HOPENFIELD: Okay, what you don't have
8 information is how fast you're going to be eroding the
9 material, how it's going to be spreading --

10 MR. CATTON: Slow down. Are you talking about
11 eroding the size of the hole?

12 MR. HOPENFIELD: Eroding both, the size of the
13 hole and the --

14 MR. CATTON: Where it impinges?

15 MR. HOPENFIELD: And where it impinges, both.
16 Let me answer your question.

17 MR. CATTON: There is data on this sort of
18 thing.

19 MR. HOPENFIELD: There is millions of data,
20 but there is nothing under this kind of condition that
21 we're talking about. The closest one -- you see, the
22 important thing is the material. And the material we have
23 here is Inconel 600 and I believe that the people --

24 MR. CATTON: The sand or whatever it is you
25 were talking about, what it is, its size distribution and

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1 number density are also important.

2 MR. HOPENFIELD: That's right. That's what
3 I'm saying. In this particular sense it's probably
4 aluminum oxide of whatever, boron oxide, whatever you
5 have.

6 MR. CATTON: Aluminum oxide can erode pretty
7 well.

8 MR. HOPENFIELD: Yes, whatever you have in the
9 system. I don't know. You definitely have boron oxide.
10 What I'm saying there is no specific data on how all these
11 parameters come together and affect, tell you what is
12 going to be the exact spread of the jet as a fraction of
13 the distance between the tubes.

14 MR. CATTON: That we know.

15 MR. HOPENFIELD: That's what I'm saying.

16 MR. CATTON: What you can't calculate is the
17 erosion rate at the second tube.

18 MR. HOPENFIELD: I cannot or can?

19 MR. CATTON: You can. I'm sorry, you -- I
20 don't know if you can calculate the erosion rate of the
21 second tube. You certainly can calculate the
22 characteristics of the jet.

23 MR. HOPENFIELD: Okay.

24 MR. CATTON: Including the barrel shocks and
25 everything.

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1 MR. HOPENFIELD: Okay, the erosion of the
2 second tube was calculated by NRR. They came up using
3 analogy with superheated tubes on some program. They came
4 up with number -- with time scale from like 5 seconds to
5 about 40 seconds which I think is reasonable.

6 Now the question is how fast this thing is
7 going to propagate. You have to realize you have 9,000
8 seconds here that you have sitting there before the surge
9 line goes. So there's plenty of time there for the
10 accident to propagate. So if you look at 9,000 seconds
11 and you say okay, what does it take to erode, well, I use
12 their numbers, average number what they suggested.

13 I have calculated my own number some times
14 before and they were much faster. The reason they're
15 faster, you see ,it's not only just -- you already have
16 degraded material. You don't have a 40 mil wall with a
17 brand new material. It's not there. It's a degraded
18 material that you start with. The data they use came from
19 some superheater and they do not report the spacing
20 between the superheater. It's usually about an inch.

21 So using their erosion rates, using a 30
22 second kind of thing, the question is how is it going to
23 propagate? Well, the way it's going to propagate is how
24 fast it's going to drill through the next one, next one,
25 next one, next one. And as it goes and drills through all

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1 these, now each time the jet goes it expands. That
2 question is how much expand, I don't know exactly how much
3 it expands. That's really what the issue is here.

4 But I assume --

5 MR. CATTON: The hole size, you're assuming,
6 is .001 inch?

7 MR. HOPENFIELD: Correct.

8 MR. CATTON: And the spacing between the
9 surfaces of the tubes is?

10 MR. HOPENFIELD: The spacing is what you have
11 on the model. It's about one inch.

12 MR. CATTON: Surface to surface, half inch?

13 MR. HOPENFIELD: This -- well, it's less.
14 It's about 300 mils. Take a look. You've got an inch
15 between -- it's about an inch and the diameter is about
16 11/16ths so the tube is about 300 mils.

17 MR. CATTON: .3 inches?

18 MR. HOPENFIELD: Something like that.

19 MR. CATTON: So what you're talking about is
20 30 diameters, 30 hole diameters away?

21 MR. HOPENFIELD: Right.

22 MR. CATTON: Your hole is .001.

23 MR. HOPENFIELD: Right.

24 MR. CATTON: The distance is .3?

25 MR. HOPENFIELD: Right.

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1 MR. CATTON: 300 diameters.

2 MR. HOPENFIELD: Later on we'll see it's not
3 that critical. Let me finish --

4 MR. CATTON: That's one of the key parameters.

5 MR. HOPENFIELD: Well, usually what it takes,
6 okay, it is a key parameter, but there's no data about the
7 core and the spread for this particular jet, but if you
8 look at liquids, okay, high velocity. L over D with
9 nothing -- turbulent flow. Over there you get into the
10 Weber number because that's you tear the particles.

11 But there it's on the order of like 300 to a
12 1000, so it depends on what you're talking about. And I
13 have seen jets that just break up immediately. There --
14 when I say there's no data --

15 MR. CATTON: This is a gas jet.

16 MR. HOPENFIELD: I understand. It's not a gas
17 jet.

18 MR. CATTON: There is data on a high pressure
19 ratio gas jet.

20 MR. HOPENFIELD: It's not a gas jet. It's a
21 gas jet loaded with particles.

22 MR. CATTON: Okay.

23 MR. HOPENFIELD: It's somewhere between fluid
24 and gas.

25 MR. CATTON: It acts like a gas.

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1 MR. HOPENFIELD: Well, it probably is more
2 than 2. We're getting something -- the relevant point is
3 that I made the assumption that it's 2 based on -- it's a
4 judgment call. I believe it's higher, but that's what I
5 use, 2. So you can perturb it any way you want to. You
6 can go to 1.5 if you wish. I believe it's going to be
7 more than 2. But if you take that 2 and you take this
8 time scale, you come up with leak rates which are huge.
9 Now you can start playing with these numbers because it
10 goes exponentially like 2 to the N. So if you take 1.5 or
11 you want more than 2, if you run research you can come to
12 something else.

13 The main point here is not to go to the detail
14 of modeling this thing. The main point what I'm trying to
15 get across here, there is a mechanism to propagate this
16 thing very fast.

17 Now let's go back to reality check. I happen
18 to spend at least a year or two thinking of these problems
19 in connection of the design basis for the ABWR where we
20 had -- in the steam generator the problem was a little bit
21 different, but some of the basics were very much the same,
22 although you have sodium-water chemical reactions
23 involved. I think I'm repeating myself, but we came up
24 with something like I believe for the design basis like 10
25 tubes, there was an accident four years ago at Dunray and

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1 there were 40 of them that went.

2 So this idea of propagating them from one tube
3 to another is not something that I'm inventing here. I'm
4 not. The concept of damaging next tubes have occurred in
5 craft boilers where millions of dollars were lost. So
6 this is not something -- I do not have the data for this
7 and I'm not going to say that these numbers really --
8 you're going to worship these numbers, because they're
9 not.

10 It's an indicator here and that's what is
11 important. It's the indicator that's important. But
12 that's what I'm trying to get across. But for four years
13 what I have been seeing and NRR has been walking away from
14 that. It's not there.

15 Well, obviously this is ridiculous, this kind
16 of number, so what you can say, well, I'm going to focus on
17 the supercell including only 4 and I'll come up with a
18 number which is obviously it's controlled by the choking
19 flow from the maximum area that you have and that would be
20 equivalent to a flow of four tubes.

21 So this is where the 250 comes.

22 MEMBER KRESS: So that's four times the leak
23 out of --

24 MR. HOPENFIELD: It's four tubes is basically
25 what it says.

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1 MEMBER SHACK: It's the leakage from what in
2 these four tubes?

3 MEMBER KRESS: From inside the tubes through
4 the steam side.

5 MR. HOPENFIELD: This indicates that you're
6 going to have very fast propagation. Obviously, when you
7 have more holes in one tube, obviously they're going to be
8 probably adjacent tubes. But if you take this number of
9 tubes, I mean holes on one tube would exceed what you
10 would have by the incoming flow through the cross section
11 of the tube which is controlled by the choke flow. So all
12 you've got to say is I really -- I cannot get more than
13 what I would have passing through the four tubes.

14 MEMBER SHACK: Okay, I guess I'm -- how did
15 you scale from a situation in which your leakage in a
16 steam generator is measured in fractions of gallons per
17 minute to a situation now where the leak rates are
18 hundreds of pounds per second?

19 MR. HOPENFIELD: I didn't scale anything. In
20 the case of what you have fraction -- during normal
21 operating -- you're talking about normal operating
22 conditions.

23 MEMBER SHACK: Right.

24 MR. HOPENFIELD: Okay, during normal operating
25 condition I have minute flows that I'm not even concerned

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1 abut that. All I'm saying I'm going now to a transient
2 and maybe I should have gone back and described the
3 transient. I'm going to a situation where the secondary
4 side on the steam generator is empty. I have a tube,
5 would steam it --

6 MEMBER SHACK: So I've upped the pressure.

7 MR. HOPENFIELD: The pressure is at 2500
8 pounds.

9 MEMBER SHACK: You've upped the pressure.

10 MR. HOPENFIELD: Now if there's a little crack
11 that's what is going to propagate. I didn't have that
12 situation --

13 MEMBER KRESS: So he's saying that's choke
14 flow out of that size hole.

15 MR. HOPENFIELD: The 25 -- you cannot have
16 more than choke flow.

17 MEMBER KRESS: Yes. You take a .001 inch hole
18 and put choke f' through it. That's what he said you
19 get.

20 MR. HOPENFIELD: If you have millions of those
21 holes, you cannot have more choke flow than you go through
22 the inlet of the tube.

23 MEMBER POWERS: What's the choked flow through
24 .001 inch hole?

25 MR. HOPENFIELD: Pardon?

1 MEMBER POWERS: What's the choked flow through

2 --

3 MEMBER KRESS: I'm assuming it's 2600 feet per
4 second. I've not calculated it.

5 MR. HOPENFIELD: I'm using what the NRR people
6 calculated. They're better at calculating things.

7 MEMBER FONTANA: Bear with me for a second,
8 Joe. What's 1.6 times 10 to the minus 5?

9 MR. HOPENFIELD: If you take one micron, one
10 mil, to get you a feel for what a mil is, it's about the
11 size of your hair. You can see it. You take one mil hole
12 and start throwing leaking through -- steam through it.

13 Then that jet is going to hit the next one.

14 MEMBER FONTANA: Right.

15 MR. HOPENFIELD: And then it's going to hit
16 the next one and it will propagate all around. I'm saying
17 when it hits the next one, it spreads a little bit, so it
18 affects, it gives you a bigger hole. It's much more
19 complicated. I'm simplifying because I really don't have
20 that much time.

21 MEMBER FONTANA: What is 1.6E-5?

22 MR. HOPENFIELD: Okay, so what happens if you
23 take the -- well, the 1.6 comes from the -- it's simply
24 density times the velocity times the area --

25 MEMBER KRESS: It's pounds per second.

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1 MR. HOPENFIELD: It's called rho V. It's a
2 continuity of mass.

3 MEMBER FONTANA: For that little one?

4 MR. HOPENFIELD: For that little one. I used
5 the rho -- I don't remember what I used, but I used the
6 atmospheric, the velocity is at 2500 and --

7 MEMBER FONTANA: Okay.

8 MR. HOPENFIELD: If you want to be accurate,
9 you can go and use the density of the choke flow condition
10 and you can keep on doing it.

11 The idea here is to give you --

12 MEMBER FONTANA: Now what's a 2 to the N?

13 MR. HOPENFIELD: Okay, each time that that jet
14 hits the adjacent tube, it spreads a little bit.

15 MEMBER FONTANA: Right.

16 MR. HOPENFIELD: So the area, the effective
17 area is going to be twice, actually probably is going to
18 be much more. Yes. The next one keeps on going. Now you
19 have -- now the next one opens up and you'll have twice as
20 much flow coming out of there and keep on going.

21 MEMBER FONTANA: Okay, so N then is a number -
22 - every time it fails it doubles is what you're saying?

23 MR. HOPENFIELD: Correct. No, that's two.
24 The doubling is two.

25 MEMBER FONTANA: That's right.

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1 MR. HOPENFIELD: Instead of 2 you can put 1.5,
2 if you wish, or put 5 or put whatever you want.

3 The time here is 9,000 divided by 30. The 30
4 is -- this gentleman, the NUREG time, I mean the NRR time
5 and the 9,000 comes from the fact, from the beginning of
6 the accident, that's the time scale we're dealing with.

7 MEMBER FONTANA: Okay. So once it gets big
8 enough to equal the area four tubes --

9 MR. HOPENFIELD: Then I said well, listen, I'm
10 getting a ridiculous number that doesn't make any sense.

11 MEMBER FONTANA: That's right.

12 MR. HOPENFIELD: So I'm going to look at 4
13 because 4 sits next to it and I'm going to say I'm not
14 going to have more than I can get through that 4.

15 MEMBER FONTANA: I've got it.

16 MR. HOPENFIELD: That's the number. Now you
17 an argue whether it's 250, but really that's
18 insignificant, but if you want 100, 100 fine, but what
19 you've got to compare and the bottom line here is going
20 back to this draft. That is the bottom line. When you
21 have 250 and you have 4 pounds, the first thing you make
22 it balance and you don't build a program that takes 3 or 4
23 years to figure out that it gets some other result.
24 That's really what the bottom line is.

25 MEMBER KRESS: So you put 4 in as N, 2 to the

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1 4th times --

2 MR. HOPENFIELD: Sir?

3 MEMBER KRESS: 2 to the 4th?

4 CHAIRMAN SEALE: No, he said he cut four tubes
5 this way. He limited this thing to the mass flow through
6 four tubes.

7 MEMBER KRESS: Yes, that's 2 to the 4th times
8 1.6 times 10 to the minus 5?

9 MR. HOPENFIELD: 2.6 -- no, it's probably much
10 larger, but I said I don't want to deal with it. I don't
11 really -- all I want to show you is I can have large
12 leakages and when you have large leakages and you have
13 such a small counter flow in the system, don't worry about
14 the counter flow, worry about what the leakage does to
15 you.

16 MEMBER KRESS: I understand.

17 MR. HOPENFIELD: And that's really the answer.
18 That's really what I'm doing here, nothing else. There's
19 nothing genius about this.

20 MEMBER POWERS: I guess this side of the table
21 still is lost a little bit.

22 When I look at a one mil hole with a 2600 foot
23 per second jet going through it, I get a flow rate of like
24 .4 of a cubic centimeter a second. That means I'm going
25 to have an awful lot of these little holes to get up to

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1 anything close to a pound a second?

2 MR. HOPENFIELD: You're correct. You've got
3 many, many holes in here because it keeps doubling up.

4 MR. CATTON: If your steam generator is
5 operating such that it's just below detection as far as
6 leakage, what size hole is that?

7 MEMBER POWERS: Well, we have a criterion --

8 MR. CATTON: Is it based on gallons per day or
9 something?

10 MEMBER POWERS: That's right.

11 MR. CATTON: If I have that many gallons per
12 day, what hole size does that translate into?

13 MEMBER SHACK: Well, do you attribute it all
14 to a single crack or how many cracks do you postulate?

15 MR. CATTON: Just contribute it to an area.
16 Anyway you want.

17 MR. HOPENFIELD: I think it's going to be very
18 small.

19 MEMBER POWERS: If somebody could remind me
20 what the --

21 MR. CATTON: Much less than the .001?

22 MR. HOPENFIELD: I think it's going to be much
23 less than .001, right. Very, very small. It's in the
24 liters per -- I forgot the numbers, but it's in liters per
25 minute.

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1 MR. CATTON: You see, under those
2 circumstances you've got a couple of hundred psi and now
3 you've got 1,000 psi, 2,000 psi across the hole.

4 MEMBER POWERS: Could somebody remind me what
5 the leakage criterion is?

6 MR. STROSNIDER: Jack Strosnider, staff. The
7 technical specification limits are about .3 gallons per
8 minute, 150 gallons per day. It's been reduced to, for
9 some of the plants that have a lot of degradation. Those
10 numbers were based on trying to assure a leak before a
11 break condition basically, such that if you detect that
12 amount of leakage, the flaw size should be less than the
13 critical flaw size at normal operating pressure which is
14 getting up somewhere around I think three quarters of an
15 inch to an inch, maybe something like that.

16 MEMBER SHACK: Now that's at main steam line?

17 MR. STROSNIDER: That's at main steam line
18 break.

19 MEMBER SHACK: I think it's about half the
20 length of the crack at main steam line break, so it's
21 roughly a half inch crack.

22 MR. STROSNIDER: Okay, at main steam line
23 break, right. And I don't know the exact numbers, but the
24 numbers that correspond to that primary to secondary
25 leakage, I believe there are some factors of safety in

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1 there too, but it's a larger flaw size than what you're
2 talking about this one mil hole. It's significantly
3 larger than that. It's a half inch crack, I think.

4 MR. CATTON: Larger than the one mil hole?

5 MR. STROSNIDER: Yes.

6 MR. HOPENFIELD: I don't have a slide of this
7 thing but five years ago, the Belgians made a presentation
8 with this regard and I think it's relevant to your
9 question, sir. And they said that there's no way that
10 it's completely a different phenomena. There's no way of
11 taking these kind of leak rates that you see during normal
12 operations and even talk in terms of the content that
13 we're talking about.

14 I don't have a slide of it, but I'd like to
15 pass this around.

16 MR. CATTON: I don't understand why there
17 isn't?

18 MR. HOPENFIELD: Well, because -- here's the
19 calculation. Why there isn't?

20 MR. CATTON: Yes.

21 MR. HOPENFIELD: Because the pressure and the
22 opening of the crack, they mention plugging the crud is
23 two different things.

24 MR. CATTON: You've got to start with
25 something and --

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1 MR. HOPENFIELD: You've got to start --

2 MR. CATTON: I could see where you could make
3 the argument just below the detection limit, that should
4 define somehow --

5 MR. HOPENFIELD: I have plugged tubes
6 according to - a lot of plugged tubes that open up the
7 pressure.

8 MR. CATTON: What happens when they do two
9 things? One, I switch to a gas flow and two, I increase
10 the pressure drop across the tube by a factor of ten.

11 MR. HOPENFIELD: And a third, you're opening
12 up the latter there because of the crud was crudded and it
13 was plugging it under normal condition. Now you open it up
14 and that has been observed experimentally.

15 MR. CATTON: I'm not disagreeing with you.

16 MR. HOPENFIELD: Okay.

17 MR. CATTON: I'm just trying to understand.

18 MR. HOPENFIELD: Yes.

19 MR. CATTON: So how much would the crack open?

20 MR. HOPENFIELD: How much?

21 MR. CATTON: I already heard that it's
22 probably greater than .001.

23 MR. HOPENFIELD: Well, I'm sure. I just took
24 the arbitrary-- you can take larger, but they've got about
25 a factor of 100 opening here. I just used, I went as

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1 small as you can to indicate to you, just to get around
2 all those questions how small is small, how large is
3 large. I start with the smallest one.

4 MR. CATTON: You can argue that some value is
5 as large as you could ever expect and you can calculate
6 the mass flow and it's a number that's too small to worry
7 about, the problem is over.

8 MR. HOPENFIELD: Right, but I don't think you
9 can. That's the problem.

10 MR. CATTON: I'm trying and I'm trying to have
11 your help.

12 MR. HOPENFIELD: I don't know how and I'm just
13 telling you -- I don't know how to get the opening. You
14 can use some elastic plastic analysis and figure out how
15 much a little crack would open up.

16 MR. CATTON: I can't do an elastic plastic
17 analysis. That's a little too stiff. I like it to be
18 more viscous.

19 MR. HOPENFIELD: If you do that, you get very
20 large flow rates. You really will because if you use the
21 normal K delta P to get the opening of that crack, you get
22 -- this is a factor of 100 here, I guess.

23 And their conclusion, because of the plugging
24 that you can't do that and I agree with that. By the way,
25 this thing is documented in one of the ACRS meetings.

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1 CHAIRMAN SEALE: Well, could I ask is this
2 question going to be addressed in the report that the
3 staff has prepared?

4 MR. STROSNIDER: I'm sorry, I didn't --

5 CHAIRMAN SEALE: Should the question be
6 addressed the report that you are preparing in response
7 to Dr. Hopenfield?

8 MR. STROSNIDER: Yes, we've done analysis in
9 this area and we can include it in the report. I would
10 comment, as we presented it yesterday that the frequencies
11 you saw containment bypass, what was built into that model
12 is if you have a quarter inch through wall flaw that it
13 leads to tube failure based on this phenomena and that's
14 represented in the frequencies that were shown. Of
15 course, this is dependent upon the frequencies you see in
16 that type of flaw.

17 CHAIRMAN SEALE: Sure.

18 MR. STROSNIDER: But we have done some
19 analyses in this area and we can include them in the
20 report.

21 MR. HOPENFIELD: Could I make a comment? It
22 really wasn't my purpose here because I can only talk
23 about thermal hydraulics. Since you mention that, you
24 really have to watch it very carefully when they talk
25 about the frequency. First of all, the support plate

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1 cracks were not taken into consideration. There's a
2 reference in this document to the fact that the aspect
3 ratio is something like 4 to 5, given it's 4, it's less
4 than .05 because there are a lot of tubes which are only
5 40 mils.

6 If you look at the aspect ratio, there's no
7 reference that one could go through the data and see where
8 it comes from and then really more important than anything
9 else, you already worry about well, those cracks were just
10 about next to the surface, they're going to open up.

11 So I think just to throw numbers in the air,
12 that's fine and I didn't want to get into that because
13 that wasn't my subject here, but when the answer comes to
14 the DPO, I think, I hope you'll address that instead of
15 just throwing numbers which this document does.

16 CHAIRMAN SEALE: Are there anymore questions
17 or comments?

18 MEMBER KRESS: I still don't know where the
19 260 pounds per second comes from. If somebody would write
20 me an equation up there and say multiply this times this
21 times this and get 260, it would be very helpful.

22 MR. HOPENFIELD: Can I answer your question,
23 sir?

24 MEMBER KRESS: Yes sir.

25 MR. HOPENFIELD: Forget about the 260. The

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1 only purpose here is to say there's a mechanism to
2 propagate a leak very fast. It doesn't have to start with
3 a large hole or a larger than .25 or whatever. That's
4 very important. The 260 is just to get you a feel because
5 some other person would have asked me where is the number.

6 MR. CATTON: And I think Tom, what he's saying
7 is you have any leaks the first thing you have to think
8 about is will the aerosols or particles or particulates or
9 whatever is in the flow cause erosion and make that hole
10 bigger. That's one.

11 The second is will the jet from this leak
12 impinge on an adjacent tube? If the hole is small enough,
13 the aspect ratio of the jet is a number of diameters away
14 is very large, most of it's going to attenuate and
15 probably not. But as the hole grows, it certainly could.

16 So I don't know if we know how to even begin
17 to answer that kind of a question, unless we can address
18 the question of what's being carried with this flow,
19 because it's probably the aerosols that are going to cause
20 the problem.

21 MR. HOPENFIELD: Absolutely.

22 MEMBER KRESS: Those are liquid droplets.

23 MR. CATTON: Well, any kind of liquid or
24 anything that's carried as a particle of the flow will
25 cause erosion. Now I know at higher temperatures because

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1 we have lots of examples in the rocket business and
2 blowing out elbows and with aluminum oxide, for example.
3 It just cuts like a torch.

4 Now here the temperatures are a lot lower. I
5 mean they are nowhere near the same kind of temperatures,
6 but on the other hand, you've got 9,000 seconds for
7 something to happen. I just don't know how all that plays
8 -- you can actually lay it out. You can first, what is
9 the probability of the pinholes, .001 or any size. And
10 then for a given hole size and pressure ratio, what is the
11 probability the jet will damage an adjacent tube?

12 What's the leakage rate through the pinhole?
13 How fast will the pinhole grow and how big can a hole be
14 during normal operation and not be detected?

15 I don't know, but it seems to me these kinds
16 of questions could be answered.

17 MR. HOPENFIELD: I think all your questions --
18 you didn't miss anything, you just hit the nail on the
19 head. You are absolutely right, but the bottom line is
20 people out there in the field, they're not interested in
21 these kind of problems. They don't look at that kind of
22 minute detail to calculate these kind of things.

23 So you don't have the data. I think the only
24 one that I've looked at, and NRR found the relevant data
25 on the material because it's the material, it's the

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1 particle size. It's the particle concentration. It's the
2 distance of the jet. It's the velocity and if you keep on
3 going, I don't know what it is and I don't think anybody
4 without spending several years running some kind of
5 experimental program will find out.

6 MR. CATTON: I think the first thing somebody
7 ought to do is sit down and just walk through some of
8 this.

9 MR. HOPENFIELD: They have tried. They came
10 up with this thing.

11 MR. CATTON: I guess I don't know what this
12 thing is.

13 MR. HOPENFIELD: Well, they came up with data
14 from superheater erosion of a superheater tube which are
15 usually on those plants, if I remember, they were running
16 at pretty high temperature and they were at like at 1000
17 pounds or so. What they had in the experimental program
18 to measure what the erosion rate is going to be from a
19 little pinhole, but the tubes, I think, were much thicker,
20 but the time erosion rate was 5 -- there was a difference
21 of a factor of 6. Correct me if I'm wrong --

22 MR. CATTON: This is an erosion rate due to a
23 hot gas without any particulates?

24 MR. HOPENFIELD: No, with and without
25 particulates.

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1 MR. CATTON: With and without particulates.

2 MR. HOPENFIELD: Yes, it's on page -- what
3 page is this? Jack, what page is this? I'll give you the
4 exact

5 --

6 MR. STROSNIDER: I don't have the report with
7 me.

8 MR. HOPENFIELD: Here, I have it. I have
9 assumed that you've seen this report.

10 MEMBER FONTANA: I remember it

11 MR. HOPENFIELD: Because of the time
12 limitation I assumed that you had seen this.

13 4-12, I think.

14 MR. CATTON: 4-12.

15 MR. HOPENFIELD: Okay, he's got 4.9 seconds
16 for clean tube and 62 seconds for jet with particles. I
17 took the in-between there. That's where the 30 seconds
18 comes from. I eyeballed it.

19 Jack, do you remember what the spacing was on
20 these?

21 MR. STROSNIDER: I'm sorry.

22 MR. HOPENFIELD: Do you remember the spacing
23 between the superheater tubes on this?

24 MR. STROSNIDER: No, I don't. Unfortunately,
25 th staff members who did that calculation aren't here

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1 right now. We have that information.

2 MR. CATTON: The time to failure is 4.9 and
3 62.6.

4 MR. HOPENFIELD: That's whether you have
5 particles or not which would make sense.

6 MR. CATTON: Then they agree with you?

7 MR. HOPENFIELD: Yes, I took their data. They
8 don't agree with me. I took their --

9 CHAIRMAN SEALE: He averaged their number.

10 MR. CATTON: Okay.

11 MR. HOPENFIELD: The only thing that you may
12 want to argue here is to come up with whether you have a
13 doubling up. I didn't want to get into the details of the
14 mechanism here, but what you have you're eating through
15 the next tube, but as you finish eating the next tube, now
16 you're going to high pressure jet come from the other side
17 and which will deflect the other one, but that high
18 pressure is going to erode the hole anyway you get into a
19 situation where we can write a Ph.D. thesis, but it's just
20 not worth the time. It's a mechanism from propagating
21 something very fast and I think we ought to accept that.

22 CHAIRMAN SEALE: Well, I think we certainly
23 will have to look at this carefully. We want to see what
24 your response report looks like as well as the report we
25 have here and we thank you very much for keeping our

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1 attention focused on this matter here, sir.

2 MR. HOPENFIELD: Thank you very much.

3 CHAIRMAN SEALE: It's of serious concern.

4 MR. HOPENFIELD: Thank you for allowing me the
5 time.

6 CHAIRMAN SEALE: We appreciate your time and
7 preparing and bringing this to our consideration.

8 I guess we're at the witching hour. I want to
9 thank the staff. I want to thank the industry for their
10 comments and their tolerance of our schedule.

11 What else can I say? Is there anything else?
12 We're adjourned.

13 (Whereupon, at 12:00 p.m., the meeting was
14 concluded.)

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C E R T I F I C A T E

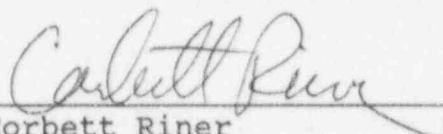
This is to certify that the attached
proceedings before the United States Nuclear
Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor
Safeguards Joint Meeting: Materials and
Metallurgy & Severe Accident
Subcommittees

Docket Number: n/a

Place of Proceeding: Rockville, MD

were held as herein appears, and that this is the original
transcript thereof for the file of the United States Nuclear
Regulatory Commission taken by me and, thereafter reduced to
typewriting by me or under the direction of the court
reporting company, and that the transcript is a true and
accurate record of the foregoing proceedings.



Corbett Riner
Official Reporter
Neal R. Gross and Co., Inc.

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INTRODUCTORY STATEMENT BY THE CHAIRMAN OF THE
MATERIALS & METALLURGY AND SEVERE ACCIDENTS JOINT SUBCOMMITTEE
11545 ROCKVILLE PIKE, ROOM T-2B3
ROCKVILLE, MARYLAND
MARCH 4-5, 1997

The meeting will now come to order. This is the second day of the meeting of the ACRS Joint Subcommittee on Materials & Metallurgy and Severe Accidents.

I am Robert Seale, Chairman of the Subcommittee.

The ACRS Members in attendance are:

George Apostolakis, Mario Fontana, Thomas Kress, Dana Powers, and William Shack. The ACRS Consultant in attendance is Ivan Catton.

The purpose of this meeting is to hold discussions with representatives of the NRC staff, to gather information concerning the technical basis and regulatory analysis associated with the steam generator tube integrity rule and related regulatory guide. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions as appropriate, for deliberation by the full Committee.

Noel Dudley is the Cognizant ACRS Staff Engineer for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on February 14, 1997.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register Notice. It is requested that the speakers first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

We have received no written comments from members of the public. One individual requested time to make an oral statement at the end of the meeting.

Today the Committee will hear from the staff and its contractor concerning the regulatory analysis.

We will proceed with the meeting and I call upon Mr. Tim Reed, Office of Nuclear Regulation, to begin.

DETAILED ANALYSIS OF SG RULE VALUE-IMPACT APPROACH

- General equation for values and impacts:

$$NV = V1 + V2 + V3 + V4 + V5 - [I1 + I2] \text{ where:}$$

V1 = avoided public risk [person-Sieverts (Sv) and \$200k/per-Sv]

V2 = avoided occupational risk w/accident mgmt [person-Sv]

V3 = avoided offsite property risk [\$]

V4 = avoided onsite financial risk-cleanup/power replacement [\$]

V5 = decrease/increase in routine occupational dose [person-Sv]

I1 = costs to NRC [\$]

I2 = costs to licensee [\$]

All \$ are 1997 \$'s

- V1, V3, and V4, dominate the calculation on value side (V2 and V5 are not discussed herein)

DETAILED ANALYSIS OF SG RULE AVOIDED PUBLIC RISK

- Utilized ΔLERF to calculate avoided public risk (V1):

V1 averted public risk in \$'s = $(\Delta\text{LERF})(\text{Conditional Conseq})(\$/\text{Person-Sv})(\#\text{PWRs})(\text{Discounted Lifetime})$

- Conditional consequences utilized SST1 values from NUREG-2239 and values from NUREG-1570 (2×10^4 person-Sv)
- Consequences were then ratio'd for each PWR by $(\text{SST1}_i / \text{SST1}_{\text{Surry}})(\text{Power level}_i / \text{Power Level}_{\text{Surry}})$

DETAILED ANALYSIS OF SG RULE REMAINING VALUES

- Calculation of averted offsite damage (V3) similar to averted public risk:

V3 averted offsite damage in \$'s = $(\Delta LERF)(\$ \text{ for Surry large release})(\text{Discounted lifetime})$ --scaled for each of 73 PWRs by $(SST1_i/SST1_{\text{Surry}})(\text{Power level}_i/\text{Power Level}_{\text{Surry}})$

- Used NUREG/CR-2723 for property damage values converted to 1997 \$'s

- Calculation of averted onsite financial risk (V4):

V4 averted onsite financial risk in \$'s = $\Delta LERF[(\text{power replacement}) + (\text{cleanup})](\text{Discounted lifetime})(\#PWRs)$

- where NUREG/CR-4627 adjusted to \$1997 is used for power replacement estimate and cleanup

DETAILED ANALYSIS OF SG RULE RESULTS CONT'

- Net value for just the risk portion of the draft rule is a modest positive \$700k/plant--remember:
 - Used a relatively bounding Δ LERF
 - Assumed 10 high risk PWRs (contribute 2/3'ds total risk)
 - Did not include the actual costs to achieve the assumed Δ LERF
- Considering the initial assumptions, the staff concluded that further refinement of the estimate was not necessary and that the actual net value would be very small or even negative (costs outweighing values)

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COMPILATION OF CONCERNS

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Committee report issued on November 20, 1996

- I. Difficulty in reaching agreement on the performance criteria
- II. Incomplete and sometimes perfunctory analyses required to provide an assessment of relative risk
- III. Reliance on core-damage frequency alone as an indicator of risk
- IV. Recourse to defence-in-depth without specific criteria for its use
 - Inclusion of programmatic elements in regulatory guide
 - Requirements for NDE supplemental performance demonstrations
 - Limit of 20% of the conditional probability of burst criteria for each degradation mechanism
 - Deterministic structural criteria use of a safety factor of 3 times the differential pressure across steam generator tube at normal operating pressure
 - Assumptions used in thermal-hydraulic codes, bounding versus best estimate
 - Assumptions used in flaw-distributions
 - Assumed reliability of components in event trees, primary relief valves assigned low failure probability versus secondary relief valves assigned high failure probability
 - Operator actions not considered in the event tree scenarios

V. Recommendations

- Allow licensee to consider risk instead of frequency. i.e. allow credit for steam generator as a filter
- Rewrite the regulatory guide to state the risk objectives and how the objectives will be assured by the performance criteria
- NRC should review and approve the methodologies developed by the utilities to demonstrate conformance with the performance criteria [the Committee suspects there is no cost savings in inspecting the methodologies after the fact]
- Encourage the staff to consider the industry concerns about overly conservative assumptions required to in the deterministic criteria
- Resolve the professional differing opinion and Generic Safety Issue 163 before implementing the steam generator rule.

4
**Comments On The Thermal-Hydraulic Analysis In
NUREG-1570**

**ACRS Materials and Metallurgy Subcommittee
& Severe Accidents Subcommittee**

March 5 , 1997

**Joe Hopenfeld
GSIB/DET/RES**

My reason for commenting on NUREG-1570

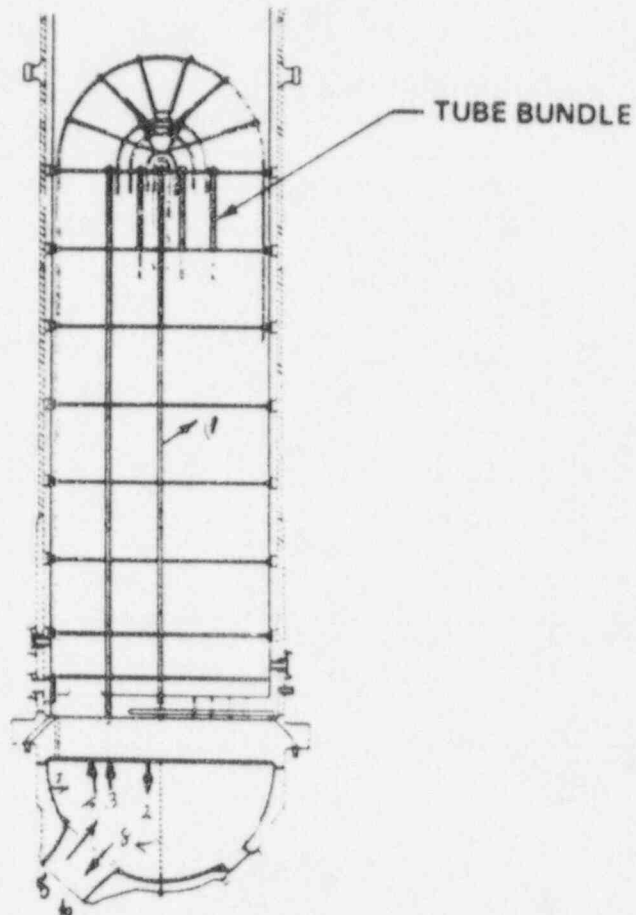
- The results of the document are not valid because leaks through degraded tubes are ignored
- Comparison of DPO & NUREG-1570 Results

Reference	Failure Mode	CONTAINMENT BY PASS FREQUENCY
HOPENFELD DPO- Memo To Beckjord (Effect of degraded tubes on risk from severe accidents, Sept 11, 1992)	SG tubes fail before surge line	1.6 E-5/year
DRAFT NUREG-1570 (Feb. 1997)	Surge line fails before SG tubes for most sequences	3.3 E-6/year

- Comparison of DPO & NUREG-1570 Assumptions Regarding Mixing In SG Inlet Plenum

	DEGREE OF MIXING
DPO	None
NUREG-1570	0.87

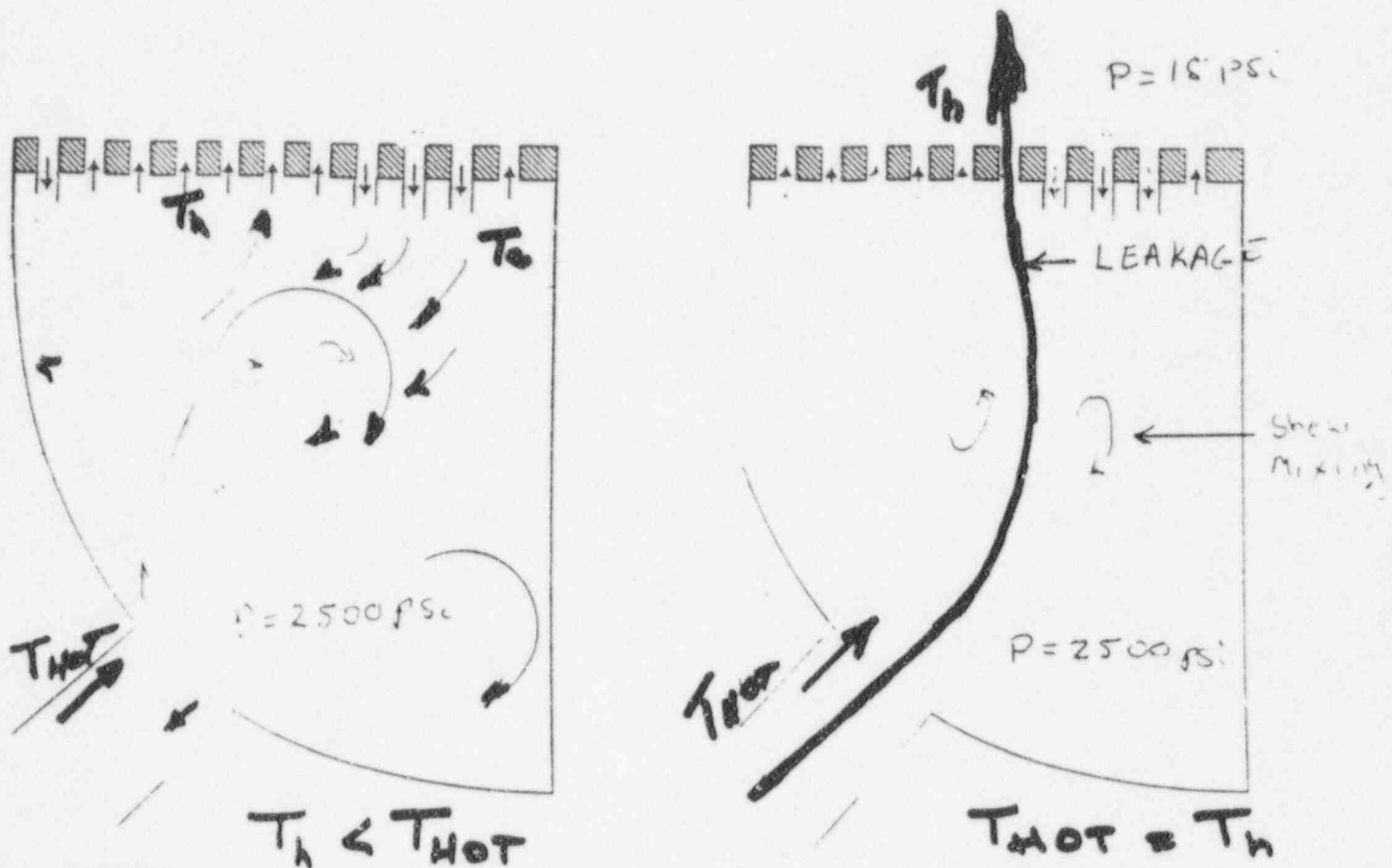
MIXING OF STEAM STREAMS IN THE INLET SG PLENUM



- (1) Flow from leaking tubes into the secondary side
- (2) Return flow from outlet plenum
- (3) Forced convection flow (leakage)
- (4) Free convection flow (buoyancy)
- (5) Counter flow (hot)
- (6) Counter flow (cold)
- (7),(8) Wall flow due to local temperature differences

Leaking Tubes Flow, (1) = 10 - 250 Lbs/sec
Counter Flow, (5) = 4 Lbs/sec

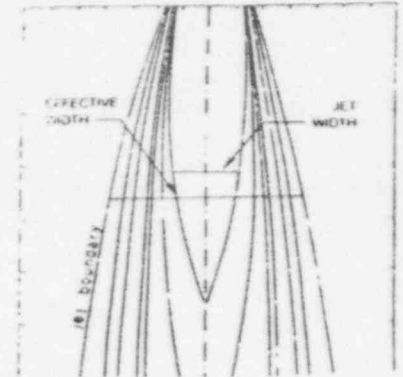
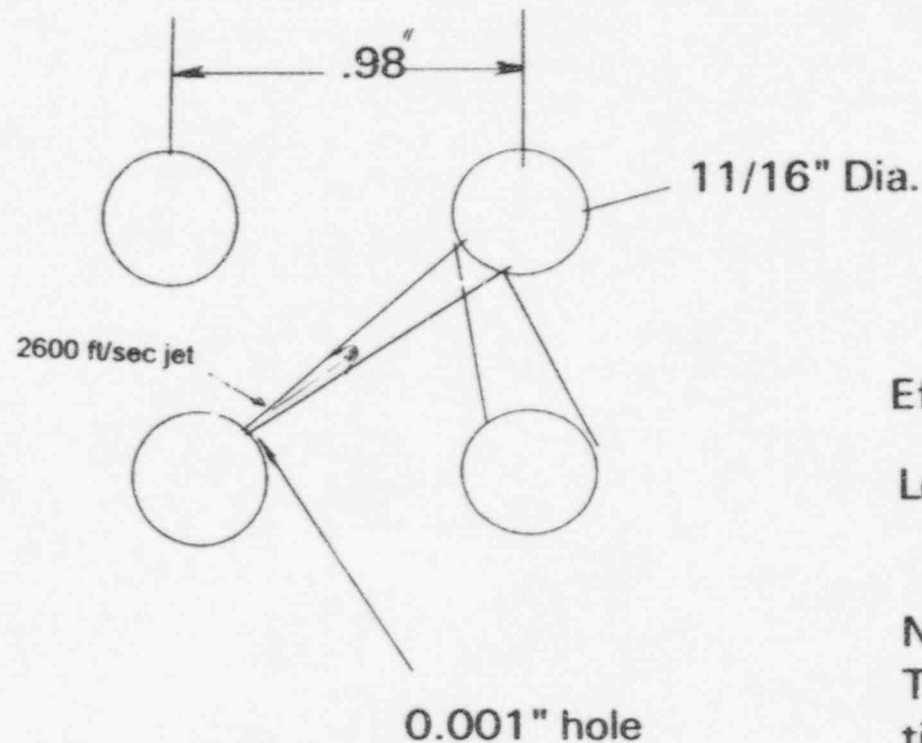
Comparison between mixing (left) and non mixing models (right)



NOTES

- Mixing decreases tube temperature rise rate in comparison to the non mixing case
- NUREG analysis is based on 1/7th scale tests where there was no mixing
- Sensitivity studies which are based on 1/7th scale test data have no physical meaning. If the tests were conducted with leakage the flow pattern would have been different
- Varying the number of hot tubes and circulation ratios may be applicable when the counter flow is larger than tube leakage.

Schematic of Tube to Tube Propagation Due to 0.001" Thru Wall Defect



Effective jet width/crack size = 2

$$\text{Leakage} = 1.6E-5 (2)^N \text{ lbs/sec}$$

$$= 1.6E85$$

N = Time for propagation =
Time to surge failure/Drilling
time = 9000/30

CONCLUSIONS

- (1) Tube to Tube Damage May Propagate Very Fast
- (2) Damage to Four Tubes is a Reasonable Assumption
- (3) 4 Tube Equivalent Leakage = 260 lbs/sec

CONCLUSIONS

Risk Assessment of Severe Accident Induced Steam Generator Tube Rupture depends on the validity of the thermal-hydraulic analysis.

- **KEY ASSUMPTIONS IN THE NUREG REPORT ARE INCORRECT**
- **THE TREATMENT OF UNCERTAINTIES *DOES NOT COVER THE PROPER PARAMETERS***