NUCLEAR REGULATORY COMMISSION

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COMMISSION MEETING

In the Matter of: PUBLIC MEETING

BRIEFING ON PRESSURIZED THERMAL SHOCK

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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

3

4 BRIEFING ON PRESSURIZED THERMAL SHOCK

5

6 PUBLIC MEETING

7

8 Nuclear Regulatory Commission
Room 1130
9 1717 H Street, N. W.
Washington, D. C.

10

Tuesday, November 24, 1981

11

12 The Commission met at 1:30 p.m., pursuant to

13 notice.

14

BEFORE:

15

NUNZIO PALLADINO, Chairman of the Commission
16 VICTOR GILINSKY, Commissioner
PETER BRADFORD, Commissioner
17 JOHN AHEARNE, Commissioner
THOMAS ROBERTS, Commissioner

18

19 ALSO PRESENT:

20 S. CHILK
T. MURLEY
21 H. DENTON
S. HANAUER
22 W. DIRCKS
S. TRUBATCH
23 R. KLECKER
D. JOHNSON
24 P. RANDALL
M. VAGANS

25

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DISCLAIMER

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

2 CHAIRMAN PALLADINO: The meeting will please come

3 to order.

4 The subject of today's meeting is a briefing on

5 pressurized thermal shock of reactor pressure vessels. The

6 briefing is being held in accord with the Commission's

7 continuing interest in this important topic and with its

8 desire to be briefed periodically on progress being made.

9 At this time I suggest that we proceed with the

10 briefing and turn the meeting over to Mr. Dircks of EDO.

11 MR. DIRCKS: Mr. Chairman, this is to give you a

12 status report on where we stand on this issue and to bring

13 you up to date on the recent staff actions that have

14 occurred since the last time we addressed the Commission.

15 Tom Murley will do the briefing. Tom, as you

16 know, has recently shifted over to a new position. But

17 since he had followed this issue up to very recent days we

18 thought he should do it. Steve Hanauer is there to provide

19 the transition team and will pick up Tom's duties as Tom is

20 phased out.

21 With that, Tom, will you begin.

22 MR. MURLEY: I do this in my spare time at night.

23 (Laughter.)

24 A lot of work has been done on this topic of

25 pressurized thermal shock since we briefed you first last

1 June. The staff conclusions are really the same as we
2 reported them back last June, although we have much more
3 information. Still there is a lot of work that is needed to
4 develop a supportable regulatory position and that is why we
5 believe that we are still going to need the extra time to
6 develop the basis for a staff position on the matter.
7 So I will discuss this recent information since
8 last September when we were down last and then where we seem
9 to be going.
10 Could I have the first chart, please.
11 (Slide presentation.)
12 I think it is important to recognize that there is
13 no clear-cut time or status of a vessel when a vessel
14 changes from being safe to being unsafe. I have found that
15 a very difficult concept to get across when I discuss it
16 with the media, but it is largely a matter of judgment which
17 depends on a good understanding of the risks involved.
18 COMMISSIONER GILINSKY: Wait a minute. I have a
19 little trouble absorbing it also. Clearly there is a
20 continuum and things can get worse and worse and worse and
21 so on, and as that happens the risks go up.
22 MR. MURLEY: That is right.
23 COMMISSIONER GILINSKY: So in nature there isn't
24 any sharp line. But we have got to decide where we think we
25 ought to draw the line.

1 MR. MURLEY: Yes.

2 COMMISSIONER GILINSKY: Are you going to address

3 that?

4 MR. MURLEY: Yes. That is where we are headed, as

5 a matter of fact.

6 COMMISSIONER GILINSKY: But I mean that is true of

7 everything we deal with. That is true of thickness of

8 containments or just anything.

9 MR. MURLEY: The goal is to draw that line, that

10 is right. Right now our regulations do not place any limits

11 on the brittleness of pressure vessels. The risks

12 involved ---

13 COMMISSIONER GILINSKY: Wait a minute. Isn't one

14 of the appendices to Part 50 devoted to this matter, or am I

15 wrong?

16 MR. MURLEY: Yes. Appendix G discusses it, but it

17 is mainly cool-down limits and heat-up rates. It does not

18 place an absolute limit per se on the brittleness in terms

19 of reference temperature that a vessel can reach. That is

20 what we are aiming for, as a matter of fact. That is the

21 goal of this program.

22 COMMISSIONER AHEARNE: Are you aiming for some

23 reference temperature? I thought your first comment there

24 was that another way of looking is saying that you can't

25 simply set a single reference temperature and say that will

1 be the criteria.

2 MR. MURLEY: No, I didn't mean that. There is no

3 clear-cut line, that is meant to say, that you could talk

4 about a vessel being safe versus unsafe. Now, as

5 Commissioner Gilinsky points out, nevertheless one has to

6 have regulations. We will do that when we assess the risk.

7 Presumably there will be a safety goal or some kind of

8 target we can analyze.

9 COMMISSIONER GILINSKY: Wait a minute. That is

10 something for the long term though. We may not have a

11 regulation now, but we have to have a view on what is

12 acceptable and what isn't acceptable. Are we going to hear

13 about that?

14 MR. MURLEY: Yes. Our view is that the vessels

15 are acceptable now and that we believe we do need a

16 regulatory limit but it takes time to develop one that is

17 supportable. We hope to have one, say, by next summer.

18 CHAIRMAN PALLADINO: You will address, however,

19 what our risk is in the interim?

20 MR. MURLEY: Yes.

21 COMMISSIONER AHEARNE: And what kind or a

22 criterion or set of criteria you are tentatively looking at?

23 MR. MURLEY: Yes. We can talk about that.

24 The items involved clearly are very complicated.

25 This is one of the more, if not the most complicated, type

1 of regulatory issue that we face because it cuts across many
2 disciplines and many matters. You have the transients, the
3 vessel properties and so forth.
4 COMMISSIONER AHEARNE: Wouldn't you also add to
5 that list operator action?
6 MR. MURLEY: Yes, I should have. That is right.
7 COMMISSIONER AHEARNE: That seemed to be a major
8 point in much of the discussion.
9 MR. MURLEY: Yes.
10 COMMISSIONER ROBERTS: Are there many mysteries
11 about the material properties of plate and weld metal?
12 MR. MURLEY: Yes, there are, because it is
13 irradiated and that does it.
14 The second chart, please.
15 Now, this is a highly schematic curve. I had
16 hoped to illustrate the following point, that for any given
17 reactor one can presumably construct a curve of the
18 probability of a transient of given severity versus the
19 severity of the transient. Our experience tells us that it
20 falls off with severity. So that there are a whole class of
21 over-cooling transients that one could talk about.
22 We have in the past dwelled very heavily on the
23 Rancho Seco transient because it is one that was
24 experienced. So we tend to use that as a benchmark in our
25 calculations and it has a certain probability of occurring

1 that is shown schematically there.

2 On the other hand, there can be, and we have

3 always recognized that there can be more severe

4 transients ---

5 COMMISSIONER GILINSKY: You say "which would cause

6 vessel cracking." Which vessel, the Rancho Seco vessel or

7 some other vessel?

8 MR. MURLEY: Well, that is my point. This curve

9 would be different if we could construct it. This would be

10 different for each reactor.

11 COMMISSIONER GILINSKY: Is this for the Rancho

12 Seco vessel?

13 MR. MURLEY: It is just a schematic.

14 COMMISSIONER GILINSKY: The reason I ask is

15 because last time I believe you or someone else informed us

16 that the Rancho Seco transient in another vessel might have

17 led to cracking.

18 COMMISSIONER AHEARNE: I think that is consistent

19 with what Tom is saying. What he is saying is that each

20 vessel has to be analyzed for each series ---

21 COMMISSIONER GILINSKY: That is what I am asking,

22 whether that is for the Rancho Seco vessel or not.

23 MR. MURLEY: Well, that could be, for example, for

24 the Rancho Seco vessel. Let's say it were. It has some

25 certain probability of occurring but we would assess that it

1 wouldn't threaten the Rancho Seco vessel now at all and
2 probably not for another, say, ten effective full-power
3 years. But there could be a more severe transient show down
4 on the curve that could threaten the vessel.
5 COMMISSIONER AHEARNE: I think Vic's point though,
6 Tom, is that the last time there was an impression left that
7 the Rancho Seco transient itself could be that transient
8 which would cause vessel cracking in some other vessel,
9 correct?
10 MR. MURLEY: Not yet, no.
11 COMMISSIONER GILINSKY: That is what I thought.
12 MR. MURLEY: We have analyzed the oldest vessels
13 using our own analysis methods developed largely at Oak
14 Ridge, and we would say that even for the oldest vessel
15 today the Rancho Seco transient would not crack that vessel
16 using nominal properties, that is not the very worst
17 properties that you could imagine.
18 Next chart, please.
19 This is highly technical. I showed it to the ACRS
20 when we talked to them a couple of months ago. It is to
21 illustrate the staff's views that there are a number of
22 margins in the fracture mechanics analyses that are done.
23 Probably the two most important would be the
24 second and third bullets there. The actual shift in
25 temperature we think will probably be less than we use in

1 Reg. Guide 1.99. That will be borne out later as we see in
2 the responses that we got from industry.
3 Similarly, the ASME Code toughness curves that we
4 use in the calculations tend to be, and in fact are lower
5 bound curves. We don't know the amount of margins that
6 those two items give us, but we are doing a statistical
7 analysis to try to get a better handle on the margins.
8 Now there are sources of non-conservatisms ---
9 COMMISSIONER AHEARNE: Could I just ask a question?
10 MR. MURLEY: Yes.
11 COMMISSIONER AHEARNE: The first bullet, is it
12 just that you assume the presence of a flaw, or do you
13 assume a presence of a necessary size flaw?
14 MR. MURLEY: Of a flaw large enough to initiate a
15 crack.
16 COMMISSIONER AHEARNE: Now you don't feel that
17 that also is an important -- (Inaudible).
18 MR. MURLEY: Yes, it is. It is a conservatism.
19 It is almost impossible to quantify is the problem. So we
20 take the conservative regulatory posture that we just have
21 to assume a flaw.
22 COMMISSIONER AHEARNE: But, as I tried to draw
23 out, it is more than just a flaw. It is a flaw of a certain
24 minimum size.
25 MR. MURLEY: Yes, but for the kinds of severe

1 transients that we look at it doesn't take a very deep
2 flaw. A half an inch, for example, deep flaw can initiate a
3 crack.
4 COMMISSIONER AHEARNE: Are those commonly found?
5 MR. MURLEY: The question is are they commonly
6 found? They have really only started looking with good
7 techniques, as I mentioned last time, ultrasonic techniques
8 recently. They looked at the Oconee 1 vessel for the
9 ten-year inspection and they found indications. They are
10 not really cracks, but just small imperfections that can be
11 of an eighth of an inch say deep. This was the first time
12 that they, using these sophisticated techniques, really
13 looked right underneath the cladding and they found these.
14 Now they are not what you would call cracks, but they could
15 initiate cracks for severe transients.
16 COMMISSIONER AHEARNE: What I conclude from what
17 you said is that they don't reach the level of the minimum
18 size that you spoke about. You said one-half inch I think.
19 MR. MURLEY: No, a half inch is not necessarily
20 minimum.
21 CHAIRMAN PALLADINO: You said a half inch, then
22 you said deep and then you said an eighth of an inch deep.
23 Did you mean the crack -- (Simultaneous Conversations -
24 Inaudible).
25 MR. MURLEY: I am sorry. I didn't mean to imply

1 that a half inch was a minimum size for initiating a crack.
2 Smaller flaws can initiate cracks if the stress is high
3 enough.
4 COMMISSIONER AHEARNE: So there is no minimum size
5 flaw that you would conclude would not lead to the crack
6 initiation which would be of concern?
7 MR. MURLEY: Let me ask someone from fracture
8 mechanics. Is there a minimum size flaw, Ray?
9 MR. KLECKER: Not really. It all depends on the
10 severity of the transient itself that you assume. If you
11 assume a very severe transient and if you ignore the effect
12 of cladding, then cracks on the order of an eighth inch or
13 quarter of an inch could initiate. However, with the
14 underclad indication which he is describing here, it is not
15 very likely that that particular flaw would initiate because
16 of the toughness of the clad over the top of it. So this
17 gets into some of the assumptions we have to make in the
18 analysis where we feel there are some conservatisms.
19 CHAIRMAN PALLADINO: Is the length of the crack
20 significant or not? If it is an eighth inch deep and a half
21 inch long is that worse or better or not significantly
22 different?
23 MR. KLECKER: The longer the flaw the more likely
24 it is to propagate. A very short flaw would not necessarily
25 initiate.

1 MR. MURLEY: The next chart, please.

2 There are, as I mentioned, some non-conservatisms

3 also. We put this up primarily for completeness. I think

4 the most important one is really the first one and I have

5 already mentioned that. There are overcooling transients

6 that can be more severe than the Rancho Seco transient. So

7 we don't by any means believe that using the Rancho Seco as

8 a benchmark is the worst that one can see.

9 CHAIRMAN PALLADINO: But is that a

10 non-conservatism in analysis or don't you analyze each

11 scenario as an independent analytical problem? I can accept

12 that first one. It is certainly true.

13 MR. MURLEY: Yes. Actually it is not a

14 non-conservatism. We analyze, yes, the more severe

15 transients.

16 CHAIRMAN PALLADINO: But the other items are truly

17 non-conservatisms even after you have picked the scenario

18 one evaluation?

19 MR. MURLEY: I have listed those as potential

20 sources of non-conservatism, yes. I mentioned that the

21 RT NTD shift may be higher than the Reg. Guide 1.99. That

22 is a true statement, but it is very unlikely because the

23 reg. guide was drawn to bound all the data points. But

24 there is the chance that it could be high.

25 COMMISSIONER AHEARNE: I guess I find difficulty

1 having one page that possibly the conservatisms are that the
2 actual shift will probably be less than 1.99 and then on the
3 non-conservatisms that it may be higher than 1.99. That is
4 too much fence straddling.
5 (Laughter.)
6 MR. MURLEY: We believe unequivocably that the
7 actual shift will probably be less than Reg. Guide 1.99.
8 COMMISSIONER GILINSKY: Remind me what RT NDT is.
9 MR. MURLEY: That is the reference temperature at
10 which the material becomes brittle. It is defined generally
11 through a Sharpe Test, when a Sharpe specimen would crack at
12 30 foot-pounds. That is typical.
13 CHAIRMAN PALLADINO: And that varies with fluence?
14 MR. MURLEY: With fluence that reference
15 temperature shifts to higher tempratures, which is to say
16 that it becomes more brittle.
17 COMMISSIONER AHEARNE: Of course, it is not a
18 go/no-go. It is a definition point on the curve.
19 MR. MURLEY: That is right.
20 COMMISSIONER AHEARNE: So it isn't that on one
21 side it is not brittle and on the other side it is suddenly
22 embrittled.
23 MR. MURLEY: That is right.
24 The next chart.
25 Since we met with you in September we have had

1 meetings with the owners groups.

2 COMMISSIONER BRADFORD: Tom, I had thought you

3 were going to go down the last chart. Can you talk a little

4 bit more about the fluence calculations possibly being in

5 error?

6 MR. MURLEY: Put back on the last chart on

7 non-conservatisms.

8 Now we generally are assuming a plus or minus 30

9 percent or 40 percent uncertainty. I don't know exactly for

10 each specific calculation uncertainty in the fluence. We

11 use nominal neutral fluences in the calculations. There

12 clearly is a spread on either side of that. In some of the

13 Combustion Engineering early calculations they were

14 substantially off in their estimates. For example, when

15 they pulled the capsule out of Maine Yankee they found that

16 the fluence was off by I think about a factor of two in the

17 non-conservative direction; that is to say, they were

18 underestimating the fluence.

19 COMMISSIONER GILINSKY: Doesn't that mean that you

20 have got an uncertainty in the effective full-power years

21 which is comparable to that?

22 MR. MURLEY: Yes, if we still had that

23 uncertainty. Now that began to show up a few years ago in

24 all of the Combustion Engineering calculations mainly

25 because they used a simpler model than other people were

1 using, a one-dimensional transport calculation. They have
2 now corrected those for capsule measurements and they do the
3 full two-dimensional calculation.
4 Furthermore, there is a benchmark research program
5 at Oak Ridge where they and the other two vendors have taken
6 part and we feel comfortable that they can calculate it to
7 within 30 percent.
8 So the numbers we would quote on any of these
9 fluences and lifetimes would be our best estimates as
10 corrected today.
11 CHAIRMAN PALLADINO: I am not sure I understood
12 the answer to what I thought was Commissioner Gilinsky's
13 question. Did you say that this was an error in full-power
14 years, effective full-power years ---
15 COMMISSIONER GILINSKY: An uncertainty.
16 CHAIRMAN PALLADINO: Yes, an uncertainty, or is it
17 an uncertainty in the correlation between fluence and
18 full-power years, or maybe both, I don't know.
19 MR. MURLEY: Well, I understood the question to be
20 the following. Suppose we were to quote the vessel life as
21 30 effective full-power years and then we made a measurement
22 when we pulled the capsule out and we found our flux was off
23 by a factor of two in the wrong direction. Then there would
24 be a direct reduction in our estimate of full-power year
25 lifetime.

1 CHAIRMAN PALLADINO: It wasn't an uncertainty in
2 what full-power years you had run up to that time, but
3 rather it was a correlation between the fluence --
4 (Inaudible).
5 MR. MURLEY: Yes. I believe that is right, yes.
6 COMMISSIONER BRADFORD: I guess I am still a
7 little confused. I had thought you were using error bands
8 of 20 percent on fluence calculations. Is that wrong?
9 MR. MURLEY: That is what we believe we can get
10 down to. We have more or less demonstrated that on the
11 benchmark program at Oak Ridge.
12 COMMISSIONER BRADFORD: What were you using say in
13 the estimates you gave us when this first came up last
14 spring with regard to the seven or eight problem plants?
15 MR. MURLEY: There we use the mean calculated
16 value.
17 COMMISSIONER BRADFORD: I see. So that when you
18 made statements about probabilities of serious events you
19 weren't using the upper end of the error band but you were
20 using the actual mean calculated value?
21 MR. MURLEY: For the flux and the fluence; that is
22 right. Where we use conservative properties consistently is
23 in the materials properties, and what else, yes, the
24 temperature shift and the materials toughness properties.
25 For the copper content of the weld and the fluence

1 calculations we use mean values, or so far we have used mean
2 values.
3 COMMISSIONER AHEARNE: What is the uncertainty in
4 the fluence measurement -- (Inaudible).
5 MR. MURLEY: The uncertainty in the fluence
6 measurement. Let me make sure I understand that. They
7 place foils in the capsules and then they count those foils
8 and from that they back calculate a flux level. I guess
9 right offhand I don't have an estimate for that. The
10 counting statistics are clearly very precise. I would have
11 to say it is in the range of 10 to 20 percent would be my
12 estimate, but I can check that.
13 COMMISSIONER BRADFORD: I had thought your Oak
14 Ridge report put it at 50 percent.
15 COMMISSIONER AHEARNE: The measurement?
16 COMMISSIONER BRADFORD: Yes. I don't have it here
17 though.
18 MR. MURLEY: Oak Ridge themselves estimated that
19 the calculation that one could use would be plus or minus 50
20 percent.
21 COMMISSIONER AHEARNE: That is what I thought.
22 MR. MURLEY: We think we can do better than that
23 and we think we currently are doing better than that once
24 one takes into account the capsule data that exists.
25 Chart 5, please.

1 COMMISSIONER GILINSKY: What is our estimate of
2 the effective full-power years that have already been
3 clocked in a reactor?
4 MR. MURLEY: Well, it would be the accuracy of our
5 flux calculations basically, and they have been benchmarked
6 against the measurements. I think the sum of those would
7 probably be plus or minus 30 percent which is where we think
8 we are today.
9 COMMISSIONER BRADFORD: I guess I am still
10 confused about that. I would have thought that the
11 effective full-power years was a calculation that didn't
12 have much to do with the flux measurements but had to do
13 with the way the reactor had been run.
14 MR. MURLEY: Well, it is, but ---
15 CHAIRMAN PALLADINO: I wonder if our terminology
16 is consistent?
17 COMMISSIONER AHEARNE: I don't think so based on
18 Peter's question.
19 (Laughter.
20 COMMISSIONER BRADFORD: Well, my terminology is
21 often inconsistent, but as long as the rest of you are on
22 the same wave length I will catch up. But I had been
23 assuming that effective full-power years was a calculation
24 that essentially took the levels at which the reactor had
25 operated and translated them into years of operation at 100

1 percent if it had been run that way.

2 MR. MURLEY: That is correct.

3 CHAIRMAN PALLADINO: That is why I found it

4 necessary to clarify that earlier.

5 COMMISSIONER BRADFORD: That is why I didn't

6 understand the answer to Victor's question which seemed to

7 suggest that somehow the effective full-power years flowed

8 from a fluence calculation.

9 CHAIRMAN PALLADINO: If I understood him

10 correctly, they are using the terms two ways. The effective

11 full-power lifetime and then we were talking about effective

12 full-power years up to a certain point. He is saying that

13 if you had expected the plant to last 40 years as the

14 effective full-power lifetime, then there were some

15 measurements made that would have showed that they were

16 unconservative by a factor of two and said the vessel would

17 have only had 20 years of full-power life.

18 Then we began to talk about effective full-power

19 years of operation and that is what I think you were

20 referring to here, and I am not sure the recent question was

21 on that subject.

22 COMMISSIONER BRADFORD: I see.

23 COMMISSIONER GILINSKY: Well, let's take it back

24 to the way you first put it, and I am jumping ahead a little

25 bit, but you say in the first item here "at least three

1 effective full power years before concern with any plant."
2 Now what assumptions are made about the uncertainty in
3 deciding that? In other words, what assumptions are made
4 about uncertainty in how fast the vessel is becoming
5 embrittled in effect? In other words, there is one sigma or
6 two sigmas or nothing or this is the mean or what? That
7 applies to any one of them. I just happened to pick this
8 one.

9 MR. MURLEY: These are merely reports of what the
10 owners groups told us. So I can't answer precisely what
11 they mean when they say any number of full-power years. But
12 in general when we do calculations, the staff does, let's
13 say, or our consultants, we use a straight deterministic
14 calculation.

15 We take a pressure temperature history for a given
16 transient and we then apply that pressure temperature
17 history to the vessel to a fracture mechanics calculation.
18 We use a fixed model and fixed properties generally thought
19 to be conservative and then calculate at what time a crack
20 of a given size might initiate and grow.

21 We then ask ourselves what fluence that is at
22 which a crack would grow and instead of talking fluence,
23 which is just flux times time, we tend to talk in effective
24 full-power years. I mean it is virtually the same thing.

25 COMMISSIONER GILINSKY: But I gather it is that

1 connection which is uncertain by the amount that you ---

2 MR. MURLEY: The answer is we have not yet done a

3 complete statistical analysis of uncertainties because that

4 involves not only the flux and the copper content by the

5 analysis of toughness properties in the code and ---

6 COMMISSIONER GILINSKY: But you don't need to do a

7 complete statistical analysis. What you were telling us, if

8 I understand it correctly, was that there is an error band

9 of plus or minus 30 percent in there.

10 MR. MURLEY: Yes.

11 COMMISSIONER GILINSKY: So what assumptions are

12 made in arriving at these various conclusions?

13 COMMISSIONER AHEARNE: I think there are two sets

14 of uncertainties though. One, I thought the conclusion was

15 there is roughly a plus or minus 30 percent on the fluence.

16 MR. MURLEY: Yes, and that could lead to plus or

17 minus 30 degrees on the reference temperature, for example.

18 COMMISSIONER AHEARNE: Then there are other

19 uncertainties in the materials properties area.

20 MR. MURLEY: Yes.

21 COMMISSIONER AHEARNE: And you have to fold both

22 of those together to reach a conclusion on what is the

23 uncertainty in the effect of full-power years remaining.

24 COMMISSIONER GILINSKY: Well, folding all those

25 things in, are these and other results that you will

1 present, are they saying that that is when you get to the
2 edge of the uncertainty band or is that when you are getting
3 to the mean of all the assumed properties?
4 CHAIRMAN PALLADINO: Do they really mean at
5 least? By at least I would presume to be that the tolerance
6 is minus zero plus perhaps two more years if I were bounding
7 the uncertainty. Or is it three years plus or minus --
8 (Inaudible).
9 MR. MURLEY: Keep in mind this is an assertion on
10 their part. They have not presented us with the report. We
11 will get that at the end of December.
12 CHAIRMAN PALLADINO: But even when they give this,
13 if they say at least we ought to have knowledge as to
14 whether or not they have made this the lower bound in their
15 uncertainties.
16 MR. MURLEY: Yes.
17 MR. DENTON: But these uncertainties are sort of
18 subsumed within the first part Tom's presentation. That is
19 a probability of a given transient. I mean it might be
20 minus ten years for a transient very severe that you
21 couldpostulate at a very low level of probability. There
22 are probably a lot of physical uncertainties on the
23 metallurgical side and the heat transfer side and the
24 operator's side. I think the fluence one is not nearly as
25 large as the uncertainty over probability of any given

1 transient.

2 CHAIRMAN PALLADINO: Well, of course, I am not

3 reading the actual Westinghouse document. But when I read

4 that at least three effective full-power years are remaining

5 before concern with any plant, I would mean by golly ---

6 COMMISSIONER AHEARNE: That is assuming a set of

7 transients.

8 MR. DENTON: That is assuming a certain transient.

9 COMMISSIONER AHEARNE: Yes.

10 CHAIRMAN PALLADINO: Where did it say that?

11 COMMISSIONER AHEARNE: In the report they sent

12 down.

13 CHAIRMAN PALLADINO: Oh, okay.

14 MR. MURLEY: The Westinghouse plants vary. There

15 are two loop, three loop and four loop. Generally the most

16 severe transient is a large steamline break. We assume the

17 probability of that is actually about ten to the minus four

18 per reactor year, which is quite low. We don't have any

19 statistics, but those are the estimates taken from WASH 1400.

20 So given such a low probability transient, they

21 would say that they have at least three effective full-power

22 years before the vessel would crack even for that transient.

23 CHAIRMAN PALLADINO: Which is the worst.

24 MR. MURLEY: Which is the worst, yes.

25 COMMISSIONER BRADFORD: Well, let's see now, does

1 the word "concern" then, is that synonymous with the vessel
2 would crack?
3 MR. MURLEY: Yes.
4 COMMISSIONER GILINSKY: I guess we would be
5 concerned at that point.
6 MR. MURLEY: Yes, but keep in mind we are still
7 talking about a very low likelihood event to crack the
8 vessel.
9 COMMISSIONER BRADFORD: If you assume the Rancho
10 Seco type event instead of the event that was assumed there,
11 how does that change the number of effective full-power
12 years?
13 MR. MURLEY: I don't have that calculation. I
14 just don't have it, but it would clearly be more than three
15 because the Rancho Seco transient is just not as severe as a
16 steamline break for a Westinghouse plant.
17 CHAIRMAN PALLADINO: So you are saying for a
18 Westinghouse plant, considering the worst though improbable
19 accident, that there would be at least three effective
20 full-power years before any one of them would be in danger
21 of failing?
22 MR. DENTON: That is what Westinghouse says.
23 MR. MURLEY: That is their assertion, yes.
24 CHAIRMAN PALLADINO: Their assertion.
25 MR. DENTON: This chart is just intended to give

1 you the benefit of their views -- (Simultaneous
2 Conversations - Inaudible).
3 CHAIRMAN PALLADINO: We are trying to understand.
4 COMMISSIONER GILINSKY: How old are some of these
5 plants?
6 MR. DENTON: We have gotten data broken down ---
7 COMMISSIONER GILINSKY: Roughly.
8 MR. DENTON: Ten years. Take Yankee, that is a
9 very old plant, although it is not one that is on my list. I
10 think around ten years for the plants that we are looking at.
11 MR. MURLEY: Yes, the H. B. Robinson/San Onofre 1
12 class, which I guess is late Sixties or early Seventies.
13 CHAIRMAN PALLADINO: Why don't you go ahead and
14 make your presentation. I do think though it is important
15 that we understand what it is these people are asserting.
16 MR. MURLEY: Yes, it is. Before I go on I want to
17 reiterate that this is really just reporting what they told
18 us here.
19 COMMISSIONER GILINSKY: I don't understand. I
20 wonder whether you have instructed them to report in such a
21 way that we understand how the uncertainties in the various
22 phases of this calculation enter into the result?
23 MR. MURLEY: Well, not having the report, but we
24 have asked for an understanding of how they did the
25 calculation and what the uncertainties are.

1 MR. DENTON: This is due at about the end of
2 December.
3 MR. MURLEY: The end of December, that is right.
4 There is no consistency amongst these three calculations and
5 three numbers. So you can't really compare Westinghouse's
6 assertion of three where they use actually a very serious
7 transient.
8 COMMISSIONER BRADFORD: Tom, let me stop you
9 again. They have already done the calculation and furnished
10 you with the results. Why do they need until the end of
11 December to provide you with the calculation?
12 MR. MURLEY: They have not furnished us with the
13 results. They have furnished us with a statement like this.
14 COMMISSIONER AHEARNE: They gave letter reports on
15 October 20th?
16 MR. MURLEY: Yes, we have had letter reports and I
17 guess you can call them interim meetings.
18 MR. DENTON: The original date was the end of the
19 year to finish the study and then we would meet with them
20 periodically and get reports back on how it is coming out.
21 So we just wanted to give you where they say it is coming
22 out, but it is going to take them until as long as we gave
23 them to finish the study and give us the report.
24 COMMISSIONER BRADFORD: But it is the kind of
25 study in which it is possible to know the answer and still

1 be a month and a half away from being able to furnish the
2 study?
3 MR. DENTON: Yes, and no.
4 COMMISSIONER BRADFORD: Okay.
5 MR. DENTON: There is still some amout of work
6 going on in this area in looking down details and there are
7 myriads of calculations, and, as you might expect, the staff
8 and the utility differ on most every assumption that goes
9 into some of these things. If you ask them today where they
10 think they are coming out, then this is what they tell you.
11 COMMISSIONER AHEARNE: As I recall, what we asked
12 them to do was to give a quick response and to give their
13 best quick estimate of how serious was the problem in their
14 plants and that is what you are reporting on and we have
15 these October 20th, I recall, letter reports.
16 COMMISSIONER GILINSKY: But if we don't understand
17 what the response means ---
18 COMMISSIONER AHEARNE: Then we also asked them to
19 do it in more detail.
20 CHAIRMAN PALLADINO: But I do gather you
21 understand what the response is intended to mean in terms of
22 words anyhow.
23 MR. MURLEY: In terms of words we don't know the
24 details of the calculation. That is why the staff can't
25 endorse these today. It wouldn't surprise me that when they

1 come in if it is two effective or four effective full-power
2 years. I mean, they are fine-tuning their calculations.
3 This is what they told us in September.
4 COMMISSIONER BRADFORD: The bottom line of each of
5 the three seem to suggest that there is almost a different
6 reporting basis involved.
7 MR. MURLEY: There is.
8 COMMISSIONER BRADFORD: The Westinghouse three
9 does not take credit for operator action; is that right?
10 MR. DENTON: That is one of the keys. If you
11 allow credit for proper operator action the operator can
12 keep you out of trouble.
13 COMMISSIONER BRADFORD: In almost any case.
14 MR. DENTON: And in a lot of things other than
15 just thermal shock you have to rely on the operator to keep
16 you out of trouble. We have been criticized I guess by the
17 ACRS for getting into this with an assumption that you
18 couldn't take credit for operator action because that
19 assumption almost always leads you to trouble if you keep
20 calculating long up and no operator actions.
21 B&W, for example, does take credit for operator
22 action. So part of our view has been to see how realistic
23 is it to take credit for that. If you allow credit for
24 proper operator actions in most scenarios, it really extends
25 the plant life because he can say well you keep the pressure

1 within reasonable bounds.

2 COMMISSIONER BRADFORD: I think B&W of all people

3 would be sensitive to the perils of that assumption.

4 COMMISSIONER AHEARNE: Yes, but at least as I read

5 their submissions at least at the moment they didn't seem to

6 have much other choice.

7 CHAIRMAN PALLADINO: What do you mean they didn't

8 have much other choice?

9 COMMISSIONER AHEARNE: Well, at least reading the

10 materials they have submitted it seemded that the way they

11 were able to conclude that there was service life, the

12 effective full-power years remaining, was by allowing for

13 operator action. Maybe I am reading something that is not

14 there, but my reading of the material was that at the moment

15 if they don't allow operator action then they couldn't reach

16 a conclusion that there is not ---(Simultaneous

17 Conversations - Inaudible).

18 MR. MURLEY: I think that is fair. For example,

19 if one just uses the Rancho Seco transient, which was a B&W

20 plant, I think we are virtually certain that the plants

21 cannot go their full service life, that is 32 effective

22 full-power years, and still withstand a Rancho Seco

23 transient.

24 COMMISSIONER AHEARNE: But it is even more than

25 that, isn't it?

1 MR. MURLEY: Yes. We can probably come close to
2 that. Then you get into anomaly of how can you take credit
3 for operator action when you have got on the books already a
4 transient where the operator didn't take the right action.
5 He didn't have enough information to take the right action.
6 COMMISSIONER BRADFORD: Tom, are their situations
7 with regard to B&W plants in which if the operator doesn't
8 take useful action you would have a problem if the Rancho
9 Seco transient occurred today?
10 MR. MURLEY: No. If I understood your question,
11 is there any plant today that would be threatened, the
12 vessel would be threated by a Rancho Seco transient?
13 COMMISSIONER BRADFORD: Yes.
14 MR. MURLEY: The answer is no.
15 MR. DENTON: Remember, that is how we looked at
16 this the first time.
17 COMMISSIONER BRADFORD: Right.
18 MR. DENTON: Let's just repeat that and in every
19 plant where they are, are we seriously concerned about them,
20 and that is what led us to think we have got a little bit of
21 time to look ---
22 COMMISSIONER BRADFORD: I was trying to get behind
23 the exchange that Tom was having with John regarding the
24 extent to which B&W had to rely on operator action. I was
25 wondering if it was turning out that the B&W calculations

1 were suggesting that they had a problem as of today without
2 operator action.
3 COMMISSIONER AHEARNE: But you prefaced it by a
4 Rancho Seco transient.
5 COMMISSIONER BRADFORD: Yes. What should I have
6 said?
7 COMMISSIONER AHEARNE: Is that the most severe
8 transient that -- (Inaudible.)
9 MR. DENTON: I get the feeling that we all want a
10 bottom line.
11 COMMISSIONER AHEARNE: Eventually.
12 MR. DENTON: We don't know a lot more today than
13 when we briefed you last, except we will give you the
14 results of the information we have obtained from those eight
15 licensees that we sought information from and report on a
16 few more meetings and discussions. Basically this
17 information on this chart is the same as we had at the last
18 briefing with you. We have had no substantive input since
19 that time.
20 COMMISSIONER GILINSKY: Let me understand.
21 Suppose we were talking about the transients comparable to
22 those that were used in the Westinghouse analysis which from
23 what you say I gather were more severe than say the Rancho
24 Seco transient.
25 MR. MURLEY: Yes. The steamline break, the large

1 steamline break for Westinghouse and Combustion plants is
2 the most severe overcooling event.
3 COMMISSIONER GILINSKY: What is it for the B&W?
4 MR. MURLEY: For B&W it is not so clear. It is
5 probably a feedwater transient, a so-called run-away
6 feedwater transient because their steam generator is
7 different. It doesn't have as much thermal heat capacity.
8 COMMISSIONER GILINSKY: Where are they today if
9 they don't take credit for operator action with one of those
10 transients?
11 MR. MURLEY: Well, the Oak Ridge report showed
12 that if one had a very, very serious feedwater transient it
13 is possible to crack the vessel today, you know, assuming
14 the conservative fracture mechanics calculation that was
15 done.
16 COMMISSIONER AHEARNE: Since you have brought up
17 that particular one, I thought that both the Oak Ridge
18 report and then Duke response pointed out that there were a
19 number of failures that had to occur to get there.
20 MR. MURLEY: That is right. That is an extremely
21 unlikely event. It is like ten to the minus fifth per
22 reactor year or less according to our analysis. The staff,
23 as you know, looked into that.
24 COMMISSIONER AHEARNE: That gets back to Harold's
25 point that you really have to look at the particular

1 scenario and which particular set of transients the
2 probability is associated with.
3 MR. DENTON: There really is no cliff in this area
4 that if you are here you are perfectly safe and if you are
5 here you are perfectly unsafe. It is a probability space.
6 You look at the frequency of the transient and how severe
7 they are, as Tom said, what the vessel properties are and
8 you postulate a lot of things going wrong. You would
9 postulate a very severe shock and the vessel properties have
10 to be exceedingly good to withstand that.
11 COMMISSIONER GILINSKY: Are the owners waiting for
12 the results of these calculations before they think about
13 what they might do?
14 MR. DENTON: That is why we wrote to the selected
15 group to get those people thinking individually about what
16 remedies might be available to them. We are waiting I think
17 for the results for the vendors to come up with what sort of
18 criteria might be appropriate to apply.
19 COMMISSIONER GILINSKY: Do the owners have a good
20 understanding of this problem or are they relying entirely
21 on the vendors?
22 MR. DENTON: They are relying heavily on the
23 vendors. Now, I think they have come a long way since we
24 started this ---
25 COMMISSIONER AHEARNE: Also, it depends on which

1 owners. These I gather, at least reading the material that
2 Duke was submitting, it seems that they are pretty well
3 along in their understanding.
4 MR. MURLEY: I might add that EPRI has recently
5 cranked up their program across the board in this area. So
6 there is a pool of expertise there for the utilities to draw
7 on.
8 COMMISSIONER AHEARNE: Tom, on the last item, do
9 you have any comments on the reliance on warm prestressing?
10 MR. MURLEY: Yes. Of course warm prestressing is
11 a phenomenon that can help prevent crack initiation during
12 certain transients. We believe it has been demonstrated for
13 the large LOCA, that is where you don't get repressurization
14 and just overcooling, that warm prestressing will prevent a
15 crack from going all the way through the wall. I should say
16 one has to have confidence that he knows the course, the
17 time pressure history of the transient before you can take
18 credit for warm prestressing.
19 The types of transients that we are dealing with
20 here whether there is operator intervention where he can
21 raise the pressure and lower the pressure by turning on high
22 pressure injection, for example, we are very reluctant to
23 take credit for warm prestressing.
24 So that is going to be a source of contention
25 between us and the industry because if warm prestressing is

1 effective it will prevent crack initiation or propagation,
2 but we can't be sure it is going to be operative in all
3 these transients. So that is where we come down on it.
4 Slide six, please.
5 We met with Germany in late September and there
6 are three points that I should make there.
7 For a couple of their older plants they have
8 decided they have a problem and they have removed outer fuel
9 elements.
10 COMMISSIONER GILINSKY: Let me ask you, do those
11 plants have more of a problem than our older plants or less
12 of a problem?
13 MR. MURLEY: About the same.
14 COMMISSIONER GILINSKY: About the same.
15 MR. MURLEY: If they had not taken action. For
16 example, I think on Obrigheim their fluence would have been
17 nine times ten to the 19th I believe if they had not taken
18 action. Having taken action, they are going to hold it to
19 somewhere in the low few times ten to the 19th fluence range.
20 COMMISSIONER GILINSKY: How large are those
21 reactors?
22 MR. MURLEY: About 600 megawatts.
23 COMMISSIONER GILINSKY: What made them feel that
24 they ought to be doing this now?
25 MR. MURLEY: Just this problem of maintaining

1 toughness of the vessel.

2 COMMISSIONER GILINSKY: Why aren't our owners

3 convinced that they need to do something now? The

4 consequences of something happening to one of these vessels,

5 even apart from harm to the public, is very, very serious.

6 MR. MURLEY: Oh, yes. A plant would not operate

7 again if it cracked clearly, even if the crack didn't go

8 through the wall. I don't know how you would repair ---

9 COMMISSIONER GILINSKY: I am just surprised that

10 there is not more interest in moving forward with this sort

11 of at least a partial solution which seems to me not a very

12 expensive way of coping with the problem. At least it slows

13 down the effect of further irradiation.

14 MR. MURLEY: I should point out that Westinghouse

15 has a scheme, and we just learned about it a few months ago,

16 called their low leakage fuel cycle option I think it is

17 called. It reduces the flux to the vessel by I believe 20

18 to 30 percent at virtually no increase in fuel cycle costs.

19 I am told many of the reload cores coming in now that the

20 utilities have chosen that option. So they are taking some

21 steps in this regard.

22 CHAIRMAN PALLADINO: Did the Germans predict a

23 more adverse condition for their plants than we predict for

24 ours?

25 MR. MURLEY: As I said for Obrigheim, I think

1 their end-of-life fluence would have been nine times ten to
2 the 19th which is very high and probably higher than ours I
3 would guess. They determined this from surveillance test
4 capsules. So they decided to take action. I believe this
5 was about three years ago that they took action.
6 For newer plants they have placed a regulatory
7 limit of one times ten to the 19th fluence on their vessels
8 and they mentioned to us an overcooling transient early in
9 the life of their Neckarwestheim plant which I only mention
10 here as another example of overcooling transients.
11 A safety valve stuck open. The plant was not
12 critical and not operating. You may think that that is
13 good, but it is really not. It makes an overcooling
14 transient worse because there is no decay heat to keep the
15 fluid temperature higher.
16 They also have much larger safety valves on their
17 steam generators then we do. So they got a very large
18 blow-down of the secondary coolant and the cold leg
19 temperature in one loop now of the affected steam generator,
20 dropped to 320 degrees in about five to ten minutes. We
21 don't have yet the complete details on the transient.
22 I might add this was a fresh vessel. So it was
23 not really threatened. But it adds some statistics to our
24 class of overcooling transients.
25 Just as important here, the pressure decreased

1 down to 1400 psi and the pressure then increased back up. I
2 have not been able to find out, but I am almost certain that
3 it was the safety systems that came on and the operators
4 repressurized it.
5 The next chart starts to show the results that we
6 have gotten from the 60-day responses from the eight
7 licensees. The key aspect of this chart is the comparison
8 of the reference temperatures in the right two columns. The
9 NRC staff using our regulatory guides and the best knowledge
10 we had of the weld properties had estimated the reference
11 temperatures in the next to the last column.
12 The licensees have given us their estimates now
13 based on generally a more thorough understanding of their
14 own vessels. As you can see, the temperatures are generally
15 lower.
16 There are two main reasons for this. One is that
17 the initial reference temperature, that is the reference
18 temperature of the virgin material, is lower for the CE
19 vessels. Now this is yet still an assertion on their part,
20 but they have gone back to some archive samples that they
21 keep and I suspect that they will be able to sustain that.
22 That is, I believe they will be able to convince us with
23 some more thorough looking.
24 Also, they have more information on their weld
25 materials. There is a class of vessels that have low nickel

1 alloy welds. We are finding that they have a much lower
2 shift. That is, for some reason, which we don't understand,
3 the low nickel welds do not embrittle as fast as high nickel
4 welds and there is a class of those reactors.
5 Let's go to the next chart.
6 COMMISSIONER AHEARNE: One question on that other
7 chart, if I could, Tom.
8 MR. MURLEY: Sure.
9 COMMISSIONER AHEARNE: Did all of the licensees
10 come in with plant specific analyses?
11 MR. MURLEY: I wouldn't call them analyses. We
12 didn't ask for analyses. We asked for what is the status of
13 your vessel.
14 COMMISSIONER AHEARNE: Are the staff estimates
15 similarly an estimate for each plant or is it more generic?
16 MR. MURLEY: Our estimates were for each plant.
17 We didn't just take every CE plant and lump it.
18 COMMISSIONER AHEARNE: So the comparison is
19 between the two columns -- (Inaudible).
20 MR. MURLEY: Yes. Now some licensees are going to
21 have to go back and do some further checking. Like Fort
22 Calhoun has got to go back and get some more information on
23 their archive samples, for example, but generally it was
24 plant specific.
25 The conclusions we have so far drawn from this,

1 and I call them preliminary, is that the reference
2 temperatures may be lower than the staff estimates. I think
3 that is shown by the chart.
4 Our earlier estimates for the low nickel welds are
5 probably what I call substantially conservative and it would
6 well be 100 degrees or so.
7 Those plants we think are going to be San Onofre 1
8 and probably Calvert Cliffs 1, H. B. Robinson and
9 Connecticut Yankee.
10 CHAIRMAN PALLADINO: What about them?
11 MR. MURLEY: They we believe will be able to
12 substantiate that they have low nickel weld material. See,
13 they have got to go back to Combustion Engineering
14 Chattanooga plant and dig out the records and the archives
15 samples.
16 If that holds up ---
17 COMMISSIONER AHEARNE: You said Connecticut Yankee.
18 MR. MURLEY: Connecticut Yankee, yes. They are
19 not on this list. But nevertheless, we have predicted a
20 very high reference temperature for Connecticut Yankee.
21 Finally, that further staff analysis is needed on
22 this.
23 CHAIRMAN PALLADINO: Looking at these numbers, I
24 guess I could conclude that the lower the better.
25 MR. MURLEY: Yes.

1 CHAIRMAN PALLADINO: But I don't have any base or
2 a threshold is what you are telling me?
3 MR. MURLEY: That is what we are going to be
4 struggling with for a regulatory limit. Let me go on to
5 chart nine.
6 We asked these eight licensees, what would you
7 propose for a regulatory limit on reference temperature.
8 They came back uniformly and said they don't think that a
9 single reference temperature is an appropriate limit for
10 continued operation. The reason for that is that it is a
11 very complicated issue and it depends on the transient that
12 you are trying to protect against and so forth. On the
13 other hand, they did not provide any alternates for a
14 regulatory limit for continued operation.
15 I think the staff has an open mind if there is
16 another proposal that one could use. Not having heard any
17 better ones, and in fact I tried to scope out what might be
18 a different types of limit and I got into a very complicated
19 evaluation model that would be required. I think in the
20 long run it would far simpler to have a simple limit.
21 CHAIRMAN PALLADINO: Tom, I don't understand their
22 argument quite. Even though they have a whole bunch of
23 assumptions and a whole bunch of scenarios, could you not
24 define a reference temperature that you ought to be below,
25 below that temperature, so that you don't run the risk of

1 failure or scenarios or whatever they decide as the one that
2 designed it?
3 MR. MURLEY: That was the staff's proposal that
4 there be such a limit.
5 CHAIRMAN PALLADINO: I don't understand their
6 argument why they can't do that.
7 MR. MURLEY: They don't think it is appropriate.
8 I am not sure I can ascribe motives. I can guess, and that
9 is that they think to be conservative we would have to set
10 it so low today that it would give them serious problems.
11 CHAIRMAN PALLADINO: That I can understand.
12 MR. MURLEY: I am pretty sure that is their
13 problem.
14 CHAIRMAN PALLADINO: (Inaudible.)
15 MR. MURLEY: I might reiterate that our regultions
16 don't put a limit at all on vessel embrittlement today.
17 There is a Reg. Guide 1.99 that sets a limit of 200 degrees
18 Fahrenheit at the quarter thickness. That of course is not
19 a regulation and furthermore it only applies to CP's
20 docketed after 1977, which is a null set.
21 (Laughter.)
22 COMMISSIONER AHEARNE: Of course one of the
23 difficulties you are obviously struggling with is trying to
24 establish a regulatory criterion in an area with at the
25 moment much uncertainty.

1 MR. MURLEY: Yes. Now we asked them also about
2 operating procedures.
3 No. 10, please.
4 They did respond. They of course all have high
5 pressure injection termination criteria and instructions for
6 terminating the feedwater flow. Generally we found that the
7 operating procedures place more emphasis, much more emphasis
8 on maintaining ECC flow than on preventing pressure vessel
9 overcooling and this is a natural result of the Three Mile
10 Island lessons.
11 CHAIRMAN PALLADINO: But if it was ECC flow and
12 that was the only problem, then you could heat up the ECC
13 and solve that problem, could you not?
14 MR. MURLEY: Yes.
15 CHAIRMAN PALLADINO: But that isn't the only
16 problem. If for those where that is a worry, that could be
17 solved.
18 MR. MURLEY: The ECC flow though becomes a problem
19 because even for overcooling transients that are initiated
20 in the secondary system like feedwater flow, the pressure
21 comes down to a point where the HPI comes on generally. We
22 have seen it in a lot of transients now. The operator has
23 not yet diagnosed what is going on. He knows the high
24 pressure injection system is on so he tends to keep it on
25 even though he doesn't have to and I guess that is the point

1 here.

2 CHAIRMAN PALLADINO: You mean you run out of hot

3 water?

4 MR. MURLEY: No, that is overcooling the vessel.

5 He thinks his most important job is to keep the core cool,

6 which of course it is, but once the coolant is already 100

7 degrees subcooled in practice he could turn off the HPI

8 pumps, but they are not instructed to do that. It is left

9 up to their judgment.

10 The conclusion is from this that the staff will

11 take steps to have the industry improve their operating

12 procedures and training to mitigate these overcooling

13 transients.

14 The next chart, please.

15 Oak Ridge, as you know, did a state-of-the-art

16 analysis. We have sent the report down to you and we have

17 done our own analysis of the report. Generally the

18 conclusions are that for Oconee 1, which was the plant that

19 they used, they found that the Rancho Seco event would not

20 pose a threat to the vessel for about 15 more effective

21 full-power years, but that for some very severe transients

22 using conservative analyses it could pose a threat to the

23 vessel today.

24 The next chart.

25 CHAIRMAN PALLADINO: That brings me to where I was

1 a while back. When I read that I got concerned. I said
2 rather than comfort I got discomfort from the ORNL report.
3 Then I asked for a briefing and at the end of the hour I had
4 a little bit of comfort, but now you have brought me back to
5 discomfort again.
6 (Laughter.)
7 COMMISSIONER AHEARNE: Well, if you turn the chart
8 you will get the briefing.
9 (Laughter.)
10 MR. MURLEY: It gets back also to that schematic
11 chart. There is a transient that one can postulate, it is
12 not impossible, that will crack the vessel, yes, but it is
13 very, very unlikely, we think much more unlikely than other
14 threats to the core melt that we already live with today
15 like ATWS and some things like that that need to be fixed.
16 COMMISSIONER GILINSKY: Let's see. You think ATWS
17 is more likely than this?
18 MR. MURLEY: Than this run-away feedwater
19 transient, yes.
20 COMMISSIONER AHEARNE: That is this particular
21 transient -- (Inaudible.)
22 CHAIRMAN PALLADINO: This particular --
23 (Inaudible.)
24 MR. MURLEY: The NRC staff reviewed it. We said
25 that some of the calculations were very conservative. For

1 the Oconee calculation of the run-away feedwater transient,
2 some aspects were actually unrealistic. They used more
3 water to cool down the steam generator than is really
4 available.
5 CHAIRMAN PALLADINO: Tom, I also got the
6 impression there were inconsistent sets of assumptions
7 between the various parts of this analysis that were brought
8 together.
9 MR. MURLEY: Yes, there were some.
10 CHAIRMAN PALLADINO: Is that going to be corrected
11 in some -- (Inaudible).
12 MR. MURLEY: I don't want to dump on Oak Ridge too
13 badly. They picked off the shelf the calculation that was
14 done over a year ago, and it was done back when we were just
15 in the early stages of looking at this problem as a bounding
16 calculation. We said let's do a quick and dirty bounding
17 calculation. That was done and no one ever went back and
18 cleaned it up. Oak Ridge used it because we had put them
19 under pressure, the research staff asked them to do it in a
20 hurry. So now they have got to go back and make more
21 realistic calculations.
22 I think the bottom line there is that the
23 probability of these severe transients we think is
24 sufficiently low that corrective action is necessary. So we
25 didn't really change our minds at all based on the Oak

1 Ridge ---

2 COMMISSIONER GILINSKY: Let me pursue this a

3 little bit. Let us even suppose that right now we are not

4 at a point where we fear that vessels will crack very soon.

5 Still doesn't it make sense to maintain that margin and do

6 the kinds of things that the Germans are doing? We should

7 in effect do precisely that. They just keep that margin in

8 front of you.

9 MR. DENTON: That is why we asked these eight to

10 propose remedial measures. We thought we didn't have to ask

11 them in 30 days. So we gave them a little time to do it

12 because the temperature shift is only 10 degrees a year.

13 But each one of these that we have tagged as being a high

14 shifter, we have asked for the impacts and the benefits of

15 removing fuel and heating up the ECCS water and other

16 remedial measures and I think we will have a proposal soon.

17 But we have got to give them a chance to explore the

18 ramifications of each fix before we propose one.

19 COMMISSIONER GILINSKY: Well, I am glad to hear

20 that. I somehow was getting the impression that the owners

21 were not much seized with the problem. I hope I am wrong.

22 MR. DENTON: No, you may be right about that.

23 COMMISSIONER GILINSKY: That is really what I was

24 addressing, and I am surprised that they are not more eager

25 to hang on to whatever margin they have got, you know, even

1 if they are three years away or five years away or whatever
2 it is from real trouble.
3 CHAIRMAN PALLADINO: Even 15.
4 COMMISSIONER GILINSKY: Or even 15 as the Chairman
5 says. I find it very hard to understand because if I owned
6 one of those vessels that is what I would be doing.
7 COMMISSIONER AHEARNE: In the German dummy
8 element, does it reduce the flux or does it shift the flux?
9 MR. MURLEY: It reduces the flux and also shifts it
10 a bit. It reduces the peak which is what counts.
11 CHAIRMAN PALLADINO: How much did they reduce it?
12 MR. MURLEY: Oh, I don't recall, but it is like a
13 factor of two or more I think.
14 You recall that the last time I told you about
15 this Finnish reactor, Loevisa (?). They had done the same
16 thing just two years ago. There they removed the whole
17 outer row of fuel and they got the flux down by a factor of
18 three by doing that.
19 COMMISSIONER AHEARNE: As I recall in one of the
20 reports that you sent down there is a set of calculations,
21 and it could be for a Westinghouse, for a substitution fuel
22 array, and there it says with increased fuel costs by two
23 and a half percent in that particular proposal. Is that the
24 kind of margin that leads them to conclude that they want to
25 do -- (Inaudible.)

1 MR. MURLEY: Well, clearly, that is the drawback
2 that I guess the utility would see.
3 COMMISSIONER GILINSKY: As John points out, we are
4 not talking about anything very drastic in terms of derating
5 the plants. We are talking about a couple of percent to
6 guard against contingies that are going to have a lot more
7 effect than a couple of percent.
8 MR. HANAUER: Well, there is another aspect of
9 it. If you take the outer row of fuel out you increase the
10 rating, the power density in the remaining fuel and this
11 gives you less margin in certain transients and accidents.
12 It is not free just for a slightly increased fuel cost.
13 There is a balancing of risks also. We haven't seen any
14 detailed analysis that I know about it.
15 COMMISSIONER GILINSKY: Have you discussed that
16 with the Germans? Presumably they have thought about that.
17 MR. MURLEY: Not in detail, no. The shifting of
18 peak flux and peak power that Steve refers to is accounted
19 for in the two and a half percent increase in fuel cycle
20 cost because it limits the burn up of the fuel that you can
21 go to.
22 I think we just have to wait until they come in in
23 mid-January with their final analysis because I have thought
24 I have heard discussions where Westinghouse has told us that
25 there is virtually no penalty for their low leakage core.

1 But I can't say that for sure. It is just a recollection
2 that I have of one of these meetings.
3 CHAIRMAN PALLADINO: At an earlier briefing I
4 asked why didn't they go do some of these things like heat
5 the ECCS water and replace some of the outer fuel elements
6 with I will call them dummy fuel elements. The answer was
7 well, we have got to wait until we get all these
8 calculations before we can see whether or not we have got a
9 problem. In a few of them we seem to have a problem.
10 Are the vendors of these plants looking at
11 possible solutions or are they so convinced they are so far
12 away from the problem that they can convince us?
13 MR. MURLEY: It depends. We have got quite a
14 spectrum of views from the licensees. I think, as
15 Commissioner Ahearne said, the Duke reply, although they
16 didn't agree with the Oak Ridge analysis and report or
17 anythink like that, they have a good understanding of the
18 issue. Others, I think they probably see it as another one
19 of NRC's games. So it varies.
20 CHAIRMAN PALLADINO: The reason I think they ought
21 to have interest aside from the problem of the vessel is
22 that it takes time to develop dummy elements and put them in.
23 MR. MURLEY: That is right.
24 CHAIRMAN PALLADINO: If any plant is two to three
25 years away from a possible problem area, they ought to use

1 the two to three years to get out of it.

2 MR. MURLEY: It will certainly prolong the useful

3 life, whatever it turns out to be, before they have to do

4 something.

5 COMMISSIONER AHEARNE: Maine Yankee I thought was

6 taking some action from a draft response that had come

7 through in the letter. We were responding to I think the

8 Governor of Maine and there is a draft that has been

9 around. My impression was that in that letter the mention

10 was made of a couple of actions that Maine Yankee was taking.

11 MR. MURLEY: I think they are looking at raising

12 the temperature of the ECC water.

13 COMMISSIONER AHEARNE: And also I thought modified

14 fuel elements. Are they addressing this?

15 MR. MURLEY: I don't recall right offhand what

16 Maine Yankee is doing. Right offhand I can't recall what

17 they are doing, but we have their reply.

18 COMMISSIONER AHEARNE: I was just answering the

19 Chairman, that at least that was one instance I saw where

20 they were going ahead -- (Inaudible).

21 MR. MURLEY: Move on to No. 13.

22 I should just point out to you that Professor

23 George Sih of Lehigh University has had discussions with the

24 staff. I believe he also talked with the technical

25 assistants of Commissioners.

1 COMMISSIONER AHEARNE: Not all of them.

2 MR. MURLEY: The staff met with him. I did not

3 personally but other did, and he has expressed views that

4 the current methodology might not be adequate for predicting

5 vessel failure correctly. The staff is evaluating these

6 comments. It is a little tough to deal with because it

7 literally calls into question the entire ASME Code and the

8 mothods used by the Code Committee, but we are looking at it.

9 CHAIRMAN PALLADINO: You could take his statement

10 as good news or bad news. Which side of the question is

11 it -- (Inaudible).

12 MR. MURLEY: I don't think he has a bottom line

13 that it is conservative or non-conservative. He just thinks

14 that the methods are not accurate.

15 COMMISSIONER ROBERTS: Well, who is he? I mean is

16 he the guru of pressure vessel design?

17 MR. MURLEY: He is a professor at Lehigh

18 Univeristy, which is well respected in fracture mechanics

19 and engineering mechanics. I think he generally marches to

20 his own drummer. I think we just simply have to evaluate

21 what he says. He has not, as far as I know, been involved

22 in a lot of the code committees and stuff that we rely on

23 for our regulations.

24 MR. MURLEY: I will move on 15.

25 The issues that the staff is going to be

1 addressing are tough ones like what credit should be allowed
2 for operator action. The regulatory limit we already talked
3 about, whether a simple limit on the reference temperature
4 is adequate or not. The industry has told us they don't
5 think it is, they don't think it is a good limit.
6 Credit for operator action? How should you do the
7 evaluations? What are the costs and the benefits of
8 corrctive actions?
9 If we decide that there is a limit and that some
10 plants either don't meet it or will soon exceed it, what
11 should be the schedule for implementing any corrective
12 actions?
13 I only put these down to show you that it is not a
14 simple matter to come up with a regulatory position today.
15 The next chart.
16 We are virtually certain that there will be
17 substantial technical disagreement between the staff and the
18 industry on the issues I just showed.
19 The work need to technically resolve it, and by
20 that I mean come to a consensus where people agree on it,
21 won't be fully completed by next summer. In some cases it
22 is going to take probably a couple of years to what I call
23 technically resolve an issue.
24 The next chart, the staff conclusions.
25 These are virtually the same conclusions that we

1 showed you in June. It is a safety concern for older PWR
2 vessels. We don't think that immediate corrective action is
3 necessary. Substantial work is needed.
4 It is the staff's judgment that some corrective
5 action will likely be required for some of the older plants
6 before their service life. Now the basis for this staff
7 conclusion is really a risk argument.
8 We have evaluated the number of classes of
9 overcooling transients. The chances of a severe overcooling
10 transient in an older PWR that could challenge the vessel is
11 about one in one hundred considering all the plants and
12 considering the probability of those transients during this
13 coming year.
14 COMMISSIONER GILINSKY: This is not per plant but
15 for ten plants?
16 MR. MURLEY: For more like 40 plants, PWRs, 44
17 actually.
18 The B&W plants clearly have a higher probability
19 but there are only about seven of those.
20 COMMISSIONER GILINSKY: Wait a minute. Is most of
21 that concentrated in the B&W plants?
22 MR. MURLEY: Yes.
23 COMMISSIONER GILINSKY: So it is one in a hundred
24 for 10 plants more or less.
25 MR. MURLEY: Let me throw another chart on that I

1 think will help illustrate it.

2 Put on B-5.

3 This is the chart of our best probability

4 estimates. The most likely overcooling transient is the

5 Rancho Seco type transient where you lose power supply and

6 you have a control system failure.

7 For B&W plants our estimate is that it is ten

8 times more likely than for Westinghouse or CE plants. There

9 are about seven plants. So one gets seven times ten to the

10 minus three for B&W plants for the next year. There are

11 30-some-off Westinghouse and CE plants. So roughly you get

12 30 times ten to the minus four, or three times ten to the

13 minus three. When you add those together then one gets

14 about ten to the minus two. These are in order of magnitude

15 estimates.

16 COMMISSIONER GILINSKY: So it is mostly

17 concentrated in the B&W plants?

18 MR. MURLEY: Yes. To go with that, although the

19 B&W plants have a more likelihood of having an overcooling

20 transient, they are not as brittle, the vessels. That is,

21 they are not as old and they are further away. You can see

22 from that table there that they are further away from being

23 threatened.

24 CHAIRMAN PALLADINO: That is because they are

25 younger or is there something peculiar or special about

1 their plants?

2 MR. MURLEY: They are younger and they also have

3 lower flux generally and so lower fluence.

4 You see, Oconee has about five effective

5 full-power years. That is the oldest B&W plant, Oconee 1.

6 I think some of the Westinghouse plants have around ten

7 effective full-power years.

8 Put 17 back on, please.

9 Even if a transient as severe as Rancho Seco were

10 to occur we would not predict vessel failure today. So the

11 combination of the chances of a transient being low plus

12 even if it were to happen, we wouldn't predict failure. I

13 don't have a number for that. It is very difficult to do a

14 a probability analysis on the fracture mechanics. We are

15 doing that. The research staff has a probabilistic code

16 that they are working on which I think personally will show

17 that there is even more margin than we thought before just

18 because it is going to treat things in a statistical way

19 rather than use bounding type numbers for material

20 properties.

21 CHAIRMAN PALLADINO: Tom, is there any particular

22 date when they started making vessels with different

23 compositions? In other words, are all the plants that are

24 now coming up for licensing, do they all have the same ---

25 MR. MURLEY: It was about '72 or '74 I think,

1 wasn't it, Ray?

2 MR. KLECKER: I am sorry.

3 MR. MURLEY: When did the vessels stop using high

4 copper and when did we recognize the problem?

5 MR. KLECKER: About 1973.

6 MR. MURLEY: About 1973. So vessels fabricated

7 after about 1973 should not have this problem. I should

8 mention that there are still a lot of vessels in the mill

9 though.

10 CHAIRMAN PALLADINO: I know. I guess what I am

11 really asking in the end is what are those plants where at

12 least on the surface this problem does not seem to exist?

13 Maybe we could get that as a separate answer.

14 MR. MURLEY: Okay, sure.

15 CHAIRMAN PALLADINO: Not that that makes the

16 problem any easier, but just to increase our information.

17 MR. MURLEY: The last chart, No. 18.

18 As a prognosis the staff can have a regulatory

19 position by next summer but it involves wrestling with these

20 issues.

21 COMMISSIONER ROBERTS: How can you make that

22 statement in light of the previous statement that says the

23 work needed to technically resolve the issues cannot be

24 fully completed by summer '82.

25 MR. MURLEY: That is right.

1 COMMISSIONER ROBERTS: But we are going to issue
2 regulations.
3 MR. MURLEY: Well, that is a question of what is
4 the perceived risk at the time. If we perceive the risk,
5 that is we the Commission perceive the risk to be high we
6 will have to have a regulatory position on it, even though
7 we won't have done all of our homework. That is the dilemma.
8 MR. DENTON: Tom, let's put a schedule of future
9 actions that maybe would show what additional information we
10 would have about that time.
11 MR. MURLEY: No. 14.
12 EPRI is doing a study on the annealing of vessels,
13 but most important I think are the owners groups reports
14 scheduled for December 31st.
15 CHAIRMAN PALLADINO: Where is that?
16 MR. MURLEY: It is back about five charts from the
17 back. I am sorry I didn't number those.
18 CHAIRMAN PALLADINO: It would be helpful if they
19 were numbered.
20 MR. MURLEY: At the end of the year we are going
21 to get the three owners groups reports, Westinghouse and
22 Combustion will be generic with some plant specific
23 information. The B&W report will focus on Oconee 1 and 2.
24 Then in mid-January the 150-day resposes will be due. There
25 will be an evaluation of corrective actions in the 150-day

1 responses. Also, they will in some cases update their
2 material properties for us.
3 MR. DENTON: That will address the effectiveness
4 of things like heating the emergency core cooling water or
5 removing fuel on a plant specific basis for the eight plants.
6 COMMISSIONER AHEARNE: Tom, you said that B&W is
7 going to focus on Oconee 1 and 2 and you just previously had
8 mentioned the seven B&W plants that were in this high
9 probability region. Then there is an item mentioned, and I
10 think it was in report of the B&W owners group meeting that
11 you had here which pointed out that the plants following
12 Oconee had additional control system features that led to
13 some of the concerns about Oconee not being valid for those
14 other plants.
15 Are you working into a position here the B&W
16 owners group is not going to allow you to address the rest
17 of those plants?
18 MR. DENTON: No, not at all. I wanted to just
19 skim across the top of these plants and not ask all 44
20 plants the first day because I didn't know the right
21 questions to ask. So I see these eight as just being the
22 lead test plants and we will go back and pick up the others
23 based on what we learn from these. I don't intend to ignore
24 any of those B&W plants, but I thought it would be
25 sufficient to deal with the highest shifts first.

1 COMMISSIONER AHEARNE: Why was it that the B&W
2 owners group decided to focus upon Oconee, because they are
3 doing more generic -- (Inaudible).
4 MR. MURLEY: They will be doing the other plants,
5 but they won't be ready by December 31st. I think Rancho
6 Seco comes in like in March and some of the others like TMI
7 follow on.
8 COMMISSIONER AHEARNE: Are you saying that they
9 reached the conclusion that they could not address it
10 generically?
11 MR. JOHNSON: Babcock and Wilcox had previously
12 submitted a generic report. We have had it in our hands,
13 oh, gee, the best part of the year. Their owners group is
14 going to plant specific as an extension of the generic
15 report they previously submitted.
16 COMMISSIONER AHEARNE: Earlier in the meeting we
17 had been told that the analyses were going to be coming in
18 at the end of December. Are you saying that we already know
19 the B&W analyses well enough that the questions that were
20 asked earlier in the meeting could have been answered
21 explicitly with respect to -- (Inaudible)?
22 MR. JOHNSON: That was a complicated question.
23 COMMISSIONER AHEARNE: Well, I will simplify it
24 for you.
25 MR. JOHNSON: Please do.

1 COMMISSIONER AHEARNE: Earlier in the meeting we
2 were told when some of us were asking questions about when
3 would we know the actual detailed information which these
4 comments were based. We were told, well, that had to wait
5 until the analyses were explained and these analyses were
6 going to be explained in the reports coming in at the end of
7 December.
8 Now what you just said is, however, that we have
9 had the B&W generic report for almost a year. Therefore,
10 you must already understand the analyses the B&W.
11 MR. JOHNSON: The analyses that are contained in
12 that report, and there is more than one, have been read and
13 generally I think understood by us, but there is a matter of
14 degree of detail.
15 As far as I know, the report was submitted for
16 information only. It was not evaluated in detail by the
17 staff, am I correct about that, Ray ---
18 MR. KLECKER: (Nodding affirmatively)
19 MR. JOHNSON: --- and what we find in the
20 evaluation that has been done is that were we to do that
21 evaluation we would be turning around right now and asking
22 Babcock and Wilcox for more details which we feel we are
23 going to get in the plant specific reports.
24 MR. DENTON: Let me answer that. I don't think
25 that the report that we had originally was adequate and that

1 is why we asked for more. They keep sending in reports. We
2 did have a year ago a rather brief summary of theirs and we
3 all read it and said, gee, this doesn't satisfy us. That is
4 why we gave them more explicit instructions about what we
5 needed.

6 COMMISSIONER AHEARNE: But you think that the
7 December report even though it is going to focus only on the
8 Oconee plants will meet your needs?

9 MR. DENTON: Maybe there is something further that
10 will have to be done in the B&W plants. It was the
11 objective to get these generic reports that deal in depth
12 with the issue for their type of plants and then provide
13 enough information about each of their vendors that we can
14 come to some conclusion about that class of plants. Now if
15 B&W has decided to be exclusive about this we may have to
16 reconsider.

17 That chart though does show that we are not going
18 to get much additional information in after about January.
19 In other words, about that time industry will have produced
20 all it has been promising and these eight vendors will have
21 produced their site plant specific remedial actions. We
22 will then have all the information that we can reasonably
23 expect to have for some time.

24 Now some people are proposing major research
25 programs and new looks at fracture mechanics and reopening

1 all kinds of interesting technical issues. But I think we
2 will have to stop at that time period and act on what we
3 know because that is going to represent the more or less
4 extent of the information available in the field for some
5 time. I don't think we can get any new information in a
6 short time frame. It takes a long time to plan new research
7 programs in this area.

8 CHAIRMAN PALLADINO: Let's come back to the
9 Germans. The Germans were able to analyze and get their
10 plant specific numbers and say here is the corrective action
11 we have got to take and they did it in a relatively short
12 period of time. Now did they put more manpower on it or did
13 they do something we are not doing or did they just make
14 some arbitrary assumptions and bound their problem and say
15 here is the way we are going to solve it?

16 MR. MURLEY: Of course the Reactor Safety
17 Committee in Germany is composed of a lot of experts, one of
18 whom is a world's expert in pressure vessels and fracture
19 mechanics.

20 COMMISSIONER GILINSKY: This is who now?

21 MR. MURLEY: Professor Kussmahl from Stuttgart.
22 They also only have to deal with one vendor essentially. I
23 can't say how it works in this case, but typically they have
24 meetings with the vendors and they come to a technical
25 understanding and the vendor or the utilities decide to make

1 the change.

2 MR. DENTON: It appears we are going to have to

3 end up ordering a change if they occur in the near future.

4 From the year's dialogue we have had with the utilities no

5 one is stepping forward to make these kinds of changes.

6 They are going to provide the information that we asked for

7 in each step on what the impact would be of removing the

8 outer row or heating up the water, but no one, with a few

9 exceptions, as you say Maine Yankee has been studying the

10 problem for some time ---

11 MR. MURLEY: Some of the licensees of Westinghouse

12 plants are coming in with their low leakage fuel options.

13 So there is some of that.

14 MR. DENTON: Maybe some indication. I shouldn't

15 say there has been no movement in this area, but not a large

16 movement toward remedial action.

17 CHAIRMAN PALLADINO: I think one of your

18 colleagues has something to say.

19 MR. VAGANS: Milt Vagans, Research. You mentioned

20 German several times. I want to make sure that the staff

21 completely understands that the Germans and the Finns were

22 not attacking the pressurized thermal shock problem, but

23 they were just attacking the problem we had in the

24 degradation of upper shelf material with fluence. Therefore

25 the problem they faced was normal operating conditions

1 projected over a period of time and the degrading effect
2 this had upon the upper shelf energy of their welds which is
3 specified in 10 C.F.R. 50. In other words, it is a
4 regulatory position.
5 So remember they had a lot easier problem than
6 what we are addressing. Normal operating conditions,
7 degradation of materials such that the upper shelf energy of
8 their welds in plain material would fall below the minimum
9 level we would like to see.
10 COMMISSIONER GILINSKY: But if you are also
11 worried about overcooling doesn't that give you an added
12 incentive to go in that direction?
13 MR. VAGANS: Absolutely. The problems are linked.
14 COMMISSIONER GILINSKY: In other words, they
15 responded to what they thought was a lesser problem.
16 MR. VAGANS: Right.
17 COMMISSIONER GILINSKY: And even so when forward
18 and took these measures to slow down the degradation of the
19 pressure vessel.
20 MR. VAGANS: That is correct.
21 COMMISSIONER GILINSKY: This is kind of an a
22 fortiori argument it seems to me. If they did it for that,
23 they certainly would have done it if they were worried about
24 overcooling.
25 CHAIRMAN PALLADINO: Tom?

1 COMMISSIONER ROBERTS: Are these Section 3 ASME
2 Code vessels?
3 COMMISSIONER AHEARNE: Yes.
4 COMMISSIONER ROBERTS: What does the ASME Code
5 have to say about this? Don't they have an ongoing pressure
6 vessel committee that refines their requirements?
7 MR. MURLEY: That is a good question.
8 COMMISSIONER ROBERTS: I think one of your
9 colleagues is trying to answer.
10 MR. JOHNSON: As part of Task A-11, which was the
11 upper shelf program, we had some of the best advice we could
12 get from the ASME Pressure Vessel Code. To name one
13 gentleman who contributed quite a bit, and you will find it
14 in NUREG 0744, Bill Cooper, from Teledyne Engineering
15 Services, points out that the Design Code, Section 3, deals
16 with normal and upset, that would be level A and level B,
17 but does not give any guidance for the accident conditions,
18 level C and level D. That is written and you will find that
19 in one of the appendices to NUREG 0744 written by Bill
20 Cooper.
21 Now Section 11, the part of the ASME Code that
22 deals with in-service inspection, does take that into
23 consideration but that is after one finds a flaw and has to
24 evaluate it. Having found the flaw, then one evaluates it
25 in the light of the transient or the accident loads that

1 might be imposed on it.

2 So I am not really sure where you are coming

3 from. If you are talking about Section 3 design, accidents

4 aren't considered. If you are talking about Section 11,

5 inspection, then a flaw has got to be found first. So there

6 are balances to be achieved here.

7 MR. DENTON: I don't have an official ASME view on

8 this.

9 MR. MURLEY: In a nutshell, the Code doesn't speak

10 to overcooling transients.

11 COMMISSIONER ROBERTS: Obviously.

12 COMMISSIONER AHEARNE: Let me follow that up a

13 little bit more. Is the ASME Code Committee doing any work

14 on this particular issue? Is this now something that has

15 led to a concern on their part?

16 MR. JOHNSON: You get a qualified yes for that,

17 Commissioner Ahearne, I think. I have got another who says

18 no besides me.

19 MR. RANDALL: Not to my knowledge.

20 (Laughter.)

21 CHAIRMAN PALLADINO: A categorical no.

22 MR. MURLEY: I really don't think, if I may, I

23 don't think that they are really up to speed. I think the

24 NRC staff here is ahead of most anybody on this matter

25 because we have had to be over the last year.

1 MR. REMICK: Tom, I have a question. Am I correct
2 that the small break LOCA is limiting in some reactors?
3 MR. MURLEY: Westinghouse tells us that for some
4 of their plants small break is limiting, yes.
5 MR. REMICK: On your supplement slide, I think it
6 was B-5, you did not show small break LOCA. Do you know
7 what those would be?
8 MR. MURLEY: Yes, I have those. We estimate the
9 probability of a pressurized overcooling event from small
10 LOCA to be one times ten to the minus five. Those, by the
11 way, are in the staff's response to the Oak Ridge report.
12 There is a complete discussion.
13 MR. REMICK: That would apply just to the
14 Westinghouse plants?
15 MR. MURLEY: Only a few Westinghouse plants.
16 MR. DENTON: I think to conclude this, we are
17 today about where we were in the middle of the summer. We
18 think action will be necessary on these vessels which have
19 shifted the most. We thought at that time that we had
20 enough time to gather the information from a class of them
21 to help us make a more rational decision. The clock has
22 been running and they have been working on these. When they
23 come in I would propose we meet early next year after we
24 have had a chance to assemble those comments together,
25 unless you feel the need for faster action.

1 I think, too, the ACRS is meeting in December, as
2 shown on this chart, to go over the program. They have
3 generally supported the approach we have taken to try to
4 develop as much information as could be reasonably pulled
5 together from existing knowledge.
6 Any attempt to refine this technology though will
7 clearly run us past the decision dates that we are talking
8 about. On this schedule we will have all the technology and
9 research results that are available. It sounds to me from
10 talking to the staff that attempts to further refine this in
11 terms of metallurgical understanding would really move it
12 out in time.
13 COMMISSIONER GILINSKY: If at that time there are
14 strong differences between you and the owners, I guess I
15 would like to hear from some of the owners.
16 MR. MURLEY: Yes. This could very well be like
17 ATWS where the staff had one view of the risk and the
18 utilities had a different view and it has led to a stalemate
19 for all these years. I hope it doesn't turn out that way in
20 this case.
21 CHAIRMAN PALLADINO: Now while we are studying the
22 problem I gather there is no problem in your mind with a
23 Rancho Seco event on some of the older plants, or is there?
24 MR. MURLEY: No.
25 MR. DENTON: Not on any plant today a Rancho Seco

1 event.

2 CHAIRMAN PALLADINO: You don't see that as a point

3 of concern for several years on the Rancho Seco event. On

4 the other events you are going into a much more improbable

5 set of circumstances than if you rely on operator action to

6 any degree. I gather that is the basis for some of your

7 confidence that we have no concern at the present time.

8 MR. DENTON: Proper operator action would certain

9 ameliorate it.

10 CHAIRMAN PALLADINO: Well, we have enough time to

11 look at it.

12 MR. DENTON: Yes, we have enough time to look at

13 it. I still think that for some class of vessels remedial

14 action is going to be necessary.

15 CHAIRMAN PALLADINO: I am looking at it while we

16 are study it. I want to have some feeling of confidence

17 myself and I am sure all of us want to have confidence that

18 there is no likelihood of any of these vessels going in the

19 time period that we are studying.

20 MR. DENTON: That is where I have come out.

21 MR. MURLEY: Yes. As I said, we feel we have got

22 time to wrestle with these issues and come up with a

23 regulatory position that can be defended. The way we are

24 headed now it will include a limit of some kind and it may

25 well mean that some plants will have to take corrective

1 action before the end of their service life. I don't know
2 what that means, but it involves some plant changes that
3 could be costly.
4 COMMISSIONER ROBERTS: Well, what form would they
5 likely take?
6 MR. MURLEY: Well, to remove fuel, but all that
7 does is slow down the problem. But removing fuel and
8 putting in dummy fuel elements on the outside is one
9 example. Another and the most radical one is to anneal the
10 vessel at high temperatures and that has never been done
11 before on a commercial plant and it would be a major
12 undertaking.
13 COMMISSIONER AHEARNE: Has it been done on a
14 non-commercial plant?
15 MR. MURLEY: Yes, it was done in a military
16 reactor in Alaska. They only raised it up to 650 degrees
17 Fahrenheit using pump heat, and one only gains like a 50
18 degree reduction in reference temperature by doing that. So
19 it is not very useful.
20 CHAIRMAN PALLADINO: But if you get reductions in
21 rates of nine or numbers like that it could be quite useful
22 over the remaining lives of some of these reactors.
23 MR. MURLEY: Yes.
24 CHAIRMAN PALLADINO: Well now the next time, and I
25 agree with the request, and I forget who made it, one of my

1 two colleagues here, that perhaps we ought to hear from some
2 of the owners groups' representatives on this. I think that
3 would be a good idea. Why don't we take that under
4 advisement and we will work out the way for doing that.
5 Any other questions or comments on this subject?
6 (No response.)
7 Thank you.
8 We will stand adjourned.
9 (Whereupon, at 3:20 p.m., the meeting adjourned.)
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NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

COMMISSION MEETING

in the matter of: Briefing on Pressurized Thermal Shock

Date of Proceeding: November 24, 1981

Docket Number:

Place of Proceeding: Washington, D. C.

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Mary C. Simons

Official Reporter (Typed)

Mary C Simons

Official Reporter (Signature)