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Indian Point Nuclear Generating Station

Docket Number: 50-247-LR and 50-286-LR

ASLBP Number: 07-858-03-LR-BD01

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UNITED STATES OF AMERICA

U.S. NUCLEAR REGULATORY COMMISSION

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BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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In the Matter of: : Docket No.
 ENTERGY NUCLEAR OPERATIONS, INC. : 50-247-LR
 (Indian Point Nuclear Generating : 50-286-LR
 Station, Units 2 and 3) : ASLBP No.
 _____ : 07-858-03-LR-BD01

Tuesday, November 17, 2015

Doubletree Tarrytown
 Westchester Ballroom
 455 South Broadway
 Tarrytown, New York

BEFORE:
 LAWRENCE G. MCDADE, Chairman
 MICHAEL F. KENNEDY, Administrative Judge
 RICHARD E. WARDWELL, Administrative Judge

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P R O C E E D I N G S

8:31 a.m.

1
2
3 CHAIRMAN MCDADE: This hearing will come to
4 order. We will continue with discussion on Contention
5 Number 25. Before we get started however, there was
6 one administrative matter that I forgot from yesterday
7 that I'm embarrassed that I forgot. Looking at the
8 Statement of Position of Entergy, this is Exhibit 615,
9 Page 33, third paragraph down. First word of the
10 paragraph is stricken from the record.

11 MR. KUYLER: Your honor, could you say
12 again the page?

13 CHAIRMAN MCDADE: Page 33, third paragraph.

14 MR. KUYLER: Yes, your honor.

15 CHAIRMAN MCDADE: We are striking from the
16 record as grossly inappropriate the first word of that
17 paragraph. Are you ready to proceed?

18 ADMIN. JUDGE WARDWELL: What about the
19 homework assignments? Should we start with Dr. Lahey
20 first and then we'll assume Entergy has something in
21 regards to the data? If not, we can give you more
22 time if you need it. But let's start with Dr. Lahey.

23 DR. LAHEY: So, he wanted these.

24 ADMIN. JUDGE KENNEDY: Well, we don't what
25 these are, Dr. Lahey.

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1 CHAIRMAN MCDADE: Yes.

2 DR. LAHEY: Oh, they're -- you asked me to
3 --

4 CHAIRMAN MCDADE: Dr. Lahey, excuse me. If
5 you're going to talk, you've got to be sitting with
6 the microphone. Otherwise, it's going to get lost for
7 the record.

8 DR. LAHEY: Okay.

9 CHAIRMAN MCDADE: And we can get someone --

10 DR. LAHEY: Richard Lahey. Your honor, you
11 asked me to give you the references that I had cited
12 yesterday. So I have copies of them for you.

13 CHAIRMAN MCDADE: Well, could you just tell
14 us what the cites are?

15 DR. LAHEY: What the references are?

16 CHAIRMAN MCDADE: Yes.

17 DR. LAHEY: Okay. There's three of them.
18 One of them is Kanaski, the other one is Arai, and the
19 other one is Korth, et al. And these had to do with
20 low cycle fatigue versus high cycle fatigue and the
21 effect of this on failure for testing components that
22 were irradiated.

23 ADMIN. JUDGE WARDWELL: And were these
24 previous exhibits that you had submitted?

25 DR. LAHEY: Yes. They were in my

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1 testimony, but Judge McDade asked me if I would -- I
2 thought it was my homework assignment if I would make
3 him a copy of them, so I did.

4 MR. SIPOS: And Judge, this is John Sipos,
5 we have the exhibit numbers if you would like.

6 ADMIN. JUDGE WARDWELL: And that's all we
7 needed.

8 MR. SIPOS: Would that be helpful?

9 CHAIRMAN MCDADE: Yes.

10 ADMIN. JUDGE WARDWELL: That's what I think
11 we were trying to imply is we just needed the cites
12 for those, we didn't need the cites.

13 MR. SIPOS: So the first one, New York
14 State 564 is Arai, A-R-A-I. Another one is
15 Riverkeeper 152 and that's Korth, K-O-R-T-H. And the
16 third is NRC 177 and the first author is Kanasaki, K-
17 A-N-A-S-A-K-I.

18 CHAIRMAN MCDADE: Okay. Thank you, Mr.
19 Sipos.

20 ADMIN. JUDGE WARDWELL: And thank you, Dr.
21 Lahey, for digging out those specific ones. We only
22 really needed the cites though. Sorry for the
23 misunderstanding, we appreciate your effort.

24 DR. LAHEY: Okay.

25 ADMIN. JUDGE WARDWELL: Entergy, is there

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1 anything you'd like to offer in regards to the data
2 that demonstrates the effect of, I believe it was
3 looking at the effects of embrittlement on fatigue in
4 some fashion or fracture toughness.

5 DR. LOTT: Yes. My understanding was there
6 were two questions that came up yesterday related to
7 data. That being one of them, the irradiation effects
8 on fatigue. And there was another question about high
9 fluence properties in general and the survivability of
10 materials at high fluences. As to the question of the
11 effects of radiation on fatigue, I must admit, I've
12 been reliant on NRC NUREG/CR-6909, which in Section
13 1.32 has a discussion of irradiation embrittlement and
14 fatigue.

15 Let me say that I have a difficult time
16 with the word synergism when we talk about these
17 particular relationships. I understand that all
18 irradiated materials are embrittled and the question
19 to me is whether or not irradiation also has effect on
20 the strain life of the material or on the fatigue
21 resistance of the material. I don't see that as a
22 synergism, that's just a question of irradiation
23 embrittlement and irradiation fatigue life.

24 I can give you a summary of what I think
25 it says in NRC 6909. It does reference the papers by

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1 Korth and Harper. I'll point out that, that data in
2 that paper is basically generated for fast meter
3 conditions, it's not at a temperature that we would
4 generally think would be applicable for PWR
5 interactions. The paper by Arai was actually
6 reporting on irradiation embrittlement work that was
7 done at Westinghouse. I'm not sure that there's any
8 fatigue data in that paper at all, I don't recall any.

9 And the paper by Kanasaki, I'll point out
10 I'm a co-author on that paper, so we're certainly
11 aware of it. It is the one paper that, and we can put
12 the data -- do you want to discuss the data or just
13 note that the data is there? That is the paper that
14 does show that at low strain amplitudes, below I
15 believe it's 0.6, the data that was tested of PWR
16 relevant conditions all showed an increase in fatigue
17 life with irradiation. We're not to discussing the
18 CUFs in Contention 26 yet, but when we do, I think
19 we'll find that there's, A, a limited number of
20 materials of the internals which have CUF values
21 calculated are irradiated. And those materials, I do
22 not expect to have a large strain amplitude. So I
23 think the data in the Kanasaki paper is directly
24 relevant to the conditions we're talking about.

25 ADMIN. JUDGE WARDWELL: Okay. When you

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1 first started off referencing a NUREG was it?

2 DR. LOTT: It's CR-6909 and I'm sorry, I'll
3 find you the --

4 ADMIN. JUDGE WARDWELL: And is there an
5 exhibit number. If you just --

6 DR. LOTT: Yes, there is.

7 ADMIN. JUDGE WARDWELL: -- have an exhibit
8 number, that would suffice because then we can find it
9 through the --

10 MR. STEVENS: Your honor, Jerry Stevens of
11 the Staff. That's New York State 490 Alpha.

12 ADMIN. JUDGE WARDWELL: Okay.

13 DR. LOTT: Yes.

14 ADMIN. JUDGE WARDWELL: Thank you.

15 DR. LOTT: Of which Mr. Stevens is an
16 author.

17 ADMIN. JUDGE WARDWELL: Okay. Is there
18 anything else you'd like to offer in regards to
19 sources of data backing your claims from yesterday?

20 DR. LOTT: Well, there is, in addition, the
21 issue of high fluence properties. There was some
22 question in our mind whether the question was high
23 fluence data on fracture toughness or high fluence
24 data on the yield stress of materials. My observation
25 again would be that, when we come to the very highly

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1 irradiated components in the plant, particularly the
2 baffle former bolts, and you look at strategies for
3 dealing with the baffle former bolts, anything that we
4 observe with a crack, we assume has failed. So we
5 never actually use a fracture toughness value for very
6 highly irradiated materials because we have this
7 failure assumption in our acceptance criteria.

8 So if you want to know about those
9 materials at very high fluences, I would recommend to
10 you and I'm going to find it here, it's Exhibit
11 Entergy 000646, MRP 210, has in there in Figure 1-4 a
12 plot of yield strength versus neutron fluence that
13 goes out to fluences data certainly greater than 90
14 dpa, actually one data point closer to 120 some dpa.
15 Which would be well beyond what we would expect the
16 fluence on the vast majority of the reactor internals
17 ever to see.

18 ADMIN. JUDGE WARDWELL: Thank you. And
19 again, is there a -- did you reference an exhibit
20 number in your --

21 DR. LOTT: Yes, I believe I did. ENT 646.

22 ADMIN. JUDGE WARDWELL: Oh, ENT, okay.
23 Thank you.

24 MS. BRANCATO: Your honors, this is Debra
25 Brancato from Riverkeeper. Dr. Hopenfeld has

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1 indicated to me he has some helpful input to this
2 discussion as well if you care to entertain some
3 testimony from him at this time.

4 CHAIRMAN MCDADE: Well, probably not at
5 this time, but before we leave the topic.

6 MS. BRANCATO: Okay.

7 ADMIN. JUDGE WARDWELL: Okay. So let's
8 continue on with some questioning and dealing with
9 Contention 25 --

10 CHAIRMAN MCDADE: But before you go on, Dr.
11 Hopenfeld is, as I said yesterday, sometimes things
12 move and we hear an awful lot of things. Take a card,
13 write down the comment to remind yourself, and you
14 will be testifying later. Thank you.

15 ADMIN. JUDGE WARDWELL: And I'll refer
16 again to Entergy's Exhibit 616, their testimony,
17 Answer 174, Pages 113 to 114. During its technical
18 review of MRP 227, the NRC Staff specifically
19 requested additional information on how the program
20 accounts for synergistic effects. And I guess I'll
21 ask again for Entergy, how does your AMP look at and
22 include actual analyses which have addressed the
23 change in fatigue strength as a function of varying
24 degrees of embrittlement of the specimen that occurs
25 with time?

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1 DR. LOTT: Well, again, to me there are two
2 questions in mind there. One is when we talk about
3 embrittlement, if we're talking about the loss of
4 fracture toughness, we calculate or look at lower
5 bound fracture toughness curves based on the dose of
6 the material. So we're using what we believe to be
7 bounding fracture toughness curves and then analyze
8 the crack that has grown. So there's certainly an
9 interaction there between the tolerance of the
10 material and the embrittlement and the fatigue crack
11 growth, they're tied into the same calculation.

12 ADMIN. JUDGE WARDWELL: But that's a
13 proposal of what you would do if a crack was observed,
14 right? And until a crack is observed and as part of
15 the development of your AMP, you haven't done any
16 analysis in regards to that, is that correct?

17 DR. LOTT: Well, we've certainly done
18 analysis to show that we do not expect to see cracks
19 occur in these materials whatsoever. Again, the CUF
20 would be a good example of that. We've looked at
21 extensive analysis of IASCC, particularly in the
22 highly rated components we generated a fairly complex
23 model of the reactor internals to look at the aging of
24 those reactor internals and predict where IASCC might
25 occur. The only place that we actually predicted it

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1 would occur was in the baffle former bolts, which we
2 discussed. There's a fairly detailed process for
3 that.

4 In our processing and recommendations for
5 inspections, we certainly looked at susceptibility to
6 multiple degradation mechanisms as part of that and we
7 based our inspection program on determination of the
8 effect of those mechanisms. So as far as we're
9 concerned, we're obviously inspecting for irradiation
10 fatigue, IASCC, or SCC, all three of which are
11 cracking mechanisms and the inspection program doesn't
12 care which one of those caused that, it's just simply
13 looking for that. So I think in our prioritization of
14 inspections, we certainly have looked at that. We've
15 looked at that in the design of our program in
16 general.

17 ADMIN. JUDGE WARDWELL: I'm just trying to
18 think of whether I'll wait until 26 to discuss this
19 further or not, but I'll bring it up again now, I
20 guess, because we did talk about it yesterday and I
21 want to fix again, I guess with you, Dr. Lott. I'm
22 trying to get a grasp on the handle between the peak
23 strength and fatigue durability. As I heard our
24 discussion yesterday, I can understand why someone may
25 say embrittlement won't come into effect really until

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1 there's a crack due to excessive peak strength.
2 You've got to get past the peak strength and then
3 embrittlement comes into play to a certain degree.
4 But fatigue durability doesn't rely on loads that
5 exceed the peak strength. It's a repetitive loading
6 that causes the types of cracks, is that correct?

7 DR. LOTT: Yes.

8 ADMIN. JUDGE WARDWELL: And so, again, I'm
9 back to the question of where is anyone looked at
10 whether or not that fatigue durability is influenced
11 by embrittlement and to what degree is it?

12 DR. LOTT: Well, again, this is, at least
13 from my perspective, I don't necessarily -- to me,
14 embrittlement and fatigue life, well, again,
15 embrittlement is not a property in and of itself. The
16 properties are yield stress, ultimate stress,
17 ductility measurements, such as total elongation,
18 fracture toughness. And I would see, again, as
19 another issue, would be the question of what's the
20 impact on the S-N curve, the number of --

21 ADMIN. JUDGE WARDWELL: Well, can't we use
22 fracture toughness as an indication of embrittlement?

23 DR. LOTT: It's an indication that the
24 material has been irradiated and irradiated materials
25 have a decrease in that. But it does not necessarily

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1 indicate how the material will survive under fatigue
2 conditions. So basically, we have a test for that,
3 just like we have a test to determine yield stress.
4 That is the fatigue life test to generation of the S-N
5 curve. We actually take a specimen, strain it at some
6 strain amplitude, we put it on repeated cycles, and
7 count the number of the cycles it takes to fail the
8 specimen or to have a load drop in the specimen
9 actually. So those fatigue life curves, again, are
10 behind basically the calculation of the CUF factors
11 based on a design curve, which is bounding to all of
12 the measurements of fatigue life.

13 ADMIN. JUDGE WARDWELL: Let me ask you
14 this, if I did a fatigue test, whatever the fatigue
15 test might be, if I try to fatigue it, as a specimen
16 that's not irradiated whatsoever, and I repeated that
17 test under different degrees of radiation exposure,
18 what would you expect the results of the fatigue test
19 to do? Remain the same, improve, or degrade?

20 DR. LOTT: That's exactly what we did in
21 the Kanasaki paper that, again, I'm a co-author on.

22 ADMIN. JUDGE WARDWELL: Okay.

23 DR. LOTT: We looked at that. We looked at
24 that at some fairly high fluences. So, if you'll --
25 the fluences are in two different papers reported in

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1 different units. If you'll take my word for it, in
2 the Kanasaki paper the data is about 20 dpa. At 20
3 dpa, if you look at the yield stress or the fracture
4 toughness curves, you'll see that there's a sharp
5 decrease in the fracture toughness of the material,
6 there's a large increase in the yield stress and, yet,
7 the fatigue life in those specimens that we tested for
8 Kanasaki, the fatigue life of that material got
9 longer. So the fatigue life improved at the same time
10 that the fluences were such that the yield stress
11 would increase and the fracture toughness decreased.

12 ADMIN. JUDGE WARDWELL: Thank you. Dr.
13 Lahey, do you have any other types of cites or
14 evidence in your testimony that differs from what they
15 have just expounded upon and/or what would you believe
16 would be the change in that fatigue property as the
17 materials are irradiated?

18 DR. LAHEY: Right. This is Richard Lahey
19 for New York State. I don't disagree with anything he
20 said except he didn't say everything. If you look at
21 the Korth paper, which admittedly was for high
22 pressure or higher temperature conditions for the
23 reactor, what it says is for high cycle fatigue where
24 you have larger amplitudes, you can have a reduction
25 by a factor of one half of the cycles to failure for

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1 irradiated materials, irradiated up to 1.1 times ten
2 to the 22 neutrons per centimeter square.

3 It is inconclusive. The reason people say
4 it's inconclusive is there's other data that shows if
5 you have high cycle fatigue or have low amplitude,
6 then it strengthens and you're in the region where
7 things get better. Here, things get significantly
8 worse. So all the real experts, the people who do
9 research on this, say the same thing. We don't really
10 have any good data for light water reactor conditions
11 and it's sorely needed. And this is why in the
12 sustainability program they're doing those kind of
13 tests. So I don't disagree with that at all.

14 What I am concerned with is there's
15 evidence, admittedly it's not perfect, but there's
16 evidence it can have a significant degrading effect.
17 And then the question is, what do you do in the
18 meantime until you can definitively tell and quantify
19 the effect? Do you just ignore it and keep looking
20 until you get a crack? Or do you put on some sort of
21 factor to account -- put a cushion in to account --

22 ADMIN. JUDGE WARDWELL: In your cite that
23 you just gave us, would that temperature have a big
24 difference and is that temperature representative of
25 what might be experienced in a PWR at IPEC?

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1 DR. LAHEY: It's somewhat higher than the
2 temperature that you would have in a light water
3 reactor for sure. Therefore, it's not a perfect data
4 set.

5 ADMIN. JUDGE WARDWELL: And would that
6 likely have an influence on the data results, the
7 extra temperature?

8 DR. LAHEY: It's hard to say.

9 ADMIN. JUDGE KENNEDY: Dr. Lahey, this is
10 Judge Kennedy. I'm curious now that I've heard from
11 Dr. Lott, we've got two conflicting views of the data,
12 one for slightly different conditions. It appears
13 that Dr. Lott's paper addressed the right conditions
14 and addressed different levels of irradiation. How
15 would you challenge his paper? You've offered up the
16 higher temperature data, but what would you say to the
17 data that he's presented? I mean, I recognize it's
18 one of the three references you provided.

19 DR. LAHEY: Right. Well, my understanding
20 -- I mean, he's the author, so --

21 ADMIN. JUDGE KENNEDY: But I think you're
22 --

23 DR. LAHEY: -- he has a little advantage
24 there, but --

25 ADMIN. JUDGE KENNEDY: I take it you're

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1 offering his same paper for a different conclusion.

2 DR. LAHEY: Yes. I mean, it is one of the
3 few papers that addressed fatigue and irradiation.
4 And as I understood the focus of his paper was more
5 into what happens once you get a crack and how does it
6 propagate and the initiation of the crack, rather than
7 the cycles to failure.

8 ADMIN. JUDGE KENNEDY: But isn't that what
9 he just said? That the number of cycles to failure
10 increases with the irradiation of the sample material?

11 DR. LAHEY: Well, that's what --

12 ADMIN. JUDGE KENNEDY: That the fatigue
13 life went up?

14 DR. LAHEY: It depends entirely on the
15 amplitude. It depends on the amplitude of the fatigue
16 cycle.

17 ADMIN. JUDGE KENNEDY: Are you suggesting
18 that the amplitude in his test data or in his
19 calculations using the test data are not the right
20 characterization of the amplitudes that would be
21 present at Indian Point Units 2 or 3?

22 DR. LAHEY: I mean, I don't -- I mean, he
23 should say what the purpose of his test was. But as
24 I understand it, it wasn't to specifically address
25 that.

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1 ADMIN. JUDGE KENNEDY: And maybe this is a
2 more general question about the term high cycle/low
3 amplitude and low cycle/high amplitude has been pushed
4 around here. I'm not sure sitting up here, are both
5 applicable to the operating conditions at Indian
6 Point? Is one grouping, I don't know if it was -- is
7 high cycle/low amplitude more applicable to Indian
8 Point? Or is low cycle/high amplitude more
9 applicable? Or are they both? And is there a hole in
10 the data as Dr. Lahey is suggesting?

11 DR. LAHEY: Well, as I under -- this is
12 Richard Lahey again. As I understand high cycle, it's
13 things like flow induced vibration, turbulence
14 induced, flow induced vibration. This is not a great
15 concern. It is in the steam generators and what that
16 might do to fretting and things like that, but it's
17 not in the primary side. It's more low cycle and many
18 of the kind of transients they have would in my
19 opinion give a larger amplitude. So it's more like
20 low cycle, larger amplitude fatigue.

21 CHAIRMAN MCDADE: Okay. Dr. Lahey, let me
22 interrupt for a second here. The document that you
23 referenced was the Korth paper, K-O-R-T-H.

24 DR. LAHEY: Right.

25 CHAIRMAN MCDADE: And that was Riverkeeper

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1 152. That paper was originally presented back in June
2 of 1974. Is that data still valid? I mean, isn't
3 there something more recent that you can address us to
4 as far -- you're talking about the absence of data
5 here and that particular study is more than 40 years
6 old.

7 DR. LAHEY: Well, that's correct. But
8 nobody that we could find in a literature search has
9 really systematically done that and as a consequence
10 that's why they took it on in the Light Water Reactor
11 Sustainability Program. I agree there's data needed.

12 CHAIRMAN MCDADE: Okay. So that particular
13 study, although it's more than 40 years old, it's your
14 position that since then there has been no significant
15 work that has generated more informative data?

16 DR. LAHEY: I haven't been able to find it
17 if there has been. And I don't know anybody else that
18 has. All the -- this has been discussed by the NRC
19 because they had input, like I'm giving you, from some
20 of their experts at Argonne and they took all that
21 input in, looked at this data, the other data, and
22 then decided it's inconclusive and so we'll do our
23 inspection program, but not do anything separate in
24 terms of putting a penalty factor in. But that's
25 their job, in my view, as regulators. That's their

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1 opinion.

2 ADMIN. JUDGE KENNEDY: I guess -- this is
3 Judge Kennedy. I'm still curious about low cycle/high
4 amplitude and high cycle/low amplitude. Is this worth
5 discussing in more detail? Is it relevant to the
6 metal fatigue for reactor vessel internals?

7 DR. LOTT: Well, I think probably what's
8 relevant to this particular discussion is the limits
9 that are in the Kanasaki paper in general, which is
10 this 0.6 percent strain amplitude. We believe those
11 conditions were chosen such that they would be
12 relevant to reactor internals, that was the intent of
13 the testing in the first place. And, again, as I
14 indicated, did a quick check of the CUF values that
15 are reported for the reactor internals and those that
16 are in components that also see irradiation, which is
17 only a fraction of the total. And having surveyed
18 those, I believe that we'll find that all of the
19 strain amplitudes are within the limits that are in
20 the Kanasaki paper. If you look at the number of
21 cycles to failure in Figure 8 of that paper, you'll
22 see that in some cases they are as few as 1,000
23 cycles. So it's not like this is thousands of cycles
24 per year kind of numbers that we're talking about.

25 ADMIN. JUDGE KENNEDY: All right. Thank

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1 you.

2 ADMIN. JUDGE WARDWELL: Moving on from
3 that, Entergy's testimony, Exhibit 616, Answer 144,
4 Pages 93 to 94, present eight age relating degradation
5 mechanisms. And they include stress corrosion
6 cracking, irradiation assisted stress corrosion
7 cracking, wear, fatigue, thermal aging embrittlement,
8 irradiation embrittlement, void swelling and
9 irradiation growth, thermal and irradiation enhanced
10 stress relaxation, or irradiation enhanced creep.

11 They then go on to say that for each of
12 these eight mechanism, MRP 227 identifies the
13 resulting aging effect, which will then be managed
14 through inspections under MRP 227-A guidelines.
15 Notably, in most cases, the key effects are cracking,
16 dimensional changes, or wear, but in all cases, as
17 explained below, the inspections specified in MRP 227-
18 A are designed to detect potential aging effects
19 applicable to each reactor vessel internal component
20 regardless of the underlying mechanism.

21 And I guess I'd address this to Entergy,
22 whoever would like to answer, if you say that in most
23 cases the key effects are cracking, dimensional
24 changes, or wear, but given that the effects are
25 managed, not the mechanism, what are the key effects

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1 in the other minority cases and are they detectable by
2 your AMP? I'm addressing your throw away statement in
3 this testimony that in most cases the key effects are
4 cracking, dimensional changes, et cetera. What I'm
5 asking is, what about in those other cases that aren't
6 included in that, what are those key effects because
7 it is true you are claiming to be monitoring for
8 effects and not mechanisms?

9 DR. LOTT: I may have to take a minute to
10 think about this one. I suspect that, that is, as you
11 suggested, a throw away sentence that we were probably
12 just overly cautious. I don't --

13 MR. DOLANSKY: Dr. Lott?

14 DR. LOTT: Yes.

15 MR. DOLANSKY: This is Bob Dolansky with
16 Entergy. Perhaps one example would be the internals
17 hold down spring.

18 DR. LOTT: Okay.

19 MR. DOLANSKY: We're actually taking
20 measurements of the hold down spring, we're not
21 looking for cracking or wear. We're going to take
22 dimensional measurements of the hold down spring and
23 use that to determine whether that is acceptable. Is
24 that --

25 DR. LOTT: Yes.

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1 MR. DOLANSKY: Would that be one example?

2 DR. LOTT: That would be a good idea.

3 ADMIN. JUDGE WARDWELL: Okay. So in that
4 particular case then for that spring, you're doing
5 some actual measurement rather than just observing for
6 a crack?

7 MR. DOLANSKY: Correct.

8 ADMIN. JUDGE WARDWELL: Do you have any
9 other examples of this?

10 MR. DOLANSKY: Give me one --

11 ADMIN. JUDGE WARDWELL: And let's just
12 assign that as a homework assignment so you don't
13 break out in beads of sweat panicking --

14 DR. LOTT: Right.

15 ADMIN. JUDGE WARDWELL: -- trying to find
16 everything you possibly can at this moment, I know the
17 feeling all too well being on that side of the table
18 often. Let's just -- when you feel comfortable, get
19 back with a response if there's any other examples you
20 can give in regards to those. Because I think it is
21 somewhat important because, again, you are monitoring
22 for the effects and I want to make sure we don't have
23 some giant hole of something else that's out there
24 that we would like to be able to track.

25 DR. LOTT: May I say that we did go through

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1 this FMECA process which looked at each component and
2 asked ourselves what are the appropriate failure modes
3 and consequences? So we certainly did look at that
4 and asked ourselves the questions in the process.

5 ADMIN. JUDGE WARDWELL: So it sounds like
6 your reference to most cases, you were referring to in
7 most of the internals, we are looking for some type of
8 strain and deformation or a crack or something in that
9 neighborhood.

10 DR. LOTT: Yes. Well, we --

11 ADMIN. JUDGE WARDWELL: And in some of your
12 -- and then other cases, you are doing something else
13 besides looking for some sort of strain.

14 DR. LOTT: Yes. We tried to identify in
15 each case what the effect was that we thought we were
16 looking for in the prescribed inspection. So if it
17 was a wear inspection, we would be looking for loss of
18 material or evidence of wear on the surfaces. If it
19 was something that was subject to a cracking
20 mechanism, we would say, we're looking for cracks.
21 And this is where the question of irradiation
22 embrittlement would come up as well.

23 ADMIN. JUDGE WARDWELL: Yes. And I kind of
24 view wear as a strain, it's not really a strain, but
25 it's a loss of the dimension if nothing else.

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1 DR. LOTT: Loss of --

2 ADMIN. JUDGE WARDWELL: A change in a
3 dimension.

4 DR. LOTT: Yes. Opening of a gap,
5 displacement of a component one with respect to the
6 other in some small way. We tried to find the places
7 where that was most evidence where we could see it.

8 ADMIN. JUDGE WARDWELL: Is it not true
9 though that your AMP is based on the fact of
10 monitoring for effects and not trying to deal with the
11 mechanism that caused those effects?

12 DR. LOTT: Yes. I think that was the
13 instruction of the Aging Management Program in
14 general.

15 ADMIN. JUDGE WARDWELL: And, NRC, would you
16 agree that, that's the motive behind the inspection
17 program for the reactor vessel internals AMP?

18 DR. HISER: This is Allen Hiser with the
19 NRC. Yes, that's correct. It's monitoring,
20 inspecting for aging effects. Mechanisms create
21 effects and they're important to understand what aging
22 effects you need to manage, but the mechanisms
23 themselves are not managed.

24 MR. STROSNIDER: This is Jack Strosnider
25 for Entergy. If I could just add there, if you want

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1 a citation on that, you can go to the Statements of
2 Consideration that were issued when the License
3 Renewal Part 54 was issued in 1995. And it explicitly
4 discusses this notion of managing effects rather than
5 mechanisms. And I think part of the reason for that
6 is to recognize that the effect doesn't care what
7 synergisms, if there are any, that are happening. If
8 you see a crack, you see a crack and whatever
9 contributed to it, contributed to it and then you need
10 to take the right corrective actions. But I just
11 wanted to get you that citation in case you want to
12 look at that.

13 ADMIN. JUDGE WARDWELL: How does one
14 observe embrittlement?

15 MR. STROSNIDER: This is Jack Strosnider of
16 Entergy. You asked -- is that question directed at
17 me?

18 ADMIN. JUDGE WARDWELL: Yes.

19 MR. STROSNIDER: Okay. So the discussion
20 in the AMP is that embrittlement is not directly
21 observed, but it is managed through the detection of
22 cracks. And, as we've been discussing, if you find a
23 crack, you then need to assess it considering the
24 material properties that would be associated with
25 whatever level of embrittlement that component has

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1 experienced. So it's an indirect approach. There is
2 not an embrittlement meter, if you will, that you can
3 go in and look. You have to do this indirectly and
4 that's what's laid out in the program.

5 ADMIN. JUDGE WARDWELL: Thank you.

6 DR. LOTT: May I add? This is Randy Lott.
7 In MRP 227, when there were components that were
8 subject to irradiation or thermal embrittlement, we
9 tried to note them in that way. There was effects
10 listed and then there would be the conditional note
11 that says, this effect should be -- aging management
12 for irradiation embrittlement, thermal embrittlement
13 would be required in this component. So we would mark
14 those places where this would be a concern.

15 ADMIN. JUDGE WARDWELL: Okay. Thank you.
16 Dr. Lahey --

17 CHAIRMAN MCDADE: Okay. If I could, just
18 -- and, Dr. Lahey, as I understand your position is
19 that given the fact that you can't directly observe or
20 monitor embrittlement, that there is a significant
21 change, even in the absence of cracks, that could set
22 up the reactor vessel internal for failure in the
23 event of a shock load.

24 DR. LAHEY: The reactor vessel internals,
25 is that what you're talking about? Yes, I agree with

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1 what they said that, that's what they're monitoring.
2 They're not looking at incipient failure, they're
3 looking at failures that have occurred. And I'm
4 concerned with the mechanism of microcracks, there are
5 plenty of cracks, but they're microcracks, and how
6 this weakens the material in the event that you have
7 an impulsive load on this material.

8 CHAIRMAN MCDADE: Okay. And it's your view
9 that there's no specific inspection technique
10 currently available that would be able to identify the
11 effects of embrittlement prior to failure and that, in
12 your view, the only way to adequately manage the
13 effect of aging is to have a reasonable replacement or
14 repair system. Am I correct in summarizing --

15 DR. LAHEY: Yes. I think you are correct.
16 I mean, the problem is, if we had all the data that we
17 really need to have, we wouldn't be having this
18 discussion. We would know what to do, the NRC would
19 be requiring it, Entergy would be complying with it,
20 and everything would be fine. But we don't. We have
21 some fragmentary data, which indicates concerns, and
22 so how do you deal with that? To me, the easiest way
23 to deal with it, for things like bolts, they're
24 relatively easy to replace, would be just replace
25 them. Get rid of the problem rather than try to

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1 calculate how many bolts can be failed and still keep
2 running and that sort of thing. I think that's a very
3 dangerous game, you're playing with fire when you do
4 that.

5 CHAIRMAN MCDADE: Okay. And let me address
6 this in turn to Dr. Hiser and then to Dr. Lott, it's
7 your view, Dr. Hiser, that in the absence of cracking,
8 there is no reason to believe that you are on the
9 verge of failure, even in the event of a shock load,
10 with these reactor vessel internals and that,
11 therefore, the inspections that are currently
12 available are adequate to monitor the aging of these
13 reactor vessel internals? Is that correct?

14 DR. HISER: This is Allen Hiser. Yes, that
15 is correct.

16 CHAIRMAN MCDADE: Okay. And, Dr. Lott, do
17 you agree with what Dr. Hiser just affirmed?

18 DR. LOTT: Yes, I do.

19 CHAIRMAN MCDADE: Okay. So that's
20 basically the difference of opinion here between the
21 NRC Staff, Entergy, and the position of New York's
22 witness, Dr. Lahey, as you see it Dr. Hiser?

23 DR. HISER: If I could just -- this is
24 Allen Hiser. If I could just elaborate a little bit
25 because --

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1 CHAIRMAN MCDADE: Please.

2 DR. HISER: -- some of the discussion
3 yesterday related to ductility of the materials at
4 high fluence and a couple of the exhibits, New York
5 487 shows data, they're up to about 70 dpa that have
6 measurable fracture toughness, which is indicative of
7 ductility, NRC 209 has data that are up to about 12
8 dpa, that again show reasonable fracture toughness.
9 So there is still ductility in the material at these
10 fluence areas of interest. And, again, there also is,
11 my understanding, there was no exhibits provided to,
12 no data that we've seen that would indicate that
13 fatigue weakens a material or a component in the
14 absence of cracks.

15 ADMIN. JUDGE WARDWELL: And what types of
16 fluences do we expect after 60 years of operation?

17 DR. HISER: My understanding is for the
18 internals on the upwards of 75 dpa for the maximum for
19 the baffle bolts. If you go beyond that area, go
20 beyond the baffle assembly, they're much lower. So
21 the baffle bolts --

22 ADMIN. JUDGE WARDWELL: But the ones you
23 just quoted were well below that, weren't they? You
24 say it was over --

25 DR. HISER: The data in New York State 487

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1 is upwards of 60, 70 dpa.

2 ADMIN. JUDGE WARDWELL: Okay. Thank you.

3 CHAIRMAN MCDADE: Okay. And, Dr. Hiser,
4 we're talking perhaps about different things. We've
5 been talking about cracks. Dr. Lahey mentioned
6 microcracks, cracks that are there, but are not
7 observable given current inspection techniques. Do
8 you agree that there's probably microcracks in many of
9 these reactor vessel internals, such as the baffle
10 former bolts?

11 DR. HISER: This is Allen Hiser. As the
12 CUF gets much closer to one, I think the likelihood
13 increases that you could have microcracks. But I
14 think the impact of those microcracks on the fracture
15 response of the component is negligible. I think
16 that's been demonstrated through many tests.

17 CHAIRMAN MCDADE: So the degradation in
18 fracture toughness would be minimal in your view?

19 DR. HISER: Well, I think the effect of the
20 degradation of fracture toughness would not be
21 significant. There may be reductions in fracture
22 toughness, but the impact of that in the presence of
23 even microcracks is not significant.

24 CHAIRMAN MCDADE: In your view, would not
25 be of consequence?

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1 DR. HISER: Yes, that's correct.

2 CHAIRMAN MCDADE: Dr. Lott, do you agree
3 with that?

4 DR. LOTT: Yes, and I believe that the data
5 that Dr. Hiser just cited basically shows you that
6 these components can survive with actual cracks,
7 macrocracks, measurable cracks, not just the
8 microcracks that are suggested here. Certainly if we
9 can withstand cracking and we can demonstrate
10 stability of the component with a crack in it, concern
11 about microcracks does not, to my view, seem to be
12 important.

13 CHAIRMAN MCDADE: Okay. And this is the
14 data in New York State 487 and NRC 209, correct, Dr.
15 Hiser?

16 DR. HISER: Yes, that's correct.

17 CHAIRMAN MCDADE: Okay. Dr. Lahey?

18 DR. LAHEY: All right. I want to try to
19 clear up something we talked about yesterday and here.
20 Dr. Kennedy brought up the question, have I invented
21 new loads, do I need new loads to show that these
22 things can fail or not? And my answer was, no, the
23 existing type of accidents and seismic events are
24 sufficient. What's happened, if you go back in
25 history, is there was a point in time when we were

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1 real concerned about design basis LOCA event and the
2 decompression wave that went in and what that would do
3 to the structures. Because in a particular instant,
4 you can have atmospheric, essentially atmospheric
5 pressure on one side and several thousand PSI on the
6 other and that would give you a very large impulsive
7 load.

8 So codes were written to address that,
9 method of characteristic kind of codes, like the WHAM
10 code that Stan Fabric wrote in Westinghouse, and
11 detailed analysis was done that showed for ductile
12 structures, they can withstand it. And we confirmed
13 that in the Loft experiment, which was an experiment
14 which we ran a simulated loss of coolant accident.
15 And so that concern was mitigated and as a
16 consequence, now people do the analyses using codes
17 such as RELAP and TRAC, those kind of codes, and they
18 really smear out this type of shock. They don't give
19 you the kind of shock loads that you would get if you
20 tracked the wave, the rarefaction waves, throughout
21 the vessel.

22 So I'm concerned with the real shock
23 loads. It's time, in my view, to go back and take a
24 look at this again with degraded materials. These are
25 weakened materials, you can't have lots of microcracks

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1 in there and not have it weakened. It depends on how
2 much weaker it is, that's just due to fatigue. And
3 then irradiation makes it weaker yet, makes it more
4 brittle, more subject to failure. So that's the real
5 difference. That's why when I say shock loads, I may
6 mean something quite different than what they're
7 talking about with shock loads because they're talking
8 about the normal safety analyses using these big
9 system codes, which really are intended to look at the
10 inventory of the liquid and the coolability and that
11 sort of stuff. They're not very good at giving
12 instantaneous loads, either the thermal or pressure
13 loads.

14 CHAIRMAN MCDADE: Okay. But according to
15 Dr. Hiser and Dr. Lot, even in the situation where you
16 have macrocracks, observable cracks as opposed --
17 there still would not be sufficient degradation in
18 order to create a real risk, a significant risk of
19 failure. And they rely on, I believe it was, what was
20 it, New York 487, which was an Argonne Lab study from
21 2010. Somewhat more recent data than the one that you
22 had cited. Does that not alleviate your fears that
23 this material would continue to be sufficiently
24 robust?

25 DR. LAHEY: That's not what the Argonne

1 experts are saying. When they give input, they're
2 saying very similar things to what I'm saying. They
3 have the same kind of concerns about the lack of data
4 and the effect of it and what it may imply. And
5 they're, of course, hoping to get funding to run more
6 experiments. And I agree, more experiments are
7 needed.

8 CHAIRMAN MCDADE: Okay. So you don't
9 disagree with the study, it's just what you take away
10 from that Argonne Laboratory study is different from
11 what Dr. Hiser and Dr. Lott take away from it.

12 DR. LAHEY: Apparently. I mean, I don't
13 agree with what he said. I think a degraded structure
14 is inherently weak and more subject to failure.

15 CHAIRMAN MCDADE: Okay. But what we're
16 dealing with here is basically a professional
17 disagreement. We're looking at the same data and
18 you're interpreting it, it creates more concern in
19 your mind as to the potential for failure than what
20 was expressed by Dr. Hiser and Dr. Lott. Is that
21 correct?

22 DR. LAHEY: I suppose.

23 CHAIRMAN MCDADE: Well, I'm not trying to
24 -- this is new material for me and I'm trying to make
25 sure that I understand the relative positions here and

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1 what the basis of the disagreement is. It seems to me
2 that it is an interpretation of the data, the
3 significance of the data that's available and the data
4 that isn't available. And that you seem to be very
5 concerned with an absence of data that leaves
6 questions in your mind. Am I correct?

7 DR. LAHEY: Well, not entirely. I'll tell
8 you why I feel the way I do is I'm on a science
9 council for a program called CASL, which is based in
10 Oak Ridge. It's a very large program, which is funded
11 by DoE, to develop computational capability for
12 nuclear reactors. It involves many national labs and
13 many universities. One of the members of the board
14 was also an executive or the person in charge of the
15 Light Water Reactor Sustainability Program, so I've
16 had ample opportunity to talk to the people who are
17 working in that program. And I know from the comments
18 that I have there's people who would like to think,
19 that's just for operating out beyond where we're
20 talking about. We're talking about 60 years, they're
21 going on to 80 years.

22 But in nobody's mind is there a sharp
23 demarcation. Those are the same concerns, they have
24 the same concerns that I do, and they're working on
25 it. And we're now looking at how to take the code

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1 that we've developed under CASL, which is a three
2 dimensional neutronics, thermohydraulics, fuel, water
3 chemistry, crud deposition, everything, code, and
4 apply it to these kind of issues for relicensing of
5 nuclear reactors. So there are certainly things you
6 can do, like the water chemistry, what is the water
7 chemistry during transience and how does that affect
8 FN?

9 So these are things we'll do in the next
10 -- I think we're going to get to in the next issue.
11 But it's not -- I haven't just made this stuff up. I
12 mean, these are valid concerns by people who are
13 working in it, some of them are even working under NRC
14 funding. So, I think it's an honest professional
15 disagreement and nobody has the perfect data set right
16 now to say, here's the answer. But there's
17 significant concerns about these type of things.

18 CHAIRMAN MCDADE: Okay. Thank you, Dr.
19 Lahey.

20 ADMIN. JUDGE KENNEDY: Dr. Lahey, since you
21 responded to my design basis question -- this is Judge
22 Kennedy. I'm just curious, it seems like the scenario
23 that you painted in terms of analysis methodologies
24 would be just as applicable to non-irradiated material
25 shock loading analysis as irradiated material shock

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1 loading analysis. Are you -- am I correct in that?
2 Do you have the same concern with non-irradiated
3 material analysis, shock loading, as you do with the
4 irradiated material shock loading analysis?

5 DR. LAHEY: I didn't explain it very well.
6 Originally, that was the concern and so they were more
7 ductile materials. These were newer reactors and so
8 the concern was, will they maintain a coolable
9 geometry during these type of events? And so, I think
10 that question has been settled and now the issue is,
11 given an intact geometry, can you cool them with
12 emergency core cooling engineered safety systems? The
13 new thing is, now you have degraded structures, which
14 you never had to deal with before, highly degraded
15 both from fatigue and irradiation, and it's time to
16 now relook at that. Because they can be, not only
17 deformed, they can be failed and relocated and then
18 the concern is core coolability.

19 ADMIN. JUDGE KENNEDY: I guess I thought I
20 understood you to say that there was a problem with
21 the analysis techniques that are being utilized to
22 analyze the shock loadings, that they were deficient.
23 Is that not the case? Is that not what you were
24 trying to say?

25 DR. LAHEY: The tools that were developed

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1 and used previously were focused on tracking
2 depressurization fronts and their effect in terms of
3 loading. They're rather expensive to run method of
4 characteristic type codes, but they give you good
5 answers. Since then, people have concluded that, at
6 least for ductile geometry, the core will stay intact,
7 so given this geometry, the geometry is assumed, now
8 we can use codes that do not do that, they're more
9 control volume kind of codes, like RELAP and TRAC. So
10 when you do the analyses for plants like Indian Point,
11 you don't look at the deformation of the core, you
12 have a certain geometry. What you look at is where's
13 the liquid, how's the cooling, what's the peak clad
14 temperature, that sort of thing, to see if you're in
15 the compliance with the safety regulations.

16 ADMIN. JUDGE KENNEDY: All right. Thank
17 you.

18 ADMIN. JUDGE WARDWELL: Getting back to the
19 inspections where we were, do you have any criticisms,
20 Dr. Lahey, of their approach of trying to monitor for
21 effects rather than mechanisms? Strictly this issue,
22 not in regards to your overall issue, but as an expert
23 witness before us, do you agree that monitoring for
24 effects is a good approach rather than trying to
25 monitor for any mechanism?

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1 DR. LAHEY: The answer to that, your honor
2 -- this is Richard Lahey for New York State. As I
3 tried to say yesterday, I think the program that they
4 have in place, which is inspection based, is a pretty
5 good program. So I'm all for it. I just don't think
6 it addresses all the real concerns.

7 ADMIN. JUDGE WARDWELL: You've said that,
8 thank you. In your testimony, 482, Page 17, Lines 6
9 through 17, you talk about the rather complex and
10 interacting metal degradation mechanisms associated
11 with fatigue, irradiation, and corrosion interact is
12 still an area of active research. And you point to a
13 DoE, USNR, in conjunction with various other national
14 laboratories that have recently embarked on a program
15 to understand and resolve issues related to these
16 interacting and synergistic effects. And you
17 reference NUREG/CR-7153, which is entitled Expanded
18 Materials Degradation Assessment, or EMDA --

19 DR. LAHEY: Right.

20 ADMIN. JUDGE WARDWELL: -- Aging of Core
21 Internals. And in that particular NUREG, do you know
22 the age of the study of how far out they were looking?
23 Was it within the license renewal period or was it
24 beyond that, to your knowledge?

25 DR. LAHEY: That report is part of the

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1 Light Water Reactor Sustainability Program. So
2 they're looking beyond the design life of 40 years,
3 they're going out farther. They're actually charged
4 with seeing if you can get out to 80 years. But the
5 phenomena has no sharp demarcation at any point in
6 time. So they're looking at it all the way out.

7 ADMIN. JUDGE WARDWELL: But any conclusions
8 they reach, if they're making them in regards to how
9 it is out to 80, that would be certainly different
10 than if it was out to 60, wouldn't it?

11 DR. LAHEY: Yes, but if they find phenomena
12 that is of concern at 50, they will communicate that
13 and it will be relevant to what we're talking about
14 here.

15 ADMIN. JUDGE WARDWELL: And did they have
16 any conclusions from that report that related to out
17 to 50 or 60 years that demonstrate or support your
18 positions?

19 DR. LAHEY: Dr. Busby is one of the authors
20 of that report and one of the things that I recall
21 from that report was he was greatly concerned about
22 irradiated assisted stress corrosion cracking and what
23 the impact of that may be.

24 ADMIN. JUDGE WARDWELL: Okay, thank you.
25 You go on, in fact on that same page and extending

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1 over to Page 18 with lines 17 through 22 and then 1
2 through 2 on the top, that the federal government has
3 also embarked on a fairly large research program. And
4 this is what you've termed -- or not you -- yes, you
5 call this Light Water Reactor Sustainability Program,
6 which includes research into whether the different
7 materials and light water reactor components can
8 continue to perform their intended functions during
9 the period of operations. This report that you cite,
10 which is Exhibit New York State 485, was in August of
11 2014. And, again, what were the periods of years that
12 they were looking at under that particular document?

13 DR. LAHEY: From now until operating out to
14 80 years.

15 ADMIN. JUDGE WARDWELL: Okay, thank you.

16 DR. LAHEY: I mean, it's being done at
17 various national labs and they put out monthly
18 newsletters on where they stand on various things.

19 ADMIN. JUDGE WARDWELL: Okay. Thank you.
20 NRC's testimony, 197, Answer 124, Page 75, states
21 that, "Entergy has also implemented a low leakage core
22 design for IP2 and IP3 prior to 30 calendar years of
23 operation, which reduces the potential for irradiation
24 driven aging mechanisms, such as the IASCC, the IE
25 void swelling, and ISR." I guess I'll go to Staff

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1 considering this was your exhibit. I knew what all
2 those other acronyms were for, but what about the ISR?

3 MR. POEHLER: This is Jeffrey Poehler of
4 the Staff. So ISR is irradiation assisted stress
5 relaxation or irradiation stress relaxation.

6 ADMIN. JUDGE WARDWELL: Irradiation stress
7 relaxation, is that what the ISR is for?

8 MR. POEHLER: Correct.

9 ADMIN. JUDGE WARDWELL: Okay, thank you.
10 How is this low leakage core design achieved?

11 MR. POEHLER: This is Jeffrey Poehler of
12 the Staff. So, basically the core design is such that
13 you have fuel assemblies that have higher, I guess,
14 levels of burn up or depletion or placed around the
15 outside of the periphery of the core so that the newer
16 fuel assemblies are concentrated more towards the
17 middle of the core.

18 ADMIN. JUDGE WARDWELL: And what does this
19 do for you supposedly?

20 MR. POEHLER: It reduces the, I guess, the
21 leakage of -- it reduces the fluence levels.

22 ADMIN. JUDGE WARDWELL: That's what I was
23 wondering. Okay, thank you.

24 CHAIRMAN MCDADE: I'm sorry. It releases
25 the -- I just didn't hear.

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1 ADMIN. JUDGE WARDWELL: It reduces the
2 fluence --

3 CHAIRMAN MCDADE: Fluence.

4 ADMIN. JUDGE WARDWELL -- or the flux
5 actually, so over time the fluence will be less.

6 ADMIN. JUDGE WARDWELL: Dr. Lahey, do you
7 have any comments on the low leakage core design?

8 DR. LAHEY: No. No, I understood what they
9 were doing and why. I mean, it's certainly helpful to
10 the concern we talked about yesterday with the core
11 plates and the pressure vessel to try to reduce the
12 fluence.

13 ADMIN. JUDGE WARDWELL: Okay. Thank you.
14 Entergy's Exhibit 616, testimony, Answer 182 on Page
15 120, failure of a component without a pre-existing
16 crack is governed by the mechanical properties of the
17 material, the yield strength, the ultimate strength in
18 particular. Irradiation increases the yield and
19 ultimate strengths, and we talked about this. I guess
20 my question for Entergy, does this increase in
21 strength with irradiation occur without any bound? I
22 mean, will it continue on forever, the longer you
23 irradiate it, will it continue to gain strength --

24 DR. LOTT: Okay. This is Randy --

25 ADMIN. JUDGE WARDWELL: -- keep on going

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1 unlimited?

2 DR. LOTT: This is Randy Lott for Entergy.
3 I think it might be clearer if you examine the exhibit
4 I offered this morning about yield stress in material
5 versus fluence. In general, most of the changes that
6 happen to the mechanical properties of the material
7 happen within the first five to ten dpa. So they
8 actually happen early in life and saturate such that
9 there are much less changes. That's true both of the
10 increase in yield stress and the ultimate stress, the
11 decrease in ductility. Most of the action happens, I
12 would say, at less than ten dpa. Which, for your
13 highly irradiated -- ten dpa may be the end of life
14 fluence for some components, for others it's as much
15 as 60, for others it's one. It just depends on where
16 the component is.

17 ADMIN. JUDGE WARDWELL: And are you
18 referring to all components or just the reactor vessel
19 internals?

20 DR. LOTT: The internals. The internals
21 are the only ones that are going to see enough neutron
22 exposure to exceed one dpa. We talk about milli-dpa
23 when get out to the reactor pressure vessel.

24 ADMIN. JUDGE WARDWELL: Okay. Thank you.
25 And recognizing that these microcracks exist, I guess

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1 are you claiming those still aren't caused by
2 irradiation or where would those microcracks be
3 occurring from?

4 DR. LOTT: The microcracks, as I understand
5 the argument, are one of the precursors to crack
6 formation in the fatigue specimens. So, as where it
7 was offered into evidence, and I think this is also
8 explained in NRC NUREG-6909, at least in the draft
9 version, they're sort of stages in the process of
10 forming an observable crack and one of those early
11 stages is the microcracking stage. So, again, yes,
12 it's a form of -- I mean, obviously, if there is a
13 limiting number of cycles, then something must be
14 changing over the course of time. It's been a
15 struggle to identify those things in these materials,
16 but this microcracking and some of these other small
17 micro-structural changes are just the evidence of
18 accumulating fatigue in material.

19 ADMIN. JUDGE WARDWELL: Okay, thank you.
20 Does irradiation decrease the resistance to the crack
21 propagation?

22 DR. LOTT: Okay. Let me ask, I want to
23 clarify here. When we talk about crack propagation,
24 are we talking about crack propagation due to loading
25 or crack propagation due to corrosion cracking or

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1 crack propagation due to fatigue? There are multiple
2 kinds of ways that, that term might be used.

3 ADMIN. JUDGE WARDWELL: Answer for each
4 situation.

5 DR. LOTT: Okay. So, I've created my own
6 question now, didn't I?

7 (Laughter.)

8 DR. LOTT: In terms of mechanical
9 properties, we talked and I think Dr. Hiser talked
10 earlier about the fracture mechanics mechanisms that
11 we look at or fracture toughness values that we use.
12 And in general, those toughness values are measured in
13 terms of J-resistance curves. That would tell you
14 effectively how much work it takes to advance a crack
15 in the material mechanically. And the slope of that
16 J-resistance curve gives you an idea of what the,
17 again, the resistance the material is to crack
18 advance. And in general, as the irradiation goes up,
19 that number goes down. So there is some decrease in
20 the resistance. The good news, however, is if you're
21 even measuring resistance, you're into ductile
22 failure, not into the brittle failures we had before.

23 Fatigue, I think we talked about the
24 effect of radiation on fatigue earlier and it's our
25 contention that where we have relevant data, that data

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1 says that the resistance to fatigue initiation is
2 decreased. Fatigue propagation, I think, follows
3 similar kinds of rules, but it is a different
4 mechanism. I think we'd have to go back -- I'd have
5 to do a little more research if you wanted to know
6 about that.

7 ADMIN. JUDGE WARDWELL: But by different
8 rules, I mean, does irradiation decrease that
9 resistance to crack propagation? Does a crack
10 propagate faster when it's been irradiated under
11 fatigue cracking?

12 DR. LOTT: Not necessarily. I think we'll
13 get back to the same kind of data that we discussed in
14 terms of the initiation. And I'd have to go back and
15 review that data for you in detail. And, again, we
16 talked about -- so there's fatigue stress corrosion
17 cracking, again, that effectively is irradiation
18 assisted stress corrosion cracking, that's the concern
19 we have is that there will be crack formation and
20 growth due to irradiation.

21 ADMIN. JUDGE WARDWELL: Okay. Thank you.
22 Dr. Lahey, do you believe that irradiation decreases
23 the resistance to crack propagation once a crack forms
24 from whatever mechanism?

25 DR. LAHEY: Yes, definitely the crack will

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1 propagate faster.

2 ADMIN. JUDGE WARDWELL: Thank you.
3 Entergy's Exhibit 616, Answer 114, Page 71, says RVIs
4 have no pressure retaining function. A pressurized
5 thermal shock, PTS, transient, therefore, does not
6 subject the RVI components to the sustained membrane
7 stresses characteristics of the effects of a PTS event
8 on a reactor pressure vessel itself. I guess my
9 question to Entergy is, why wouldn't the internals
10 still feel the pressure wave from a PTS transient if
11 one occurred?

12 DR. LOTT: Well, and again, I'm not sure if
13 someone else from Entergy panel wants to -- I'll step
14 forward first, I guess, and they can help me out as I
15 go along. Effectively, the pressurized thermal shock
16 is a repressurization, it's not necessarily -- it's a
17 long time in developing. It's not, I don't believe,
18 the same kind of process we're talking about here.
19 And one of the key elements of it is that you've
20 cooled down the vessel at a time when the internal
21 pressure on the vessel, the membrane stresses, remain
22 high because you've not seen the depressurization of
23 the system. So, the pressure itself in the vessel
24 creates the baseline high loads that the thermal shock
25 challenges. I'm not sure I've -- perhaps somebody can

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1 help me out with my words.

2 MR. AZEVEDO: Yes, this is Nelson Azevedo
3 from Entergy. What Dr. Lott said was correct, the
4 repressurization during a PTS event is not an
5 instantaneous event like a pipe break, we have a
6 fraction wave traveling through the system. This is
7 a repressurization that takes some time to
8 repressurize the system.

9 ADMIN. JUDGE WARDWELL: But even so,
10 wouldn't the vessel internals feel however small
11 gradual change there is regardless? And I'm trying to
12 understand your statement that, as I assume you're
13 trying to imply on this Answer 114, is that we don't
14 have to worry about PTS because it's not a pressure
15 retaining -- these aren't pressure retaining
16 components, but they're in and amongst the pressurized
17 area and so why wouldn't it still feel that change,
18 whatever shock that does occur?

19 MR. AZEVEDO: This is Nelson Azevedo for
20 Entergy. And, yes, that's correct, but the way I
21 visualize at least, for a pressure boundary component,
22 like the reactor vessel, you have 2,200 pounds on the
23 inside and essentially zero on the outside. So you
24 have that whole delta P across the component. When
25 you're talking about a reactor vessel internal, like

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1 a column, it's pressurized the same amount all the way
2 around, so there's no pressure differential. That's
3 why they're differentiated between pressure boundary
4 components and vessel internals.

5 ADMIN. JUDGE WARDWELL: Thank you, that's
6 helpful. And, Dr. Lahey, do you agree with those
7 statements? Any disagreement?

8 DR. LAHEY: I was somewhat surprised when
9 I got comments on my concerns about thermal shock,
10 significant thermal shocks, because I was not worried
11 about pressurized thermal shocks, that's a pressure
12 vessel phenomena. I was worried about cold water, for
13 example, coming in and some of the internal structures
14 would then be suddenly changed in temperature, it
15 would hit, it would shock the surface, it would try to
16 contract, it would crack, it could fail. That was my
17 concern.

18 ADMIN. JUDGE WARDWELL: Sure. And I just
19 want to verify that you don't have any disagreement
20 with the pressurized thermal shock specifically that
21 we just discussed now.

22 DR. LAHEY: No, I have no disagreement with
23 it.

24 ADMIN. JUDGE WARDWELL: Okay, great.

25 DR. LAHEY: I wasn't concerned with it.

1 ADMIN. JUDGE WARDWELL: Just want to make
2 sure they're not trying to spoof me over here with
3 some voodoo.

4 DR. LAHEY: No.

5 ADMIN. JUDGE WARDWELL: That's why I'm
6 going to you to see if you can agree with those small
7 points. That's why I go back and forth. But I
8 understand your comments about the other thermal
9 shock.

10 DR. LAHEY: Okay.

11 ADMIN. JUDGE WARDWELL: That was a
12 different issue. Thank you. Entergy's Exhibit 616,
13 Question and Answer 185, Page 122. The Question 185
14 says, do accident loads need to be considered as a
15 contributor to the effects of aging on reactor vessel
16 internals? And the Answer in 185 says, no, aging is
17 a gradual, long-term degradation of a component
18 resulting from sustained environmental conditions,
19 that is applied loads and residual stresses. And then
20 goes on to talk about the ASME codes and Staff
21 Guidance.

22 While I can understand why the loads
23 aren't a contributor to aging, I just want to make
24 sure that it's clear that I haven't confused this by
25 saying that still those loads, those design basis

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1 loads, are considered in your AMP in regards to any
2 evaluation that you might be doing to look at any
3 changes in strength or whatever else occurs during the
4 aging process. Is that correct? And I'll address
5 this to Entergy, I guess, because it was your
6 testimony.

7 DR. LOTT: This is Randy Lott for Entergy.
8 Yes, what we were trying to say, I think, is exactly
9 what you have said that it does not contribute to the
10 condition that you would observe at any time of the
11 components, but if we're looking at the ability of the
12 components to withstand an accident mode, that's a
13 different question.

14 ADMIN. JUDGE WARDWELL: You're still --

15 DR. LOTT: It's not defined as the aging.

16 ADMIN. JUDGE WARDWELL: You still will
17 consider those loads --

18 DR. LOTT: Right.

19 ADMIN. JUDGE WARDWELL: -- design basis
20 loads. And aren't the design basis loads -- do not
21 the design basis loads also include LOCAs?

22 DR. LOTT: Yes.

23 ADMIN. JUDGE WARDWELL: Thank you.
24 Entergy's testimony, 616, Answer 185, Page 122, the
25 ASME Code Section 3 compares accident loads such as

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1 large break LOCAs and large main steam line breaks to
2 the stress allowables to ensure that the affected
3 components remain capable of performing their intended
4 safety function during and after the event. And so I
5 want to just confirm again with you that doesn't the
6 degraded age strength of the PEO determine these
7 stress allowables in your analysis?

8 DR. LOTT: I -- go ahead.

9 MR. AZEVEDO: Yes, this is Nelson Azevedo
10 for Entergy. The stress allowables are directly
11 obtained from the ASME code. So based on what
12 material the component is made out of, the ASME code
13 specifies what the allowables are, we don't get to
14 choose those.

15 DR. LOTT: Yes, and I think that what
16 you're talking about is basically the design section
17 of the code, right? So it's --

18 MR. AZEVEDO: Right. So this would be
19 discussed in ASME Section 3, the original analysis,
20 and the analysis has been revised since then.

21 ADMIN. JUDGE WARDWELL: So isn't it taking
22 advantage of the full virgin strength of this
23 material if it's part of your -- or, I guess not, if
24 it was an allowable.

25 MR. GRIESBACH: Yes, this is Tim Griesbach

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1 for Entergy. You're right. The original Section 3
2 design process uses ASME minimum yield strength and
3 code allowables in evaluating the margins that are
4 intended to be there. What we've described
5 previously, those tensile strengths and yield
6 strengths may actually increase due to the irradiation
7 and aging process. That's not taken into account, you
8 still use the code required properties of the virgin
9 material when you do those analyses. They're still
10 valid, in fact.

11 ADMIN. JUDGE WARDWELL: But if you observed
12 a crack and now you're trying to evaluate where you go
13 from there, does this statement not apply to those
14 types of analyses that you may or may not perform as
15 part of your corrective measure for the observation of
16 that crack?

17 MR. AZEVEDO: Yes, this is Nelson Azevedo
18 for Entergy. The design process, the ASME Section 3
19 specifically that we're talking about right now, does
20 not allow cracks. So cracks are not allowed during
21 the design phase. If you find cracks, then you
22 evaluate them either under ASME Section 11, which is
23 the operating version of the code, or another NRC
24 approved methodology. But the original design that
25 we're talking about, stress calculations do not allow

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1 cracks.

2 ADMIN. JUDGE WARDWELL: Thank you, that's
3 helpful. Let's move now on to talk a little bit more
4 about these inspections. Yes, Dr. Lahey, would you
5 like to -- I hadn't gotten back to you after telling
6 you why I was getting back to you all the time.

7 DR. LAHEY: This is Richard Lahey again.
8 I think that was a great question because it really
9 captures a fundamental difference in our view, or my
10 view and the view that they have expressed. I'm
11 concerned with having degraded properties and the
12 ability if you have high enough strain to fail those
13 properties, those components in core. And I don't
14 believe it's adequate just to do a safety analysis
15 using ductile materials. I don't believe it's
16 adequate at all. That's the fundamental difference in
17 our view.

18 ADMIN. JUDGE WARDWELL: Okay. Thank you.

19 CHAIRMAN MCDADE: Excuse me. Judge
20 Wardwell, before we move on, I've got a question,
21 perhaps going back a little bit, that I need some
22 clarification on. Maybe a little bit off point, but
23 Dr. Lahey had raised an issue at Pages 45 and 46 of
24 his testimony, about issues at Davis Besse. And in
25 the response, in Answer Number 102, by Entergy, you

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1 indicated that -- dismissed it by saying, it does not
2 appear that conditions similar to those which led to
3 the degradation at Davis Besse are present at Indian
4 Point. But there isn't any explanation as to why the
5 conditions are different or how the conditions are
6 different. This is your Answer 102 on Page 59 of your
7 testimony. Anybody from Entergy can address what the
8 differences are between the conditions at Davis Besse
9 and Indian Point and why you believe the concern of
10 Dr. Lahey is unwarranted?

11 MR. AZEVEDO: Yes, this is Nelson Azevedo
12 for Entergy. The events at Davis Besse, I'm assuming
13 you're talking about the corrosion that the reactor
14 vessel had --

15 CHAIRMAN MCDADE: Yes.

16 MR. AZEVEDO: -- at Davis Besse.

17 CHAIRMAN MCDADE: And I realize that's
18 covered by a different AMP, but --

19 MR. AZEVEDO: Yes, so the events at Davis
20 Besse occurred because the reactor vessel had
21 penetrations, which are LI600, cracked and they were
22 undetected for a period of time. And that caused
23 leakage onto the reactor vessel head, which eventually
24 corroded the base metal itself. Indian Point does not
25 have this issue and one of the reasons is because we

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1 do inspections every outage. We inspect those
2 penetrations every outage and we have not found any
3 cracks to date. So we know there is no leakage going
4 on similar to what happened at Davis Besse.

5 MR. DOLANSKY: This is Bob Dolansky with
6 Entergy. Additionally, we not only inspect the
7 penetrations for cracking, but we also do what's
8 called a bare metal visual inspection on the top of
9 the head, on the outside surface of the head, where we
10 go around every penetration and look visually and make
11 sure that there's no evidence of any corrosion. So we
12 actually look for where cracking could start inside
13 the head and then we also verify by a bare metal
14 visual inspection that there is in fact no corrosion
15 going on like there was at Davis Besse.

16 CHAIRMAN MCDADADE: Okay. But, Dr. Lahey, am
17 I correct, what your concern was, was the mechanism
18 that caused the cracking as opposed to the failure of
19 inspecting?

20 DR. LAHEY: Well, I'm concerned about what
21 happens internally and what happens if it's a through-
22 crack. So it's heartening to hear that they do those
23 types of inspections. I think that's very
24 responsible. But there are some welds in the inside
25 that they can't do full inspection of and if they

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1 weaken for various degradation mechanisms, like stress
2 corrosion cracking or whatever happens, you can have
3 a concern, particularly for some of the stub tubes
4 associated with the control rod drives. So this is
5 one of the concerns that we had.

6 CHAIRMAN MCDADA: Okay, but are we
7 concerned about the mechanism that caused the
8 cracking? As I understand it, at Davis Besse, there
9 was an issue that many of these locations were either
10 inaccessible to inspection or very difficult to
11 inspect and that they didn't inspect and that's why
12 the problem was able to reach the level that it had.
13 Here, Entergy is indicating that they do have an
14 inspection program that identifies these potential
15 problems and are able to ensure that there has not
16 been cracking. What I'm concerned with is the
17 mechanism that would have caused the cracking in the
18 first place, not the ability to identify it, but the
19 mechanism that would cause the cracking. And would
20 there be any difference in the situation leading to
21 that mechanism between Davis Besse and Indian Point?

22 DR. LAHEY: Well, one of -- this is Dr.
23 Lahey again. One of the things in the conclusions in
24 the document that you asked about before, which was
25 authored by Dr. Busby, was that irradiated assisted

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1 stress corrosion cracking was still one of the
2 greatest concerns that we have. And in fact, EPRI had
3 put that out as a statement about a year before as
4 well. So it is an issue, I mean, that's the mechanism
5 as I understand it that's of most concern and since
6 you can't do full inspection inside, it remains a
7 concern.

8 CHAIRMAN MCDADE: Okay. When --

9 MR. STROSNIDER: This is Jack Strosnider
10 for Entergy, if I could just comment on this. First
11 of all, there could be differences in the
12 susceptibility to cracking based on who manufactured
13 the vessel head and the specific configuration. I
14 can't speak to that without a lot of details, but
15 there could be differences. But I think the important
16 thing to recognize is that GALL says that the
17 potential for cracking does exist and that's why these
18 inspections are done.

19 So, if you look at the overall framework,
20 the GALL report doesn't say you're not going to see
21 that kind of cracking, it says, it's a potential and
22 you need to go look for it and they're doing two
23 different types of inspections. And, by the way, at
24 Davis Besse, they had several outages of opportunity
25 to identify the problem that was occurring there, but

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1 the inspections weren't being done that needed to be
2 done.

3 CHAIRMAN MCDADE: And all I'm trying to
4 find out is just to make sure I understand, when you
5 use the term, does not appear to have conditions
6 similar, are we talking about only the fact that you
7 have an effective inspection program, and specifically
8 your reactor vessel head penetration inspection AMP,
9 that it is effective versus the one at Davis Besse?
10 Or is there something different about the reactor
11 itself where when you use the term conditions similar
12 which would result in cracking as opposed to just your
13 ability to identify it?

14 MR. AZEVEDO: Yes, sir. It's Nelson
15 Azevedo for Entergy. There are differences between
16 the way the reactor vessel heads were fabricated for
17 Davis Besse versus Indian Point. Davis Besse's
18 reactor vessel head was made by B&W. Our heads were
19 made by Combustion Engineering. So the process they
20 used to install the penetrations and the way they
21 strength the penetrations, the way the welding was
22 done, was different. Also, the materials were
23 different. They're both LI600, but the Davis Besse
24 materials were B&W tubular products, ours are
25 Huntington alloy materials.

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1 And if you look at the OE, at the
2 operating history for the leaks, essentially all the
3 leaks occurred in heads made by B&W. If you look at
4 Oconee, Davis Besse, most of the other leaks were by
5 B&W heads. Again, ours is different. So they're both
6 LI600, so they're both material susceptible, but I
7 feel that our material is much less susceptible than
8 the Davis Besse heads. Also, Oconee --

9 CHAIRMAN MCDADE: Excuse me. Why and is
10 there anything here relevant that carries over to the
11 reactor vessel internals, which we're focusing on?

12 MR. AZEVEDO: Yes, that's what it was going
13 to say. As far as the irradiation on the upper head,
14 there's no -- the fluence is very, very low, less than
15 one times ten to 17. And, no, I don't think there's
16 anything that carries over to the reactor vessel
17 internals.

18 CHAIRMAN MCDADE: Okay. Dr. Lahey?

19 DR. LAHEY: Yes, I misspoke, I should have
20 said primary water stress corrosion cracking. He's
21 absolutely correct.

22 CHAIRMAN MCDADE: Okay, thank you. Dr.
23 Wardwell?

24 ADMIN. JUDGE WARDWELL: Entergy's
25 testimony, 616, Answer 139, Page 86, states at Table

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1 5-2 of Attachment 2 to NL12-037, and that Attachment
2 2037 is the Inspection Plan, so this is Table 2 of the
3 Inspection Plan, specifies a required timing of the
4 first inspections and subsequent intervals for the
5 primary components in the reactor vessel internals
6 AMP. For most components, the first planned
7 inspection at Indian Point are scheduled for two
8 refueling outages from the beginning of the PEO, i.e.,
9 the Spring of 2016 for IP2 and the Spring of 2019 for
10 IP3.

11 You go on to state in Answer 142 of Page
12 92 that the NRC Staff, in a safety evaluation for MRP
13 227-A, acknowledged the justification for the timing
14 of the initial PEO and subsequent inspections and
15 found the inspection intervals acceptable, and
16 referencing the SE that Staff put out for MRP 227,
17 which I believe is Entergy's Exhibit 230. And I guess
18 I'll start with Entergy. What's your technical basis
19 for justifying not performing the first inspections
20 during the first refueling outage?

21 DR. LOTT: This is Randy Lott for Entergy.
22 As I think someone said earlier in the day, we did a
23 lot of evaluations for these components and we did not
24 identify any component where degradation, shall I say,
25 fell off the edge of the table. That it was a gradual

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1 process, it was a process that seemed to be
2 appropriately managed. We wanted to see that it was
3 integrated into -- that there were baseline conditions
4 set up within the program. And so we thought within
5 the first two years of PEO was appropriate.

6 It also gave a chance to coordinate some
7 of these examinations with the ASME Section 11
8 examinations, gave some flexibility to that schedule,
9 which I think is important to the implementation of
10 these exams. It's proven to be -- and we've already
11 done a number of baseline exams and I think we've
12 shown that our number of findings have been extremely
13 low and it seems an appropriate response.

14 ADMIN. JUDGE WARDWELL: But I guess I don't
15 understand the timing need. I mean, the application
16 was submitted in 2007, so they knew this was coming
17 up. Why did they need more time to get ready for the
18 first inspection besides the first refueling outage
19 after the PEO started?

20 MR. DOLANSKY: This is Bob Dolansky with
21 Entergy. To perform the MRP 227-A inspections, we'll
22 remove the component called the core barrel. We also
23 do that when we do the ten year ISI inspections. So
24 we wanted to do both of those together. And the ten
25 year ISI inspection, which inspects the reactor vessel

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1 itself, the welds that make up the reactor vessel,
2 that's required on a ten year frequency for ASME
3 Section 11. So the reason we're doing it during the
4 second outage of the PEO is to allow us to do both of
5 those together so we only have to remove the core
6 barrel one time.

7 ADMIN. JUDGE WARDWELL: NRC Staff, would
8 you like to comment on why you are convinced through
9 their justification that the second refueling outage
10 was adequate?

11 DR. HISER: This is Allen Hiser. The Staff
12 -- I think some of the bases relate to the
13 expectations of degradation and the desire to allow
14 for a higher likelihood that degradation would be
15 detectable. Some of the mechanisms, the analyses by
16 Westinghouse, it led to MRP 227, the degradation that
17 they -- the levels that they were using relate to 60
18 year fluences and things like that. At 40 years, the
19 fluences aren't to that level. So I think we just
20 thought that it was reasonable to delay the baseline
21 inspections into the PEO.

22 As Dr. Lott mentioned, plants have done
23 inspections so far, so far there have been very
24 limited, if any, indications of degradation identified
25 at all. So I think that reinforces -- if the

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1 inspections that had been done at other plants
2 indicated problems, then I think the NRC would have
3 likely pushed to accelerate the inspections at Indian
4 Point and similar plants.

5 ADMIN. JUDGE WARDWELL: Back to Entergy.
6 I believe your Table 5-2 and 5-3 of your Inspection
7 Plan shows inspection intervals of ten years for many
8 components. Were there any other shorter intervals
9 incorporated into your Inspection Plans beside the ten
10 year cycle that you can remember?

11 MR. DOLANSKY: No.

12 ADMIN. JUDGE WARDWELL: And what's the
13 justification for what seems like a pretty long
14 interval between inspections considering the
15 importance of which you're placing on these
16 inspections?

17 DR. LOTT: This is Randy Lott for Entergy.
18 Again, there were two issues. One was coordination of
19 schedules because we felt that, that was actually
20 important, it's a fairly difficult operation to remove
21 the core barrel and it's not something people want to
22 do lightly. And I have to point out that it was our
23 feeling that, particularly as an industry, a single
24 inspection gives us information about a wide variety,
25 for instance, the 800 baffle former bolts in the

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1 plant, there's factors of three and four in the
2 fluences, so we see lead components, we see a whole
3 range of fluences in a single inspection. As we
4 gather data, that gives us a much broader data base.

5 And I'll say that we looked at in
6 particular one of the components that had us most
7 concerned were the baffle former bolts themselves.
8 That, as Dr. Hiser has kind of alluded to here, that
9 drove a lot of our inspection schedule decisions. As
10 well, we found because of the assumptions in our
11 analysis and the way that the analysis was put
12 together that the rate of degradation of the baffle
13 former bolts was actually slower in the last part of
14 our irradiations and that it took at least, I think it
15 was 25 effective full power years of operation before
16 we had a reasonable number of predicted failures such
17 that we thought there would be actually something to
18 see. We have experience on baffle former bolt
19 inspections from the 1990s when things were done at
20 lower fluences and very little is seen in any of those
21 plants. So, again, we just felt that it gave us the
22 best opportunity to collect data and that we would get
23 a robust data base from the industry.

24 MR. STROSNIDER: This is Jack Strosnider
25 for Entergy. I'd also like to add to this and what

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1 was mentioned a minute ago that I think it's helpful
2 if you look at this from a fleet perspective. There's
3 a lot of plants doing these inspections at different
4 times and they have similar designs, similar
5 environments. So if something shows up in the
6 operating experience, in accordance with the Program
7 Element 8, Operating Experience portion, that's going
8 to be reviewed and evaluated and if it required a
9 change in the inspection frequency, then they could do
10 that. So there's a lot more data than is coming just
11 from the inspections at this point.

12 CHAIRMAN MCDADE: Okay. If I can clarify
13 in my own mind here, so the difference between the
14 initiation and propagation of a crack, do you have
15 sufficient data to determine, for example you inspect
16 today, tomorrow a crack is initiated, it's another ten
17 years before you inspect again. At the rate of
18 propagation of that crack, do you have data that would
19 indicate how long it would take after initiation for
20 a crack in the bolt to become problematic?

21 DR. LOTT: Well, again, our presumption in
22 the bolts was that any bolt that had a crack would
23 fail. So we basically did not do a calculation of
24 crack propagation in the bolts. We basically said, if
25 it's cracked, it's gone. We do have --

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1 CHAIRMAN MCDADE: Well, what I'm getting
2 at, Dr. Lott, is you do the inspection today, you
3 don't see any cracks in a baffle former bolt. You now
4 don't inspect it for another ten years. You don't
5 know when during that period of time a crack may
6 initiate. If it initiates nine years nine months
7 after the inspection, there's no reason to believe
8 there will be significant propagation by the time you
9 inspect the next time.

10 My question is, is there any way of
11 knowing, for example, if the crack initiates a day, a
12 week, a month after the inspection of whether it is
13 subject to failure within that ten year period before
14 it's inspected again? Is there data that would lead
15 you to believe that the propagation would be at a rate
16 slow enough that it would not be problematic prior to
17 the time of the next inspection? Do you understand
18 where my --

19 ADMIN. JUDGE WARDWELL: And if it helps
20 you, because this was my question I was going to ask,
21 don't relate it to the bolts, relate it to anything.
22 What's to say that a crack that is just ready to be
23 initiated when you inspected it, but hadn't occurred
24 yet, or at least wasn't large enough to be visible,
25 and the next day, it became visible, you don't inspect

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1 it now for ten more years, how do we know there won't
2 be some catastrophic type of result associated with
3 that crack over that ten year interval? What gives
4 you confidence that, that interval is sufficient
5 enough to still be within the range of it being able
6 to maintain its intended function?

7 DR. LOTT: I guess in response to that, I
8 would point out that in preparation for these
9 examinations, we're working with Entergy to develop
10 inspection acceptance criteria. Those inspection
11 acceptance criteria have built into them, again, how
12 large a crack would be allowable and that includes an
13 allowance for crack growth. So that would be starting
14 with a crack, that means there is an allowable size.
15 I would suggest to you that if a crack were to
16 initiate now, it would be less than that allowable
17 size because there's ten years of growth in the
18 acceptance criteria. So as long as --

19 ADMIN. JUDGE WARDWELL: But what is the
20 allowable size in your acceptance criteria? I thought
21 it as soon as a crack appears, you have to take some
22 -- that is --

23 DR. LOTT: Well, we need to --

24 ADMIN. JUDGE WARDWELL: -- that isn't an
25 acceptance criteria.

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1 DR. LOTT: Well, that would trigger an
2 engineering evaluation. What I'm talking about is the
3 engineering evaluation, the basis for the engineering
4 evaluation.

5 ADMIN. JUDGE WARDWELL: Yes, but the ten
6 years is passed, you're not doing that evaluation,
7 you're not doing anything on it, but the crack is
8 already there and off and running. And what's to lead
9 you to believe that it will maintain its intended
10 function for ten years as this crack propagates?

11 DR. LOTT: Well, again, within the
12 evaluation, we started with a finite crack length and
13 allowed it to grow ten years and showed at the end of
14 ten years it would still be acceptable. That's part
15 of the engineering evaluation.

16 ADMIN. JUDGE WARDWELL: And you know that
17 for all the RVIs that they will still be able to
18 maintain their function as a crack initiates, assuming
19 that the criteria for evaluating it occurs the day
20 after you inspect it, when you didn't see anything,
21 and you do nothing during that period, do you have
22 enough data to comfort yourself that it won't reach
23 some -- it will still be able to maintain its intended
24 function ten years later?

25 MR. DOLANSKY: I don't think -- this is Bob

1 Dolansky with Entergy. I don't think I can say right
2 now that I've reviewed and looked at that for every
3 component. I mean, I know that -- what Dr. Lott is
4 saying, Westinghouse is doing work for Entergy right
5 now coming up with acceptance criteria for the
6 inspection. I don't know for every single component
7 what that acceptance criteria is. I do remember for
8 some of the components where there is an acceptance
9 criteria, where there's an acceptable crack length,
10 that it says crack below this length are acceptable.
11 That means that they have done the calculation out to
12 ten more years before we would inspect it again and
13 determined that, that's acceptable. But I can't say
14 right now if -- I'd have to go back and -- I don't
15 think we have -- we don't have the final acceptance
16 criteria at this time. I'd have to go ask
17 Westinghouse if they've --

18 ADMIN. JUDGE WARDWELL: You've got
19 acceptance criteria in your AMP, don't you?

20 MR. DOLANSKY: The methodology and -- yes.
21 Acceptance criteria, but not the detailed plant
22 specific where we look at the plant specific loads,
23 the plant specific licensing basis, where they
24 actually did the engineering evaluation. You'd have
25 to ask --

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1 ADMIN. JUDGE WARDWELL: Well, we've got
2 more questions, we'll get into the acceptance criteria
3 in more detail a little bit later. But I guess I'd
4 like to turn to Staff in regards to, what did you
5 review that comforts you that you could accept this
6 program knowing that there's a potential for a crack
7 to occur the day after an inspection was finished and
8 it wouldn't be looked at again for ten more years that
9 it would still maintain its intended function?

10 DR. HISER: This is Allen Hiser with the
11 NRC. I was not involved in the specific review of MRP
12 227 and their program is based on 227. In general
13 though -- and there's nothing in the SCR that really
14 describes the basis for acceptability, the ten year
15 reinspection interval. In general, I think there's an
16 expectation that given the knowledge that we have of
17 crack growth rates and things like that, that a flaw
18 that could initiate the day after the inspection as
19 you mentioned, that it would not have sufficient time
20 to propagate to where it could cause a failure of that
21 piece, maybe not even the assembly, but of that
22 individual piece, before the next inspection.

23 ADMIN. JUDGE WARDWELL: And there's data to
24 support that or is that just based on, because that's
25 what we've doing all along?

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1 DR. HISER: I don't believe it was, that's
2 what we've been doing all along. I believe there was
3 more consideration to it. Fundamentally though, it
4 came, my guess is that it came down to engineering
5 judgment. There is nothing in the SCR that really
6 provides a roadmap to that, but I think given our
7 knowledge of crack growth rates, evaluations that have
8 been done for similar components, for example in BWR
9 internals, that, that was found to be a reasonable
10 reinspection interval to provide reasonable assurance
11 of the integrity of the RVI.

12 ADMIN. JUDGE WARDWELL: Some of these
13 inspections have been going on as part of your current
14 licensing basis, haven't these, for some of these
15 internals?

16 DR. HISER: That's correct.

17 ADMIN. JUDGE WARDWELL: And what's the
18 frequency for those?

19 DR. HISER: Those would be every ten years.

20 ADMIN. JUDGE WARDWELL: That's what I
21 thought. With the ten year interval, wouldn't it mean
22 that these inspections basically are going to occur
23 just once over the PEO?

24 DR. HISER: Well, they would occur twice.
25 One would be, say, at year 43 roughly and then at year

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1 53. So they would occur twice, every ten years during
2 the PEO.

3 ADMIN. JUDGE WARDWELL: Well, you've got a
4 20 year PEO period. That's going to be the end of the
5 --

6 DR. HISER: Right. So --

7 ADMIN. JUDGE WARDWELL: -- 53 is going to
8 be the end, you're going to shut down then. You're
9 going to inspect them as you shut down and tear it
10 down?

11 DR. HISER: Year 43 would be the first
12 inspection under this program. Year 53,
13 approximately, would be the second inspection. So it
14 would be two times during the PEO.

15 MR. DOLANSKY: This is Bob Dolansky with
16 Entergy. Just to clarify, the first inspection would
17 be within two outages of the beginning of the PEO.

18 ADMIN. JUDGE WARDWELL: Right.

19 MR. DOLANSKY: That's the first. And then
20 the second one --

21 ADMIN. JUDGE WARDWELL: Oh, that's what
22 you're -- I'm calling the first -- that's what I call
23 a baseline inspection. The first subsequent interval
24 inspection will occur --

25 MR. DOLANSKY: Ten years.

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1 ADMIN. JUDGE WARDWELL: -- 53 and then, so
2 you have only have one interval inspection is what I'm
3 saying beyond this baseline inspection.

4 MR. DOLANSKY: Okay. We count the baseline
5 as the first. We say that we're doing the MRP 227-A
6 exam in Spring of 2016 at Indian Point 2.

7 ADMIN. JUDGE WARDWELL: That's your
8 baseline, correct?

9 MR. DOLANSKY: Yes, but we --

10 ADMIN. JUDGE WARDWELL: Right.

11 MR. DOLANSKY: We treat that as our first
12 227-A exam.

13 ADMIN. JUDGE WARDWELL: Fine. Semantics
14 and that's -- I understand the difference between our
15 discussion. Okay.

16 CHAIRMAN MCDADE: Okay. And I understand
17 the, I think, genesis for the ten year period of the
18 difficulties and what is involved in the inspection.
19 And trying to become sanguine that the ten year
20 inspection is adequate. And I was using the term
21 crack propagation, Dr. Hiser, you used the term crack
22 growth rates. Where do you look to determine the
23 anticipated crack growth rates for these kinds of
24 materials? To satisfy you that a ten year period is
25 adequate?

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1 MR. POEHLER: This is Jeffrey Poehler of
2 the Staff. So MRP 227-A has guidance on crack growth
3 rates to be used for engineering evaluations and
4 that's in Chapter 6 of that report. Also, the
5 industry plans to use WCAP-17096, which is under
6 review by the Staff and we mentioned that yesterday.
7 But that provides methodologies for engineering
8 evaluations when degradation is found. And that
9 report gives guidance on which crack growth rates to
10 use. But they are referencing industry accepted crack
11 growth rates that have been developed for -- well, I
12 probably shouldn't say because it's proprietary at
13 this point.

14 CHAIRMAN MCDADE: Okay. But basically, as
15 I understand what you're saying, is that you look
16 right now to MRP 227, the crack growth rates that are
17 projected there. That your review suggests those are
18 valid and you're willing to rely on those crack growth
19 rates --

20 MR. POEHLER: Right.

21 CHAIRMAN MCDADE: -- and your review of the
22 validity of those crack growth rates in determining
23 that a ten year period is sufficient to ensure that
24 these reactor vessel internals will maintain their
25 intended function.

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1 MR. POEHLER: The Staff believes or it's
2 our opinion that the crack growth rates that they're
3 recommending would be conservative for pressurized
4 water reactors, given the --

5 CHAIRMAN MCDADE: Would be or are?

6 MR. POEHLER: Are.

7 CHAIRMAN MCDADE: Okay. Okay, Dr. Lahey,
8 do you have some input here with regard to crack
9 growth rates and MRP 227 and the validity of the ten
10 year period?

11 DR. LAHEY: Yes. Your honor, we have the
12 same concern as you expressed in your questions. Two
13 inputs that I would give to this discussion is there's
14 been publications which indicate the baffle former
15 bolts, when you do ultrasound inspections, you're
16 unable to detect up to or below 30 percent through-
17 crack. So that means you could already start out with
18 a significant weakened bolt at that point. And I want
19 to remind you that on top of all of this, this is an
20 inspection based program and I agree with the concerns
21 that you have raised, but on top of this, at any time
22 during this event, if you have some of these highly
23 degraded structures subject to shock loads, you can
24 fail them. That's the concern that I have. Because,
25 as you know, I'm focused, the bottom line is on the

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1 safety of the plant. And the safety of the plant
2 means to be me core coolability.

3 CHAIRMAN MCDADE: It means core --

4 DR. LAHEY: Coolability.

5 CHAIRMAN MCDADE: -- coolability?
6 Coolability, you're saying?

7 DR. LAHEY: Yes. Once you lose an intact
8 geometry, all bets are off as to core coolability.
9 And by far the most vulnerable reactor vessel
10 internals are these baffle bolts.

11 CHAIRMAN MCDADE: Which of course Entergy
12 and the Staff represent can have a 50 percent failure
13 rate without impacting the integrity.

14 DR. LAHEY: Well, my understanding of how
15 that conclusion was drawn was really based on the kind
16 of loads you get during steady state operation and the
17 redundancy to hold them in place. But during accident
18 loads, if you have significant loads, you can unzip
19 the rest of your bolts. That's what I'm worried
20 about.

21 CHAIRMAN MCDADE: Okay.

22 MR. STROSNIDER: This is Jack Strosnider
23 for Entergy. I just should comment that those bolting
24 patterns that were analyzed in the WCAP, and I don't
25 remember the exact number right now, that they're

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1 based on accident loads.

2 DR. HISER: This is Allen Hiser with the
3 Staff.

4 ADMIN. JUDGE WARDWELL: What was the --

5 DR. HISER: I can fill in. Entergy 654 and
6 655 are exhibits that are, at least in one case, is an
7 NRC approved report that looks at the bolting patterns
8 under accident loads.

9 ADMIN. JUDGE WARDWELL: Okay. Well, we'll
10 talk about baffle former bolts in more detail this
11 afternoon too. But before that, I do want to ask the
12 Staff in regards to what's their understanding of the
13 current acceptance criteria that's in the AMP as it
14 stands now?

15 DR. HISER: This is Allen Hiser with the
16 Staff. The acceptance criteria are provided in the
17 RVI Inspection Plan for Indian Point. I think there
18 maybe was some confusion with some of the discussion
19 earlier. The acceptance criteria that are under
20 development by Westinghouse would be an engineering
21 analysis option under corrective actions. So it's --
22 maybe if we say inspection acceptance criteria are in
23 the Inspection Plan and they are definitive.

24 ADMIN. JUDGE WARDWELL: And what do they
25 state there?

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1 DR. HISER: I think in general for
2 cracking, it's no cracking. Any identified cracking
3 is subject to corrective actions.

4 ADMIN. JUDGE WARDWELL: Thank you.

5 CHAIRMAN MCDADE: Okay. Let me -- Dr.
6 Hiser, mentioning that any identifiable cracks, we've
7 talked quite a bit over this morning and yesterday
8 about microcracks. The existence of microcracks that
9 could be present even during an inspection, but not
10 identified. Does the possibility of those microcracks
11 affect your consideration of this, of the frequency of
12 inspection?

13 DR. HISER: No, I don't believe so.
14 Because a microcrack would be subsumed under the
15 inspection -- or depending on the size of the
16 microcrack. I mean, microcracks, if they're below the
17 inspectability limit of the NDE method would not --
18 clearly you would not be able to detect those. And I
19 don't believe that microcracks would have a
20 significant impact on the integrity of the RVI
21 components, sort of as a starting point. So with the
22 analyses --

23 CHAIRMAN MCDADE: But isn't the microcrack
24 basically the crack initiation and then you have the
25 propagation. So the question is, being able to

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1 identify where you are on that spectrum at the time of
2 the inspection. The clearer picture you have, the
3 better way to follow it. Now, you made reference to
4 the crack growth rates in MRP 227, does that take into
5 consideration that at the time of the inspection there
6 may well be significant, and perhaps maybe not use the
7 word significant, but microcracks that are approaching
8 visibility, but not yet visible?

9 DR. HISER: Yes. This is Allen Hiser of
10 the Staff. When the report was reviewed for
11 acceptability, my expectation is that the
12 consideration was along the lines of what kinds of
13 flaws could be missed by the inspection given the
14 knowledge that we have of crack growth rates. Was it
15 likely that there would be a challenge to
16 functionality at the end of the ten year reinspection
17 interval? Based on that analysis, be it -- and my
18 guess is this may have been an engineering judgment
19 based that there was not thought to be a significant
20 concern. There was reasonable assurance that the RVI
21 would still maintain their functionality.

22 CHAIRMAN MCDADE: Okay. Thank you, Dr.
23 Hiser.

24 ADMIN. JUDGE WARDWELL: Entergy's
25 testimony, 616, Answer 209, Page 140. The results of

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1 the IPEC inspections will be available to the NRC
2 Staff for onsite inspection. Are these results also
3 publically available?

4 MR. DOLANSKY: This is Bob Dolansky for
5 Entergy. These inspection results are put into a
6 report and supplied to EPRI for the whole industry and
7 EPRI rolls that up. I don't know if that's publically
8 available. I don't think it's publically available,
9 but it's available to the industry for sure.

10 ADMIN. JUDGE WARDWELL: So publically it's
11 not available?

12 MR. DOLANSKY: I don't believe so.

13 ADMIN. JUDGE WARDWELL: Okay, thank you.

14 MR. POEHLER: And, your honor, I would just
15 like to add to that. And that report is also
16 submitted to the NRC Staff for our information. So,
17 that's in the MRP 227 implementing process that they
18 will do that. So we will get a chance to review what
19 the operating experience has been and if there's been
20 any trends in failures, then we'll know about it.

21 ADMIN. JUDGE WARDWELL: And is that
22 available to the public or is it considered
23 proprietary information?

24 MR. POEHLER: I don't know the answer to
25 that offhand, I can check.

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1 ADMIN. JUDGE WARDWELL: Do that, would you
2 please? And I think now would be a good time to take
3 a break.

4 CHAIRMAN MCDADE: Okay. Would anybody need
5 more than ten minutes? Okay, it's now -- why don't we
6 come back at 10:40.

7 (Whereupon, the above-entitled matter went
8 off the record at 10:26 a.m. and resumed at 10:44
9 a.m.)

10 CHAIRMAN MCDADE: We're back on the record.

11 ADMIN. JUDGE WARDWELL: Let's turn to some
12 inspection actions now. NRC's Exhibit 197, testimony,
13 Answer 80, Page 51, says inspection techniques include
14 ultrasonic UT testing, EVT1 enhanced visual
15 examinations, and VT3 visual examinations. And so,
16 considering it's NRC's testimony I'm referring to,
17 I'll let them answer. Could you explain each type of
18 test and its applicability for the various reactor
19 vessel internals?

20 MR. POEHLER: Okay. This is Jeffrey
21 Poehler of the Staff. So, just to clarify the
22 question, you want us to explain the applicability of
23 each type of inspection technique?

24 ADMIN. JUDGE WARDWELL: I want you to
25 explain what's a UT test, what's an EVT1 test, and

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1 what's the VT3 test.

2 MRP: So UT test is an ultrasonic
3 examination. And it's basically using sound to detect
4 cracks in a material. Do you want a detailed
5 explanation or --

6 ADMIN. JUDGE WARDWELL: How do they show
7 up? How does a crack show up? So, you put an --

8 MR. POEHLER: So you have a transducer that
9 generates ultrasonic sound. It has to be in contact
10 with the material and it puts sound into the material
11 and you get echos back from the material basically
12 that are detected by either the same transducer or a
13 separate transducer. And those are processed
14 electronically such that you get a signal. So if you
15 have a discontinuity, like let's say in a bolt, you
16 have a partially cracked bolt, that's going to reflect
17 the sound back and be detected and it'll be processed
18 by the electronics such that you can determine the
19 location of that discontinuity.

20 And with certain ultrasonic techniques,
21 you can create images, you can image the
22 discontinuity. So ultrasonic is used throughout the
23 nuclear industry for piping weld exams to detect
24 cracking and also in vessels, in large structural
25 welds. So it's a very established technique for welds

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1 and it's also for bolting, such as baffle former
2 bolts, that's been used -- it was first used back in
3 the 1990s when baffle former bolt cracking was first
4 detected.

5 ADMIN. JUDGE WARDWELL: So that's a type of
6 test that's used for the baffle former bolts?

7 MR. POEHLER: It's a pretty well
8 established technique for bolts.

9 ADMIN. JUDGE WARDWELL: So is it used for
10 the clevis bolts that we'll talk about later also?

11 MR. POEHLER: It is not specified for the
12 clevis bolts at this time. It could be, but it's not
13 --

14 ADMIN. JUDGE WARDWELL: Okay.

15 MR. POEHLER: -- has been determined not to
16 be necessary.

17 ADMIN. JUDGE WARDWELL: So is the baffle
18 former bolts the only one it's used for in regards to
19 reactor vessel internals?

20 MR. POEHLER: The only component in a
21 Westinghouse design reactor internals that it's
22 currently used for is the baffle former bolts.

23 ADMIN. JUDGE WARDWELL: Okay.

24 MR. POEHLER: You also asked about visual
25 examination.

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1 ADMIN. JUDGE WARDWELL: How about the
2 enhanced visual examination, EVT1, what is that
3 composed of?

4 MR. POEHLER: Well, so enhanced --

5 ADMIN. JUDGE WARDWELL: Well, let me ask
6 one other question about the UT. So is this a sensor
7 that you put in at the time you do the inspection or
8 are these permanently mounted so you can turn it on?
9 Or how are the mechanics of this, the logistics of
10 this achieved?

11 MR. POEHLER: Right, it's a sensor that has
12 to be put in. It's put in for the time of the
13 inspection and there's special tooling to access the
14 bolting. And so it's not permanent.

15 ADMIN. JUDGE WARDWELL: Okay, thank you.

16 CHAIRMAN MCDADE: What percentage of the
17 baffle former bolts are accessible to the UT
18 inspection?

19 MR. POEHLER: For the UT inspection,
20 essentially 100 percent of them are accessible. There
21 are minimum coverage requirements in MRP 227-A, so you
22 can credit 100 percent -- you can take credit for an
23 examination if you exam 75 percent of a population in
24 general. And that would include both the accessible
25 and inaccessible members of the population. But, to

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1 my knowledge, I don't think there are any major
2 obstructions that would prevent you from accessing all
3 the baffle former bolts.

4 CHAIRMAN MCDADE: To Entergy, are 100
5 percent of the baffle former bolts accessible to the
6 ultrasound inspection?

7 MR. DOLANSKY: Yes. This is Bob Dolansky
8 with Entergy. We believe 100 percent will be
9 accessible. We won't know for sure until we actually
10 get out there and do the exam, but based on all of our
11 drawing reviews and so forth, we expect to get 100
12 percent of all the bolts and we expect, there's 832 of
13 them, we expect all 832 to be accessible.

14 CHAIRMAN MCDADE: So unless somebody
15 changed the design since you last looked at it?

16 MR. DOLANSKY: Well, there could -- in
17 theory, there could be -- let me give a little bit of
18 background. The technique to perform this inspection
19 is a submarine that goes down underwater, it's done
20 underwater. It basically docks up against the baffle
21 plate and there's a special head that goes in and
22 inspects the bolt. So although all the bolts should
23 be accessible, we're not 100 percent sure we can reach
24 every one with this tooling technique. So that's why
25 there's a possibility that we wouldn't get every one.

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1 But other Westinghouse plants have got 100 percent, we
2 expect to get 100 percent, but there could be some
3 interference that would limit us, but only a very
4 small number.

5 CHAIRMAN MCDADE: Okay. Thank you.

6 ADMIN. JUDGE WARDWELL: Enhanced visual
7 examinations?

8 MR. POEHLER: Yes. This is Jeffery Poehler
9 of the Staff. So enhanced visual examinations are
10 specified for examining welds for cracking. Or
11 anytime you're looking for cracking specifically in
12 MRP 227-A. For example, the core valve girth welds in
13 a Westinghouse design, reactor internals, you use
14 enhanced visual testing. And that's a visual
15 examination that has a fairly stringent detection or
16 resolution requirement. So you have to be able to --
17 the way that they test this in situ is that they have
18 to be able to identify a character, like a letter,
19 letter C or A or O, and they have to identify that
20 letter and the letter has a 0.04 inch size on the
21 card. So it's a pretty small letter. So that's how
22 they determine the resolution is adequate in the
23 environment that you're going to do the testing.

24 ADMIN. JUDGE WARDWELL: And what's this
25 card?

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1 MR. POEHLER: It's like a plaque --

2 ADMIN. JUDGE WARDWELL: A plaque, a little
3 plaque?

4 MR. POEHLER: Yes, it's a --

5 ADMIN. JUDGE WARDWELL: Okay.

6 MR. POEHLER: It's something that -- yes.

7 ADMIN. JUDGE WARDWELL: Is it on each
8 internal or is it just a test plaque for you to start
9 off to verify that you've got enhanced --

10 MR. POEHLER: It's just a test plaque. You
11 could -- analogous to calibration standard.

12 ADMIN. JUDGE WARDWELL: Calibration coupon
13 --

14 MR. POEHLER: Right.

15 ADMIN. JUDGE WARDWELL: -- shall we say?

16 MR. POEHLER: Right. And so then you have
17 to -- so that's basically how that's qualified. And
18 you would do that before you start the examination.

19 ADMIN. JUDGE WARDWELL: This is a camera
20 that you put --

21 MR. POEHLER: Yes, remote --

22 ADMIN. JUDGE WARDWELL: -- in there, it's
23 not someone's eyeball that you're calibrating.

24 MR. POEHLER: I think they used to -- the
25 submarine type delivery system, or I think for the

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1 core valve girth weld, they have special tooling to go
2 up under the thermal shield to deliver the camera. So
3 those are used for when you're specifically looking
4 for cracks such as stress corrosion cracks, IASCC,
5 irradiation assisted stress corrosion cracks, in welds
6 or other components. Other than bolting, it would not
7 be used for bolting because of the location. Where
8 the cracks are would be at the head, the shank area in
9 the bolt, which you're not going to be able to look at
10 side-on. So that's why ultrasonic is used for those
11 bolts. So you also asked about --

12 ADMIN. JUDGE WARDWELL: VT3, visual
13 examination.

14 MR. POEHLER: So VT3 is another visual
15 examination technique. The main difference between
16 VT3 and EVT1 is that it is -- VT3 has a slightly lower
17 resolution requirement and it's used for general
18 mechanical and structural conditions. So you're
19 looking for gross failure, like broken components,
20 broken bolts, and other distortion in structures such
21 as it's used for the baffle former assembly to look
22 for effects of void swelling. But the VT3 visual is
23 only specified in MRP 227-A when it's for either a
24 redundant population of components or components that
25 have been changed to be highly flaw tolerant, such

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1 that they could tolerate cracks. So that's VT3.

2 ADMIN. JUDGE WARDWELL: And VT3 implies
3 there's a VT1 and a VT2 and where did they go and are
4 they ever used at Indian Point?

5 MR. POEHLER: Yes. VT1 is not used for,
6 and Entergy may correct me, but I don't believe it's
7 used for any of the Westinghouse RVI exams. But in
8 some other designs it's used for looking for gaps.
9 But VT1 is also a more -- would have a higher
10 resolution requirement than a VT3. But it's an
11 examination that's called out in ASME code, so it's
12 defined in there. But it's not used very much for the
13 internals. And VT2 is another type of visual
14 examination where you specifically look for leakage of
15 pressure boundary components. So that's not
16 applicable and they don't use that for reactor
17 internals.

18 ADMIN. JUDGE WARDWELL: In New York State's
19 testimony on 482 at 62, lines 3 through 8, Dr. Lahey
20 criticizes the use of VT3 in visual inspections as
21 inadequate for use in inspections for cracking,
22 stating that there are significant shortcomings of
23 this technique to detect material cracking,
24 degradation, or wear prior to failure, as illustrated
25 by the visual detection of only seven out of 29

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1 fractured clevis insert bolts at the Westinghouse PWR
2 in 2010. Why I don't I turn to -- well, I'll stay
3 with you. So, why do we have any confidence in VT3
4 for any components and what components beside the
5 clevis bolts is this technique used and what's it's
6 track record for the other components?

7 MR. POEHLER: Well, for example, it's used
8 for the baffle former assembly, for the general
9 examination for the assembly for distortion due to
10 void swelling. So that wouldn't be something you
11 would use -- it's the most appropriate for looking for
12 that type of aging deformation.

13 CHAIRMAN MCDADE: Okay. Well, let me jump
14 in here a second and to Entergy, in your Exhibit 616
15 at Page 87, your Table 1, you list the various items
16 to be inspected and how you're going to be inspecting
17 them. Is there any difference in the, for lack of a
18 better phrase, degree of difficulty in the EVT1 and
19 the VT3? I mean, it appears that the EVT1 gives you
20 greater resolution, more information. Is there any
21 reason why you use the VT3 for certain items, like
22 baffle edge bolts, as opposed to the EVT1?

23 MR. DOLANSKY: This is Bob Dolansky with
24 Entergy. An EVT1 is looking for cracking. A VT3 is
25 not looking for cracking. So, for example, the baffle

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1 edge bolts, if the cracking is down in the bolt, a
2 visual inspection is not going to see it. So if you
3 do an EVT1 on the baffle edge bolts, it's not going to
4 give you any more information than a VT3 would and it
5 is in fact a more difficult exam to do because you
6 have -- the character requirements are more stringent
7 and --

8 CHAIRMAN MCDADE: I'm sorry, I just didn't
9 hear. The what requirements?

10 MR. DOLANSKY: The character card
11 requirements are more stringent and you have to
12 inspect at a certain speed. You typically use video
13 enhancement to do that inspection. So, for the baffle
14 edge bolts, since you can't see the area where they
15 would be cracking anyway, an EVT1 doesn't buy you
16 anything. What a VT3 tells you about baffle edge
17 bolts is that if you look at all the edge bolts, if
18 you saw that there was -- the two plates where they go
19 together are shifted or moved, a VT3 is very good for
20 that. You're not --

21 ADMIN. JUDGE WARDWELL: But I thought you
22 used the UT for baffle bolts.

23 MR. DOLANSKY: For baffle former bolts, a
24 UT is used.

25 ADMIN. JUDGE WARDWELL: Yes.

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1 MR. DOLANSKY: But a baffle edge bolt --

2 ADMIN. JUDGE WARDWELL: Oh, okay, sorry.

3 MR. DOLANSKY: -- it's not.

4 ADMIN. JUDGE WARDWELL: Sorry.

5 MR. DOLANSKY: A VT3 is used for the baffle
6 edge bolts. Did that answer your questions, your
7 honor --

8 ADMIN. JUDGE WARDWELL: Yes.

9 MR. DOLANSKY: -- about the differences?

10 MR. AZEVEDO: Your honor, this is Nelson
11 Azevedo. Maybe I can add a little bit to that. A VT1
12 is done up close. So, for example, if you're looking
13 for deformation of a component, see if a component is
14 bent, if you're up real close to a component, you may
15 not be able to see if the component is bent. So you
16 actually, if you step back, you can be further from
17 the component, in a lot of cases, you actually get a
18 better assessment of what the component is
19 experiencing rather than be within a couple inches of
20 the component. So that's another reason why sometimes
21 VT3 are used versus VT1.

22 CHAIRMAN MCDADE: Sort of why I take my
23 glasses off to thread a needle?

24 MR. AZEVEDO: If that's the example you
25 want to use.

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1 CHAIRMAN MCDADE: Do you thread needles?

2 (Laughter.)

3 MR. AZEVEDO: Occasionally.

4 CHAIRMAN MCDADE: Sorry. Staff, do you
5 thread needles?

6 (Laughter.)

7 ADMIN. JUDGE WARDWELL: Back to the clevis
8 insert bolts, and I'll direct this to, I guess I'll
9 stay with Entergy, it doesn't seem like the seven out
10 of 29 fractured clevis insert bolts that were detected
11 by this process is a very high percentage of success.
12 Well, let me rephrase that, you look confused. New
13 York State claimed that only seven out of 29 fractured
14 clevis insert bolts were detected in 2010 at a
15 Westinghouse PWR. Are you aware of that and, if so,
16 why is VT3 a successful inspection technique for seven
17 out of 29?

18 MR. DOLANSKY: This is Bob Dolansky with
19 Entergy. We definitely were aware of that. There was
20 a Technical Bulletin that was issued as a result of
21 the clevis insert bolting. I would say that the VT3
22 is what initially found it at the other plant. I
23 think it was sufficient, they did find it, they didn't
24 find every one, but it showed them that there was
25 something going on and then they did additional exams

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1 to determine that. To me, with the clevis insert
2 bolts, and Dr. Lott can step in and help me with this,
3 but the clevis insert bolts don't have any safety
4 function. So there's no -- the fact that they cracked
5 and that they detected that with VT3 shows that, as
6 part of the Section 11 program, shows that, that is in
7 fact working in my estimation. Do you want to add
8 anything about that?

9 DR. LOTT: I don't think we ever believed
10 or contended that the clevis insert bolts, the VT3
11 inspection would identify failed clevis insert bolts.
12 What we were worried about, as Mr. Dolansky said, was
13 that the location and the securing of the clevis in
14 the log on the reactor pressure vessel -- and the
15 Technical Bulletin that he referred to, which is
16 Westinghouse Technical Bulletin 14-5, is ENT Exhibit
17 656, just for the record.

18 And we looked very closely at the clevis
19 insert bolts in that case and made additional
20 recommendations about inspections that would help us
21 determine what we thought was the key feature, which
22 was the clevis being still in place. Once the reactor
23 is loaded, the lower core plate is in, the clevis is
24 effectively locked in place and the safety function of
25 the clevis, as long as it's there when you start up,

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1 there's no place for it to go when you're basically
2 running the reactor. We can go through this in more
3 detail if you want to, but we'd probably have to pull
4 up some of the diagrams.

5 ADMIN. JUDGE WARDWELL: Yes. I think I at
6 least have the picture of that. How did you determine
7 that eventually there was 29 -- or how did
8 Westinghouse determine that there were 29 fractured
9 bolts, not just the seven that were detected by the
10 VT3?

11 DR. LOTT: Well, Westinghouse's involvement
12 in this program, we had advised the utility that, when
13 they observed the first, or you told me the number
14 seven, broken bolts, advised them that they should
15 think about replacing the bolts, not because of a
16 safety concern, but our concern was that if that were
17 to become dislodged in the refueling cycle, it would
18 be extremely expensive and difficult to put it back in
19 place, it's a precision fit part. So therefore --

20 ADMIN. JUDGE WARDWELL: This is the clevis
21 itself, the insert itself?

22 DR. LOTT: The clevis itself. The clevis
23 insert is specifically machined to match the keys in
24 the core barrel.

25 ADMIN. JUDGE WARDWELL: And if I understand

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1 it correctly, these bolts merely hold that in place
2 until that superstructure or whatever you call it, the
3 --

4 DR. LOTT: The core barrel.

5 ADMIN. JUDGE WARDWELL: -- the core barrel
6 coming in and --

7 DR. LOTT: Yes, once the core barrel is
8 engaged --

9 ADMIN. JUDGE WARDWELL: -- resting on that,
10 which --

11 DR. LOTT: -- in the key, it's effectively
12 restrained by multiple factors that we can go into if
13 you want to. And so, therefore, we determined it
14 wasn't a safety concern, but that it might be in the
15 best interest of the utility to replace those bolts
16 because if it were to come loose, it would be
17 incredibly difficult to replace.

18 ADMIN. JUDGE WARDWELL: Are either the --
19 any of these bolts, whether it's the clevis or the
20 baffle edge or the baffle former bolts, if they fail,
21 do they become dislodged and have a potential to
22 impact the geometry, if you will, and the coolability
23 of the core itself? Or a function of any of the other
24 vessel internals?

25 DR. LOTT: Well, one of the things and one

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1 of the advantages of the VT3 examination is that it
2 allows you to determine whether the lock bars, which
3 hold the heads of all the bolts in place, lock bars
4 that are locked across the heads, are in place. And
5 as long as those lock bars are in place, there's no
6 way for the bolt to escape. In particular, the clevis
7 insert bolts are, again, geometrically constrained.
8 Once they're in place, there's no way for that head to
9 escape from this very small tight dimensions of the
10 object.

11 ADMIN. JUDGE WARDWELL: Well, couldn't the
12 bolt itself crack and fall away from the head and go
13 down below?

14 DR. LOTT: Well, it's threaded in and it
15 can't -- there's nowhere for it to go except for out
16 past the head.

17 ADMIN. JUDGE WARDWELL: Okay, thank you.
18 While we're on it, Dr. Lahey, would you agree with the
19 statements that were made in regards to the clevis
20 bolt inserts and do you have comments about the seven
21 out of 29?

22 DR. LAHEY: Well, our concern was it was
23 not a very effective non-destructive testing technique
24 and the accuracy of it wasn't very effective. I'm not
25 very concerned about the safety aspects of the clevis

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1 bolts, but the technique itself had some deficiencies.

2 ADMIN. JUDGE WARDWELL: Thank you.

3 CHAIRMAN MCDADE: Okay. If I could, just
4 to clarify. We've talked about these clevis bolts and
5 not having a safety consideration. If you could
6 elaborate for me, as I understand from that, Dr. Lott,
7 you referred to the Westinghouse Technical Bulletin,
8 which was Entergy Exhibit 656, and it talks about
9 maintenance risk due to the complexity and cost of
10 repair and the required level of contingency planning.
11 That inability to remove the core barrel or need to
12 replace the insert to reestablish customized design
13 gaps. Could you explain to me, what really --
14 elaborate a bit on the implications of a failure of
15 these clevis bolts?

16 DR. LOTT: Sure. The clevis inserts
17 themselves are actually, they're positioned -- they
18 locate these keys and they're relatively high
19 tolerance components, such that if it -- when the
20 reactor is actually built, they're precision machined
21 to match. And then they're shrunk fit into the lugs
22 in the component, so they're frozen, put in -- so
23 they're a tight fit. That's one of the reason they
24 don't come out is because they're shrunk fit in place.
25 And in order to do that, to repeat that hand operation

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1 in the plant and relocate it into the exact location
2 where it was in the first place if the bolts were to
3 come loose and you wanted to even put the same one
4 back in, much less replacement, is a very difficult
5 job. So if we were to lose it, it would be hard to
6 replace. Is that --

7 MR. DOLANSKY: Dr. Lott, can I just add
8 something?

9 CHAIRMAN MCDADE: Hard to or impossible and
10 then --

11 DR. LOTT: I don't think I would say
12 impossible to replace, but, again, this was a
13 maintenance concern, not a safety concern. So it was
14 really a matter of what did it make sense for the
15 utility to do at that point?

16 MR. DOLANSKY: This is Bob Dolansky with
17 Entergy. Just to try to clarify a little bit, when
18 you refuel the reactor vessel, basically you do
19 everything remotely, so you're not unbolting things.
20 Basically, everything slides together and slides
21 apart. So when you're removing the core barrel, the
22 clevis insert basically is like a key and there's a
23 key on the core barrel that just slides in there.
24 Once it's in there, there's no safety function, it has
25 no safety function.

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1 But if I as the owner am planning to
2 refuel the reactor vessel and remove the core barrel
3 and that clevis insert moves, then I cannot get that
4 back in. That's very expensive for me to then try to
5 get that fixed, just so I can get it back in, it has
6 no safety function, but just to be able to put it back
7 together. So that's why it's a commercial issue and
8 not a safety issue. And that's why what Dr. Lott is
9 saying is, if three out of six bolts or four out of
10 six bolts failed, but two are still holding it, I can
11 get those four that are failed out and put new ones in
12 without that thing shifting. Once it shifts, to try
13 to get it lined up exactly again, underwater, would be
14 very, very difficult. It could be done, absolutely
15 could be done and would be done, but it just would be
16 much more difficult. So for us, it makes much more
17 sense to try to get those things replaced before it
18 causes us a commercial issue. Does that help?

19 CHAIRMAN MCDADE: Yes. So basically what
20 you're saying is, it's not an inability to remove the
21 core barrel, it just makes it a much -- the degree of
22 difficulty increases significantly?

23 MR. DOLANSKY: Getting it out or putting it
24 back together. Putting it back together, if it's
25 cocked, it wouldn't slide, it's a very close machine

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1 tolerance. The core barrel may not slide back into
2 the key if it were totally -- if it had moved.

3 CHAIRMAN MCDADE: Okay. Thank you.

4 ADMIN. JUDGE WARDWELL: Entergy's
5 testimony, 616, Answer 188, Page 124, states that the
6 basis for the adequacy of these inspection techniques
7 is described in the companion document to MRP 227-A,
8 which is MRP 228. This document describes the
9 standards to be met by each specific examination
10 method. The standards in MRP 228 reflect the latest
11 information and regulatory documents, such as
12 NUREG/CR-6943, which addresses visual examinations,
13 including remote visual examinations, and describes
14 the characteristics of flaws to be detected in nuclear
15 reactor components. In particular, such critical
16 characteristics as the crack opening displacement.
17 And I guess I just want to verify, is 228 an exhibit
18 in this proceeding, Entergy, as far as you know?

19 DR. LOTT: I believe it is.

20 MR. DOLANSKY: I believe it is.

21 ADMIN. JUDGE WARDWELL: Okay, thank you.

22 MR. KUYLER: Your honor? MRP 228 is
23 Exhibit Entergy 645.

24 ADMIN. JUDGE WARDWELL: Thank you. I guess
25 I'll ask Dr. Lahey, have you provided any evidence

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1 challenging these details on the basis for the
2 development of Entergy's Inspection Plan or that
3 Entergy's Inspection Plan does not meet all the
4 requirements of MRP 227?

5 DR. LAHEY: Are you talking about other
6 than the inability to detect the clevis bolts?

7 ADMIN. JUDGE WARDWELL: Right. Just --

8 DR. LAHEY: I would have to look back, I
9 don't know off hand.

10 ADMIN. JUDGE WARDWELL: Okay. Thank you.

11 CHAIRMAN MCDADE: Excuse me one second, and
12 perhaps I just got confused. Did you say, MRP 227?

13 ADMIN. JUDGE WARDWELL: Yes.

14 CHAIRMAN MCDADE: Okay. Because 645 is
15 EPRI 228.

16 ADMIN. JUDGE WARDWELL: Right. That was my
17 first question.

18 CHAIRMAN MCDADE: Thank you. I'm just --
19 thank you.

20 ADMIN. JUDGE WARDWELL: Okay. We switched
21 MRPs on you. NRC 197, testimony, Answer 183, Page
22 105, states that we disagree with Mr. Lahey's concern
23 regarding synergistic effects because, one, primary
24 components are to be inspected under Entergy's program
25 are those components which are most likely to be

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1 effected by synergistic effects, if they exist. Two,
2 that Entergy's AMP inspects for and will detect
3 cracking whether a single aging mechanism or multiple
4 or synergistic aging mechanisms contribute to
5 cracking.

6 Three, embrittlement alone will not cause
7 failure without the presence of a crack and the
8 inspections performed by Entergy's AMP are sufficient
9 to detect cracking. Four, Dr. Lahey has not
10 identified any tests or operating experience which
11 demonstrates that synergistic effects are significant
12 for PWR RVIs and existing laboratory test data on
13 synergistic effects is inconclusive. And, five, the
14 industry reactor vessels internal program in which
15 Entergy is participating is a living program which
16 shares operating experience among all PWR licensees
17 and, thus, any occurrence of an unexplained or
18 accelerated degradation due to synergistic effects
19 will be identified and adjustments to the industry
20 guidance and the Entergy AMP will be made to ensure
21 continued integrity of the RVI across the fleet.

22 I think with this statement, I'd like to
23 start off fixing one other point again. And this is
24 this statement that embrittlement will not occur
25 without a crack. And I'll address this to Entergy.

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1 Does this statement mean that embrittlement won't have
2 any affect until cracking is caused by some other
3 mechanism or is this a statement that says that
4 embrittlement won't alone cause failure without a
5 crack? Meaning that embrittlement can cause a crack,
6 but it won't result in failure unless there is a crack
7 demonstrated from the embrittlement?

8 DR. LOTT: This is Randy Lott for Entergy.
9 The statement, I believe, is saying that if a material
10 is embrittled, that fact alone will not result in the
11 failure of the component, it needs to be combined with
12 a crack and a load that would challenge the stability
13 of the component.

14 ADMIN. JUDGE WARDWELL: With embrittlement,
15 can embrittlement eventually cause a crack in and of
16 itself?

17 DR. LOTT: No. It's not identified as one
18 of the crack causing mechanisms in the component.

19 ADMIN. JUDGE WARDWELL: What is the effect
20 of embrittlement then?

21 DR. LOTT: What is the effect? The change
22 in the -- for me, the discussion of embrittlement is
23 a discussion of the change in properties that happen
24 when the material is irradiated. And we've listed
25 them several times before, it's the increase in yield

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1 stress, the decrease in ductility, the decrease in
2 fracture toughness, those combined effects.

3 ADMIN. JUDGE WARDWELL: Is the resulting
4 effect?

5 DR. LOTT: Those are -- yes. If I had a
6 test specimen, those are measurable, objective things
7 I could measure.

8 ADMIN. JUDGE WARDWELL: So regardless --

9 DR. LOTT: I can't do that test non-
10 destructively.

11 ADMIN. JUDGE WARDWELL: So regardless of
12 how long or how much fluence there is at a location,
13 a piece of metal there will not exhibit a crack due to
14 just embrittlement causes? Let's say you have a test
15 coupon and --

16 DR. LOTT: If I had a test coupon and I
17 were to just -- we certainly irradiated lots of
18 specimens to the fluences that we've talked about
19 lots. We've irradiated specimens to the fluences that
20 we've talked about here, the 60, 70 dpa, and they do
21 not just spontaneously crack.

22 ADMIN. JUDGE WARDWELL: Okay.

23 DR. HISER: And, your honor, this is Allen
24 Hiser of the Staff. I just want to make sure, the
25 Staff did not imply that embrittlement can cause

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1 cracking. The statement that you read just says
2 embrittlement cannot cause failure unless there is a
3 crack.

4 ADMIN. JUDGE WARDWELL: Correct.

5 DR. HISER: So the Staff did not imply
6 embrittlement causes cracks.

7 ADMIN. JUDGE WARDWELL: Right.

8 DR. HISER: Okay. Just to make sure.

9 ADMIN. JUDGE WARDWELL: Yes. I didn't mean
10 to imply that you implied that.

11 DR. HISER: Okay.

12 CHAIRMAN MCDADE: Okay. And --

13 DR. HISER: Maybe I inferred that from you.

14 CHAIRMAN MCDADE: And either Dr. Hiser or
15 Dr. Lahey, let me -- and, again, I want to make sure
16 I understand this before we go off to try to make a
17 decision here. Embrittlement is a mechanism, an
18 effect of embrittlement is a decrease in ductility.
19 And it's Dr. Lahey's position that, that decrease in
20 ductility makes the item more susceptible to cracking.
21 Dr. Lahey, is that correct?

22 DR. LAHEY: The effect of embrittlement is
23 -- I mean, fundamentally, the difference is no crack
24 no problem. I mean, there are people who believe no
25 crack no problem, to me that was the quotable quote

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1 from yesterday. I don't believe that. I believe with
2 or without a crack, if you have an embrittled
3 structure and you hit it with a significant impulsive
4 load, you can fail the structure. And that's the
5 concern.

6 CHAIRMAN MCDADE: But that's -- again, the
7 concept there is the ductility has decreased because
8 of the embrittlement and because of that decrease in
9 ductility, the item is more susceptible to cracking
10 under stress with a load?

11 DR. LAHEY: Well, the fracture toughness,
12 how the material can retard crack growth, is
13 decreased. So cracks can grow faster if it's
14 embrittled. So we don't disagree on that. What we
15 disagree on is, do you need a surface crack or not?
16 Is the material weakened or subject to failure if it's
17 embrittled? That's really the crux of it. One thing
18 that --

19 CHAIRMAN MCDADE: Also, and again maybe
20 we'll get into this later, but you used the word
21 failure and there's an inspection failure and then
22 there's a failure of intended use. The failure of
23 intended use involves cracking. But as I understand
24 it, there would be cracking before you had a
25 catastrophic failure, where it would no longer serve

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1 its intended use. I'm just trying to follow in my
2 mind the mechanism along. And bear with me here
3 because I'm plowing new ground for me, I realize that
4 this is old ground for all of you. But I had thought
5 from yesterday that ductility decrease made the item,
6 a bolt for example, more susceptible. I thought that
7 the fracture toughness actually increased with the
8 embrittlement. Do you disagree? Did I --

9 DR. LAHEY: It depends, what do you mean by
10 fracture toughness? If you mean the ability of a
11 crack to propagate, which is the way I think it's
12 being used, then it's not correct. I mean, there is
13 another mechanism in which the strength of the
14 material is increased by irradiation induced
15 embrittlement.

16 CHAIRMAN MCDADE: Okay. And I guess what
17 I'm confused then is the sort of the inter-reaction of
18 these terms and what these terms represent. So if,
19 and again, bear with me here, the strength increases,
20 I'm not really sure what you mean by strength, I had
21 taken strength to be synonymous with fracture
22 toughness. And that the ductility, basically the
23 ability to bend and come back is something entirely
24 different. And although the ductility was decreasing
25 with embrittlement, that there was a strength increase

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1 and there was not a decrease in fracture toughness.
2 Dr. Hiser, is that the Staff's position? Or please
3 educate me here.

4 DR. HISER: This is Allen Hiser with the
5 Staff. What neutron fluence does to stainless steel
6 in particular or the internals is you increase the
7 fluence, the yield strength increases, the ultimate
8 strength increases, the fracture toughness is reduced,
9 and that's normally what we consider neutron
10 embrittlement. It makes the fracture toughness
11 decrease. In addition, the ductility decreases. And
12 that's the bendability that you spoke of. So the
13 fracture toughness does get reduced by neutron
14 fluence.

15 CHAIRMAN MCDADE: And please explain to me
16 very briefly if you can exactly what you mean by
17 fracture toughness --

18 DR. HISER: Fracture toughness --

19 CHAIRMAN MCDADE: -- as opposed to
20 strength.

21 DR. HISER: Well, I guess to separate them
22 maybe in two ways. Strength is in particular relevant
23 if you have an uncracked component. The failure of
24 that component will be directly related to the
25 strength of the material. So if you have an

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1 embrittled component or an irradiated component that
2 has no cracks, it will fail at a higher load than one
3 that is unirradiated. And going back to yesterday's
4 discussion, you can always have a higher load and
5 cause that uncracked component to fail.

6 For the fracture toughness, that really
7 relates to the response of a component that has a
8 crack in it. So, for example, if you have two
9 components that are identical, one is irradiated, one
10 is not, they both have the same size of crack, they
11 both are subjected to the same loads, the one that's
12 irradiated will have a lower fracture toughness, the
13 crack will grow more readily in that material than in
14 the unirradiated component. So that is where the
15 fracture toughness comes into place. If you have a
16 crack to start with.

17 CHAIRMAN MCDADE: Okay. And, Dr. Lahey, do
18 you agree with that?

19 DR. LAHEY: Yes, sir. I tried to say that,
20 he said it better than I. And I do want to bring
21 another thing up --

22 ADMIN. JUDGE WARDWELL: Before you go on to
23 that other thing, I want to clarify something else you
24 said to fix this point, if I might.

25 DR. LAHEY: Yes.

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1 ADMIN. JUDGE WARDWELL: And that is, you
2 used the phrase that if it's embrittled and then it's
3 hit with a significant load. Would your same result
4 happen if it was hit with design basis loads? Do you
5 believe those are significant loads to cause the issue
6 that you're dealing with?

7 DR. LAHEY: Yes, many of them are. Many of
8 them are and --

9 ADMIN. JUDGE WARDWELL: That's all I want
10 to know is that it doesn't have to be an excessive
11 load, you believe this will happen under design basis
12 loads. Is that correct?

13 DR. LAHEY: That's correct.

14 ADMIN. JUDGE WARDWELL: Thank you.

15 DR. LAHEY: The difference between what
16 you've heard in the past and what I'm saying is, is
17 that when people have said that they can withstand
18 design basis loads, if you look at the EPRI document
19 and see what they've done, they've applied those in a
20 static way, not in an impulsive way. And I tried to
21 show you in my little cartoon yesterday that you can
22 have significant difference between static and dynamic
23 loads. I want to return to the document where Mr.
24 Lott was an author of. This is the Icone paper that
25 you had asked about. And in that one, the difference

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1 from the one we had talked about in more detail --

2 CHAIRMAN MCDADE: Do you have an exhibit
3 number on that?

4 DR. LAHEY: Do you know the exhibit number?
5 Oh, yes -- NRC 000177.

6 CHAIRMAN MCDADE: Thank you.

7 DR. LAHEY: Okay. In there is a statement
8 which is a little different from what I heard before.
9 This is light water reactor conditions and it says
10 that the increase in tensile strength because of
11 irradiation causes a, in the high cycle fatigue
12 region, low amplitude, an increase in the strength
13 capability, less failure, and a decrease of ductility
14 results in a decrease of fatigue life in the low cycle
15 fatigue region. So this is entirely consistent with
16 a high pressure or the high flux reactor data,
17 which was at a higher temperature.

18 They go on to say that the strain
19 amplitude in their test was rather small, 0.6 percent,
20 so they only saw the increase, not the decrease. And
21 we're worried about the decrease, because that's an
22 indication if you have enough amplitude, you can cause
23 the thing to fail early and if you have a larger
24 amplitude because of a shock load, it can have a
25 catastrophic failure. So I wanted to bring that quote

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1 to you. That's on Page 2 under the Effect of Fluence,
2 is the heading.

3 DR. LOTT: And may I, your honor? I just
4 want to say that, that statement about the high strain
5 amplitude data or the low cycle data reflected
6 primarily the limits of what was tested in this
7 program. And we were aware when we wrote the program
8 of exactly the data that Dr. Lahey has suggested here.
9 And just wanted to be cautious about how far we
10 extended the findings of this paper. And I would
11 stick by that. I will also point out, and I think
12 it's again something we may get to under the next
13 Contention, that we don't really expect to see these
14 large strain amplitudes in the reactor internals, at
15 least the reactor internals that have significant
16 irradiation effects.

17 MR. STROSNIDER: Your honor, this is Jack
18 Strosnider for Entergy.

19 ADMIN. JUDGE WARDWELL: I think we're going
20 to move on now, thank you.

21 MR. STROSNIDER: Going to move on? Okay.

22 ADMIN. JUDGE WARDWELL: Yes. Back to my
23 original question, which I really don't want to reread
24 again, but it was all those -- the statement that NRC
25 disagreed with your concerns and pointing out that --

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1 one of the things they pointed out was primary
2 components to be inspected under Entergy's program are
3 those components that are most likely to be affected
4 by synergistic effects if they exist. Do you agree
5 that the primary components will be those most likely
6 to be affected by synergism?

7 DR. LAHEY: Yes. I don't disagree with
8 that.

9 ADMIN. JUDGE WARDWELL: Thank you.

10 DR. LAHEY: Their difference between how I
11 view it and how they view it is, is the cracking
12 required?

13 ADMIN. JUDGE WARDWELL: But if cracking
14 does occur, wouldn't that be a result of whatever
15 mechanisms created that? And so the synergism would
16 be built into that observed crack, would it not?

17 DR. LAHEY: I don't disagree what that
18 either. But remember, what I'm concerned with is
19 either before or after any of the significant surface
20 cracking. If you have an event which loads it
21 impulsively, you can fail the structure. And then
22 once you fail the structure, depending on what it is,
23 it can lead to an uncoolable geometry. That's what
24 I'm concerned with.

25 ADMIN. JUDGE WARDWELL: Okay, thank you.

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1 I think you may have said this, but I'm going to ask
2 it again because maybe you didn't, so I want to make
3 sure we do cover this space. Are you concerned with
4 the interval of the inspections or do you feel that's
5 adequate based on the operating experience to date?

6 DR. LAHEY: You're going back to the ten
7 year --

8 ADMIN. JUDGE WARDWELL: Right.

9 DR. LAHEY: -- interval?

10 ADMIN. JUDGE WARDWELL: Exactly.

11 DR. LAHEY: It seems a little long, but I'm
12 more interested in a baseline inspection, a very
13 thorough baseline inspection as they go into the
14 period of extended operation, because otherwise, an
15 inspection process doesn't make a lot of sense if you
16 don't know where you start. So I think the sooner the
17 better they do that. And then after that, the
18 interval I think would depend on the kind of things
19 that were discussed. What would be the implications
20 of failure and how long do you have to take action
21 before you can have a big problem?

22 ADMIN. JUDGE WARDWELL: Right now, and I
23 believe they're planned for 2016 and 2019, if I was
24 correct in my memory. Do you have any comments in
25 regards to what you would recommend and what's your

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1 justification for recommending anything earlier than
2 -- well, it's not going to happen before 2016 anyhow,
3 but the 2019 one?

4 DR. LAHEY: Well, we had recommended some
5 time ago, but time goes on, so the sooner the better.
6 But if that's the sooner they can do it, so be it.

7 ADMIN. JUDGE WARDWELL: Thank you. I guess
8 you, and as I heard you say, you're more concerned
9 with the extent of that inspection program rather than
10 necessarily any timing between the small years between
11 2016 and 2019?

12 DR. LAHEY: I think that's correct.

13 ADMIN. JUDGE WARDWELL: Thank you. Let's
14 move on now to talk a little bit more about the
15 preventative actions, the corrective actions, and
16 acceptance criteria. Entergy's testimony, 616, Answer
17 203, Page 136 to 137, Entergy has undertaken or will
18 implement several types of preventative actions to
19 manage the effects of aging on reactor vessel
20 internals at Indian Point, including implementing the
21 IPEC water chemistry control program, replacing the
22 split pins at IP2, committing to replace IP2 split
23 pins again in 2016, using the fatigue monitoring
24 program and addressing the action levels Number 8 in
25 the safety evaluation for MRP 227-A, tracking plant

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1 transience and cycles, thereby assuring that fatigue
2 usage from actual plant transience does not exceed
3 ASME code design limits, and implementing neutron flux
4 reduction measures to minimize the neutron fluence on
5 the reactor pressure vessel, which in turn will
6 minimize radiation induced aging effects at high
7 fluence locations within the RVIs. I guess I'd ask
8 the Staff, do you agree that these are considered
9 preventative maintenance activities that are
10 designated by GALL to be part of a consistent AMP?

11 DR. HISER: This is Allen Hiser with the
12 Staff. The water chemistry program clearly is a
13 preventative measure that's implemented as part of
14 their AMP. The replacement of split pins, again,
15 clearly putting in new material would prevent the
16 accumulation of degradation that had occurred with the
17 old pins. Fatigue monitoring is, I'm not sure if I'd
18 call it preventative, but it clearly is an appropriate
19 measure to ensure that the fatigue life is adequately
20 monitored during the operation of the plant. So that
21 would -- I'm not sure if I would call it preventative,
22 but it -- prevent, mitigate, or minimize the effects
23 of aging, I'd say, yes, it's within that umbrella.
24 And finally the flux reduction, again, would help to
25 minimize the aging effects on the vessel internals.

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1 So I would agree with each of these.

2 ADMIN. JUDGE WARDWELL: Okay, thank you.
3 In New York State's Exhibit 496, Attachment 1, which
4 is the AMP, Page 5, the AMP states that the reactor
5 vessel internals program is a condition monitoring
6 program that does not include preventative actions.
7 So I guess I'd ask, and I'll start with Entergy,
8 doesn't that kind of contradict what you've stated in
9 Answer 203 that I quoted from above where you're
10 taking credit for a bunch of preventative actions?

11 MR. COX: Could you repeat that question?

12 ADMIN. JUDGE WARDWELL: Yes. The previous
13 quote I had from your testimony of which I just asked
14 Staff to respond to, which was Answer 203, you listed
15 a number of preventative measurements that you were
16 taking credit for. Your AMP states that, on Page 5,
17 that the reactor vessel internals program is a
18 condition monitoring program that does not include
19 preventative actions. Well, it seems like you just
20 took credit for a bunch of preventative actions and
21 then you're saying in your AMP, it doesn't include
22 them.

23 MR. COX: This is Alan Cox for Entergy. I
24 think it's really a matter of semantics and how you
25 describe things. What was meant by the statement in

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1 the reactor vessel internals program was that the
2 water chemistry controls were included in another AMP.
3 I mean, there is a separate AMP that applies not just
4 to reactor vessel internals, but to water chemistry on
5 the primary side as a whole. So that AMP goes beyond
6 just reactor vessel internals. It's treated as a
7 separate program, but it is referenced from the
8 preventative action section here and it says that we
9 do have preventative actions in that AMP that will
10 apply to the reactor vessel internals. It's not a
11 part of the reactor vessel internals AMP in the way it
12 was described because it's a program that covers a
13 whole lot more areas than just reactor vessel
14 internals.

15 ADMIN. JUDGE WARDWELL: Okay, thank you.
16 I guess that explains it as best you can. And I guess
17 I'll turn to Staff. That Criteria 2 of GALL does
18 require preventative actions. So don't there need to
19 be some preventative actions within each individual
20 AMP for each of the different components that are
21 addressed by different AMPs, i.e., doesn't the reactor
22 vessel internals have to have preventative actions
23 associated with it in order to be consistent with
24 GALL?

25 DR. HISER: This is Allen Hiser of the

1 Staff. For the vessel internals program, that is
2 correct. Water chemistry is an essential element of
3 the program. Otherwise, the inspection types,
4 frequency, scope, et cetera, would be different,
5 because there's an expectation that there is a program
6 that's helping to minimize the effects of aging.

7 ADMIN. JUDGE WARDWELL: Would the,
8 likewise, the activity in regards to the fuel that
9 reduces the fluence, if you will, but the way it's
10 configured also be considered one of these
11 preventative measures that you're taking account of
12 and taking credit for in your evaluation of whether or
13 not Criteria 2 is met for the RVIs?

14 DR. HISER: This is Allen Hiser of the
15 Staff. I think the flux reduction is not explicit
16 within the GALL AMP, but it is explicit in MRP 227
17 that it was one of the three criteria used for
18 demonstrating that a plant was bounded by the report.
19 And based on that, it is sort of implicit to the GALL
20 AMP that, that is necessary. Again, if flux reduction
21 was not implemented at a plant, than it would be
22 inappropriate for them to use MRP 227 because that is
23 one of the fundamental assumptions because under the
24 aging evaluation, it's in the report, and to
25 demonstrate the adequacy of aging management.

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1 ADMIN. JUDGE WARDWELL: And in your SER,
2 have you specifically addressed each of the criteria,
3 including Criteria 7 for corrective actions and 8 for
4 confirmation process dealing with assuring
5 preventative and corrective actions?

6 MR. POEHLER: This is Jeffrey Poehler of
7 the Staff. Yes, we have specifically addressed each
8 of the ten elements of the GALL Aging Management
9 Program, as modified by the LRISG.

10 ADMIN. JUDGE WARDWELL: Okay, thank you.
11 Entergy's testimony, 616, Answer 146, Page 95, states
12 that once a defect is discovered, its ability to
13 withstand fatigue and combinations of both normal and
14 accidental loads is evaluated by either fracture
15 mechanics analysis or a structural analysis, i.e., an
16 engineering evaluation, using the lower bound fracture
17 toughness, i.e., the evaluation assumes a bounding
18 level of embrittlement of the material.

19 Thus, the program has compensated for any
20 inability to directly determine the level of
21 embrittlement through a conservative assumption
22 employed during evaluation of inspection findings.
23 Thus, reasonable assurance that the effects of aging
24 will be adequately managed is provided without the
25 need for direct observation or measurement of the

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1 level of embrittlement. I guess my question to
2 Entergy is, how was this bounding level of
3 embrittlement, as you referred to up above,
4 determined?

5 DR. LOTT: Basically, it was determined
6 based on published data on fracture toughness and,
7 effectively, analysis. Which is in -- I'm going to
8 look to my colleagues for the reference numbers, 727?
9 And published by the NRC in the NUREG process.

10 MR. GRIESBACH: 7207?

11 DR. LOTT: 7207, I'm sorry.

12 MR. GRIESBACH: Also MRP 210.

13 DR. LOTT: Yes. Maybe I should let Mr.
14 Griesbach talk.

15 MR. GRIESBACH: This is Tim Griesbach from
16 Entergy. That data and the evaluation method that
17 would be used as an example is given in MRP 210.
18 That's an EPRI MRP program document.

19 ADMIN. JUDGE WARDWELL: And you believe
20 that's an exhibit in this proceeding?

21 DR. LOTT: Yes.

22 MR. GRIESBACH: Yes, it is.

23 ADMIN. JUDGE WARDWELL: Okay. Thank you.

24 DR. LOTT: 646.

25 ADMIN. JUDGE WARDWELL: And I assume I'll

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1 hear what the number is shortly from my ace searchers
2 of what that is.

3 MR. KUYLER: Your honor, MRP 210 is Entergy
4 Exhibit 646.

5 ADMIN. JUDGE WARDWELL: Oh, thank you so
6 much. I'd also like to -- in that statement, to
7 refresh your memory from three minutes ago, the
8 program has compensated for any inability to directly
9 determine the level of embrittlement through a
10 conservative assumption. And what is this
11 conservative assumption employed during the evaluation
12 of the inspection findings to which you refer that
13 ensures that the program has compensated for any
14 inability to directly determine the level of
15 embrittlement? And where might that be documented?

16 DR. LOTT: Again, that's documented and
17 it's required based on the procedures in WCAP-170986,
18 which was our internal, we'll be calling methodology
19 and data requirements for determinative engineering
20 evaluations. What we -- again, the bounding value is
21 based on a fracture mechanics analysis where we're
22 looking at this reduced fracture toughness, which is
23 a property of the material. In most cases, it's done
24 on the basis of a linear elastic evaluation, even
25 though we've already testified that it appears that

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1 there's some ductility left in these materials, it
2 assumes very low levels of ductility. And it bounds
3 the existing data on fracture toughness of material as
4 a function of fluence, for stainless steel alloys in
5 general.

6 ADMIN. JUDGE WARDWELL: Thank you. Dr.
7 Lahey, why hasn't this approach covered much of some
8 of your uncertainties that you are concerned with in
9 regards to the potential failure modes of what might
10 take place under operational conditions?

11 DR. LAHEY: Does your question -- this is
12 Richard Lahey from New York. Does your question also
13 include the previous discussion with the replacement
14 of split pins and that sort of thing?

15 ADMIN. JUDGE WARDWELL: Sure, if you want
16 to add that --

17 DR. LAHEY: Okay.

18 ADMIN. JUDGE WARDWELL: -- into it, you can
19 talk about that also.

20 DR. LAHEY: Those steps, I believe, are
21 quite prudent. We particularly like the replacement
22 of a degraded component and would highly encourage the
23 replacement of other degraded components, in
24 particular the baffle bolts, which are the most
25 vulnerable. The other part of your question, I guess,

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1 relates to the loads and are the loads which are
2 applied to determine the integrity or the time it will
3 take for a component to failure, if they are
4 appropriate loads, if they are impulsive loads, which
5 would have the maximum effect on causing a failure.
6 If they're absolutely correct, then I have no problem
7 with it. So far, I haven't seen that.

8 ADMIN. JUDGE WARDWELL: I think I was more
9 concerned with the bounding level of embrittlement
10 that was selected for this analysis and the
11 conservative assumption employed in evaluation of the
12 inspection findings.

13 DR. LAHEY: Okay. Maybe you can -- one of
14 the exhibits we have, New York State 000495, could we
15 bring that up and we talk about it?

16 ADMIN. JUDGE WARDWELL: What page number
17 would you like?

18 DR. LAHEY: It's Page 3.

19 ADMIN. JUDGE WARDWELL: Okay.

20 DR. LAHEY: Right. So this is a --

21 ADMIN. JUDGE WARDWELL: Well, wait just a
22 second until we get that --

23 DR. LAHEY: Oh, it's not up yet?

24 ADMIN. JUDGE WARDWELL: It's not up in
25 front of me at least.

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1 DR. LAHEY: Oh, it's up here.

2 ADMIN. JUDGE WARDWELL: The ON/OFF button
3 being in the wrong position. We all -- none of us
4 have it, do we?

5 MR. HARRIS: Your honor, this is Brian
6 Harris for the Staff. We don't have it over here
7 either.

8 ADMIN. JUDGE WARDWELL: You don't have it
9 either?

10 MS. SUTTON: Neither does Entergy, your
11 honor.

12 MR. SIPOS: Your honor, for New York, we
13 have it up over here.

14 (Laughter.)

15 ADMIN. JUDGE WARDWELL: You seem pretty
16 smug about that, Mr. Sipos.

17 MR. SIPOS: It's a rare feeling.

18 (Laughter.)

19 ADMIN. JUDGE WARDWELL: You going to rent
20 us out a little sneak views of this or --

21 MR. SIPOS: I could turn the monitor
22 towards your honors direction if you like.

23 ADMIN. JUDGE WARDWELL: For the right
24 price?

25 (Laughter.)

1 ADMIN. JUDGE WARDWELL: These aren't
2 connected in series are they, like my Christmas
3 lights? Here we go. We've got a winner.

4 (Laughter.)

5 DR. LAHEY: Can you see it? Is it up on
6 your screen now?

7 ADMIN. JUDGE WARDWELL: It is, thank you.

8 DR. LAHEY: Okay.

9 ADMIN. JUDGE WARDWELL: Thank you for
10 waiting.

11 DR. LAHEY: Over there is it okay?

12 ADMIN. JUDGE WARDWELL: Is everyone happy?

13 MR. HARRIS: Yes.

14 MR. SIPOS: Yes, your honor.

15 DR. LAHEY: Okay. So this is a plot that
16 keeps getting passed around. It's in Gary Was's
17 classic book on nuclear metallurgy, it's in a lot of
18 EPRI reports, a lot of U.S. NRC reports. It came from
19 an individual and there's certain assumptions made in
20 it in terms of how you calculate the fluxes, the
21 neutron fluxes. And, in particular, what components
22 you're choosing. But it gives you a pretty good
23 estimate of the type of fluences you're going to see.
24 So on the upper curve is the fluence for greater than
25 one million electron volt neutrons, which are the

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1 damaging ones. And on the lower scale is the
2 corresponding displacements per atom, how many times
3 each atom is knocked out of its lattice. So you can
4 see, if you look at the end of PWR life extension,
5 it's expected to be greater than 100 dpa or greater
6 than ten to the 23 --

7 ADMIN. JUDGE WARDWELL: And what are the
8 years for, do you know, that they assume for this life
9 extension?

10 DR. LAHEY: This is the 20 year life
11 extension.

12 ADMIN. JUDGE WARDWELL: Okay. So the 60
13 years total?

14 DR. LAHEY: It's the type we're talking
15 about.

16 ADMIN. JUDGE WARDWELL: Okay, thank you.

17 DR. LAHEY: So you can see there's
18 significant, absolutely significant fluences and
19 damage at that point. And of course, that is where
20 you have to be really concerned because if you look at
21 the data on when bad things happen in terms of
22 embrittlement and all these other issues we've been
23 talking about, you have to get to a displacement per
24 atom of about one or so before bad things start to
25 happen. Then it drops off pretty fast, it really goes

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1 down very fast.

2 So once you start getting out here, you're
3 really in a region where you have to be very careful
4 because you're on what I call the bathtub curve, if
5 you know what I mean by that. You're way out on the
6 other part of the bathtub curve where you're starting
7 to wear things out, you're really beating them up and
8 they're failing. So, hopefully this gives you some
9 insight into what the concerns are, just as a way to
10 benchmark yourself.

11 The NRC uses the criterion for significant
12 embrittlement, as I understand it anyway, you folks
13 can correct me if I'm wrong, but about one times ten
14 to the 21 for fluence, when for stainless steel you
15 start to get significant embrittlement. And other
16 people use like 6.7 times ten to the 20, but it's of
17 that order of magnitude. So you can see, by the end
18 of this thing we're a thousand times greater than the
19 onset of that kind of damage.

20 DR. LOTT: Your honor, may I just -- a
21 moment ago, I had trouble coming up with a reference
22 for you in terms of limiting fracture toughness
23 values. I wanted to point that actually those
24 limiting values, when I think about it, are in MRP
25 227, Section 6, as well as in the other documents we

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1 described. I'd also like to perhaps amend a little
2 bit to my statement and say that, one of the other
3 conservatisms in our analysis has been throughout, we
4 tend to apply peak fluence values to entire
5 components. So we don't necessarily -- and when we're
6 doing evaluations, when we've identified components,
7 we have looked at 60 year fluences and looked at the
8 peak location on that and there could be a large
9 gradient in fluence across the component. So I would
10 just suggest that, that's an additionally conservative
11 assumption we've made about determining the fluence on
12 a component.

13 ADMIN. JUDGE WARDWELL: Okay, thank you.
14 Do you have any other comments that you'd like to add
15 in regards to this figure that Dr. Lahey has presented
16 and his comments associated with it?

17 DR. LOTT: I mean, I think I've seen this
18 document many times before as well. It's just a
19 schematic that I think is consistent with actually
20 many of the assumptions we've made here in terms of --
21 I think Dr. Lahey was talking about the threshold
22 values for irradiation embrittlement of seven times
23 ten to the 20, that's exactly the value we used in our
24 evaluations, that's approximately one dpa. So, I
25 think that we're on the same -- we've dealt with and

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1 understand these concerns and that our testimony has
2 demonstrated that.

3 ADMIN. JUDGE WARDWELL: Clarify for me,
4 will you, if you are using seven times ten to the 20
5 or about one dpa, as what you assume as a conservative
6 fluence value, how does that relate to what you may
7 actually be experiencing, which is two orders of
8 magnitude higher than that by the end of the life
9 extension?

10 DR. LOTT: Well, first of all, what we're
11 looking at is the threshold for what's the lowest
12 value. I mean, so basically what that determines is
13 whether a component has any irradiation embrittlement
14 concern at all. Above that, all the way up to a
15 million, presumably, it has susceptibility. Our first
16 goal of the threshold values was to determine the
17 lower limit.

18 ADMIN. JUDGE WARDWELL: So it's
19 conservative because it's on the low side,
20 encompassing much more numbers of --

21 DR. LOTT: Right.

22 ADMIN. JUDGE WARDWELL: -- potential of --

23 DR. LOTT: Right, so yes. That's --

24 ADMIN. JUDGE WARDWELL: -- internals.

25 DR. LOTT: -- what the concern is and we

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1 identified components with potential irradiation
2 embrittlement. And our basis for that was a
3 relatively low value, the onset of embrittlement,
4 consistent with the curve I showed you earlier this
5 morning on yield stress.

6 ADMIN. JUDGE WARDWELL: Yes. Okay. Thank
7 you.

8 ADMIN. JUDGE KENNEDY: Dr. Lott, this is
9 Judge Kennedy. The baffle, let's see if I'm getting
10 this right, the baffle bolts are, at least components
11 I identify on this chart, at somewhere around ten to
12 the 22, PWR baffle bolt failures?

13 DR. LOTT: Yes. Some --

14 ADMIN. JUDGE KENNEDY: Are there --

15 DR. LOTT: Yes.

16 ADMIN. JUDGE KENNEDY: Are there reactor
17 vessel internal components that experience fluences
18 beyond that value?

19 DR. LOTT: Yes, there are. I mean, it's
20 not like that's a fall off the cliff value. When we
21 have -- and have reported seeing IASCC and baffle
22 bolts in operating plants, I think that, that value is
23 basically trying to demonstrate that it happened
24 roughly at that fluence.

25 ADMIN. JUDGE KENNEDY: Okay. All right,

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1 thanks.

2 CHAIRMAN MCDADE: Is this the baffle former
3 bolt or the baffle edge bolt or is this all baffle
4 bolts that they're talking about here?

5 DR. LOTT: Okay. There are basically three
6 different kinds of baffle bolts. There's the baffle
7 -- if you're familiar with the baffle structure,
8 they're plates that surround the core and there's
9 plates behind them, horizontal plates, that hold them
10 in place. The bolt between the baffle plate and the
11 horizontal plate is a baffle bolt. Where the two
12 plates come together, along the edge, along the seam,
13 there may be bolts that go from baffle plate to baffle
14 plate, not baffle plate to the former. Those are the
15 baffle edge bolts. They basically seal up the gap
16 between the two plates to keep water from jetting
17 through there. Not all plants even have baffle edge
18 bolts.

19 And we've done evaluations to determine
20 that in terms of holding the baffle together, in terms
21 of an accident type scenario, we don't take credit for
22 the baffle edge bolts at all. So it's, again, a
23 conservatism in our assumptions when we do these
24 acceptable bolting patterns. So baffle edge bolts.
25 And then there's barrel former bolts, which are from

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1 the round barrel, which is the outside container of
2 the entire internals, that the horizontal plates, the
3 other side of them, attach to the barrel. So barrel
4 former bolts, baffle former bolts, and baffle edge
5 bolts.

6 MR. KUYLER: Your honor, there's a diagram
7 in Entergy's testimony, Exhibit 616, Page 54.

8 CHAIRMAN MCDADE: Okay, thank you. And
9 thank you, Dr. Lott.

10 ADMIN. JUDGE WARDWELL: NRC's testimony,
11 197, Answer 179, Pages 102 to 103, the reactor vessel
12 internals AMP is structured to managing the aging
13 effects such that the intended function of the
14 components will be preserved during the period of
15 extended operation from 40 to 60 years. It
16 accomplishes this task by establishing an Inspection
17 Plan for the relevant components that it's able to
18 identify potential aging effects prior to any loss of
19 function through appropriate schedules and
20 conservative acceptance criteria. And so I'll ask
21 Entergy, does Table 5-5 of the Applicant's Inspection
22 Plan, and that's New York State 496, Attachment 2,
23 contain these acceptance criteria?

24 MR. DOLANSKY: This is Bob Dolansky with
25 Entergy. Yes.

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1 ADMIN. JUDGE WARDWELL: Okay. And does it
2 not state that the examination acceptance criteria for
3 visual examination is the absence of the specific
4 relevant condition?

5 MR. DOLANSKY: Yes.

6 ADMIN. JUDGE WARDWELL: And now the tougher
7 part, what are examples of this relevant condition?
8 And where would one find that?

9 MR. DOLANSKY: For an EVT1, it would be a
10 crack-like indication.

11 ADMIN. JUDGE WARDWELL: So it varies by
12 your inspection technique generally, rather than by
13 component?

14 MR. DOLANSKY: And by the component. In
15 other words, EVT1 is typically looking for cracking,
16 but a VT3 -- this is Bob Dolansky for Entergy. VT3
17 could be looking for either wear or it could be
18 looking for a dimensional change, like void swelling,
19 something like that. So the acceptance criteria would
20 depend on what you're looking for and the method that
21 you're using.

22 ADMIN. JUDGE WARDWELL: And where is that
23 documented anywhere in regards to the various
24 components so that we could turn to that and it would
25 say, yes, it's any indication of cracking or it's any

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1 indication of a dimensional change or --

2 MR. DOLANSKY: Give me one moment, please.

3 ADMIN. JUDGE WARDWELL: If you want to get
4 back to us --

5 MR. DOLANSKY: Okay. If you -- I'll give
6 a cite, one second. New York State 496, Letter 12-
7 037.

8 ADMIN. JUDGE WARDWELL: Okay.

9 MR. DOLANSKY: Table 5-5.

10 ADMIN. JUDGE WARDWELL: Yes, that's what I
11 was referring to.

12 MR. DOLANSKY: That gives -- you'll see the
13 actual -- under examination acceptance criteria in the
14 table. For instance, for the upper core barrel
15 cylinder girth welds, the specific relevant condition
16 is a detectable crack-like surface indication.

17 ADMIN. JUDGE WARDWELL: Okay. So where
18 ever we see that, that's what it means. As soon as
19 you detect cracking, you're going to take some
20 corrective action.

21 MR. DOLANSKY: Right. So our inspection
22 procedure, that's the people actually doing the
23 inspection use a procedure, their acceptance criteria
24 for a recordable indication would be that.

25 ADMIN. JUDGE WARDWELL: Okay. Thank you.

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1 MR. DOLANSKY: You're welcome.

2 ADMIN. JUDGE WARDWELL: That helps. Just
3 for completeness, Dr. Lahey, any comments in regards
4 to that acceptance criteria and where it's found and
5 the adequacy of it?

6 DR. LAHEY: This is Richard Lahey. I'm
7 sorry, I don't have that document in front of me and
8 I don't recall it.

9 ADMIN. JUDGE WARDWELL: Okay. You have no
10 comment?

11 DR. LAHEY: So I can't really answer right
12 now.

13 ADMIN. JUDGE WARDWELL: If you do later on,
14 if you do want to look at it later on and have some
15 comments --

16 DR. LAHEY: Okay.

17 ADMIN. JUDGE WARDWELL: -- remind me of it
18 and we'll be glad to. I want to make sure you have a
19 chance to anyhow.

20 DR. LAHEY: Thank you.

21 ADMIN. JUDGE WARDWELL: New York State's
22 testimony, 482, Page 79, states that, I believe that
23 the most vulnerable reactor pressure vessel internals
24 need to be carefully identified and repaired or
25 replaced prior to the extended operation since it is

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1 beyond the current state of the art to perform
2 realistic and accurate calculations on relocation of
3 failed RVP internals and the resultant potential for
4 core blockages or degraded core cooling. And I guess
5 I'll ask you, Dr. Lahey, that while I understand the
6 basis for your position in regards to this
7 replacement, does not this run counter to the whole
8 idea of managing aging? And doesn't it to a large
9 degree try to circumvent all of the regulations that
10 are geared towards aging management as opposed to
11 prescriptive replacements?

12 DR. LAHEY: That's a very interesting
13 question. In my opinion, aging management is indeed
14 important. But when you get components that look like
15 they're vulnerable and can fail and you're not able to
16 determine with any precision what the effect of that
17 might be, then I think the prudent thing to do is to
18 replace those components. I've spent ten years of my
19 life trying to calculate where things go and it's very
20 hard to do, very difficult to do, there's too many
21 possibilities.

22 But the one thing I know for sure is, once
23 you lose an intact geometry, you've got big problems.
24 So, anything that will preserve that, I think we're
25 way ahead of the game and, to me -- do you know what

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1 a make-buy decision is? You decide is it cheaper to
2 make something or buy something? This is like a make-
3 buy decision. Is it cheaper to calculate and inspect
4 and go through litigation and all that or is it
5 cheaper just to replace it and have the problem go
6 away? And, for many of these things, I think it's
7 cheaper and much more prudent to just replace it.

8 ADMIN. JUDGE WARDWELL: The -- I forgot my
9 question now because I was going to change it in
10 regards to your last comment. But with your
11 description of the details which basically are in the
12 AMP and the inspection program that's in there and
13 your applauding of it as not the complete what's
14 needed, but not really a lot of substantive
15 disagreements with the approaches and the extents of
16 what they're doing, given what we've heard in regards
17 to the conservative assumptions, why isn't there a
18 fair degree of reasonable assurance that something, if
19 it does go amiss, would be detected before that
20 intended functionality of the RVIs was lost?

21 DR. LAHEY: This is again Richard Lahey
22 from New York State. When you say conservative
23 assumptions, are you referring to embrittlement alone
24 now or --

25 ADMIN. JUDGE WARDWELL: I'm talking about

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1 all that we've heard about --

2 DR. LAHEY: All of the above?

3 ADMIN. JUDGE WARDWELL: -- to date in
4 regards to our questioning and what's in their
5 testimony in regards to the decisions they make as
6 they prepared their AMP and then how they're
7 implementing their AMP.

8 DR. LAHEY: Right.

9 ADMIN. JUDGE WARDWELL: Does that not give
10 one reasonable assurance that if something does go
11 awry, it's not going to try to stop anything that
12 might go awry, but if it does, isn't there a
13 reasonable assurance that it would be detected prior
14 to the RVI losing all of its intended function, even
15 though it may crack or even do some other things?

16 DR. LAHEY: Not in my opinion. If you have
17 sufficient degraded components that can lead to a
18 destruction of intact geometry, there's a reasonable
19 chance that you can have an unexpected accident.
20 Accidents, by definition, you don't expect them, but
21 they happen, or an earthquake happens just when you
22 don't want it. And then what will that lead to? If
23 it can lead to degraded or materials which fail and
24 relocate, then I'm very concerned about it. Because
25 I just know you can't calculate the consequence of

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1 that.

2 So if you can identify materials that are
3 highly irradiated, and we can, and highly fatigued,
4 and we can, and they are things that could lead to
5 destruction of a coolable geometry, then you should
6 take action, the sooner the better. Don't wait for
7 something bad to happen. So that's why I'm very keen
8 on do what you're doing with the -- have Entergy do
9 what they're doing with the split pin, replace it
10 because it's degrading. Replace the things that have
11 a significant effect on the safety of the reactor.
12 There's not that many. I mean, we haven't talked
13 about pressure boundary components yet, but we will,
14 tomorrow I guess. And there's only a few that are
15 really, really crucial. And there's only a few things
16 in core that are really, really crucial. And,
17 happily, these are things that aren't that hard to
18 replace.

19 ADMIN. JUDGE WARDWELL: Thank you, Dr.
20 Lahey.

21 DR. LAHEY: That's why --

22 ADMIN. JUDGE WARDWELL: Thank you.

23 DR. LAHEY: -- I feel that way.

24 ADMIN. JUDGE WARDWELL: Entergy, have you
25 addressed anywhere or evaluated or how did you handle

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1 this potential relocation of failed RVIs and the
2 resultant potential for core blockages and degraded
3 core cooling?

4 MR. DOLANSKY: This is Bob Dolansky with
5 Entergy. When we do an analysis that looks at
6 components, one of the requirements is that we
7 maintain core coolability and core geometry. I mean,
8 that's ultimately what we're trying to do. We want to
9 make sure that, that core -- that's the basis of the
10 whole thing is that the core stays coolable and the
11 geometry stays -- that it maintains core geometry. I
12 mean, that is what we do, that's the exact
13 requirements that we analyze for.

14 DR. LOTT: Yes, this is Randy Lott. And I
15 think, again, we kept coming back to it, but the
16 acceptable baffle bolting pattern analysis is a good
17 example of what we're doing. In that analysis,
18 effectively, you're looking to see that there are
19 enough baffle bolts to keep the baffles from moving,
20 interacting with the fuel, crushing fuel grids, or
21 interfering with the ability to drop control rods.
22 Which is really always our concern, it's maintaining
23 core coolability and being able to insert the control
24 rods, shut down the reaction. That's basically the
25 definition of the safety requirement.

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1 MR. DOLANSKY: Right. And I just want to
2 clarify one thing that Dr. Lahey said. We are
3 replacing split pins. We're not planning to replace
4 baffle bolts. Replacing baffle bolts is not some no
5 nevermind, easy thing to do. They have lock bars
6 welded on, it's an extremely difficult area to get to.
7 Split pins were more designed that they might have to
8 be replaced. So the replacement of the split pins is
9 a little easier, it's more straightforward, something
10 that can be done much more easily.

11 It's easy to sit here and say, just
12 replace the baffle bolts. Actually replacing baffle
13 bolts, although it can be done, is not a simple
14 things. There's a lot of dose involved with that,
15 there's a lot of possibility of loose parts, and
16 there's consequences to replacing things that aren't
17 bad. So, the way we look at is, we will go out and do
18 these inspections on the baffle bolts using a
19 technique that's very good, difficult tooling that was
20 developed just to get us a better UT exam will
21 additionally -- when we do that inspection, as Dr.
22 Lott said, we're going to use an acceptable bolting
23 pattern analysis that ensures that if we find degraded
24 bolts that we can maintain core coolability, core
25 geometry. If we do that inspection and we find that

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1 there's very, very few bolts that are degraded, to me,
2 it doesn't make any sense to go out and just wholesale
3 replace baffle bolts. There's too much danger and
4 risk in doing that. If the bolts are good, I don't
5 see any reason to do that.

6 ADMIN. JUDGE WARDWELL: Okay, thank you.

7 CHAIRMAN MCDADE: Okay. And also, just as
8 our discussion moves on for the rest of the week, I
9 mean, we neither have the authority or interest in
10 micromanaging the way that Entergy does its
11 operations. You have to make certain business
12 decisions. Our function is just whether or not the
13 plans that you have put forward provide reasonable
14 assurance that these items will maintain their
15 intended function for the period of extended
16 operation.

17 So, certain issues of whether or not as a
18 matter of policy you replace, that's outside the scope
19 of what we're looking at. Again, the scope of what
20 we're looking at is whether or not the plans that you
21 have put forward provide that reasonable assurance
22 with regard to intended function, period. So, it's
23 not as wide -- it's not just an open-ended discussion.
24 We're trying to focus in on what we have to decide
25 here. Judge Wardwell?

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1 DR. LAHEY: Yes, and your honor, can I say
2 something? What we just heard from Entergy is the
3 most encouraging thing I've heard in the last eight
4 years. I'm very happy to hear it because it sounded
5 like they're going to do something that makes a lot of
6 sense, look at the integrity of it, and if it's not a
7 big issue, then don't do it, if it is a big issue,
8 presumably they will entertain that as a possibility
9 to replace. Up until now, all I heard was, question,
10 do you agree with Dr. Lahey on anything and the answer
11 is, no. Everything, no, no, no.

12 (Laughter.)

13 DR. LAHEY: And so this was encouraging to
14 me.

15 ADMIN. JUDGE WARDWELL: Thank you, Dr.
16 Lahey. NRC's Exhibit 197, Answer 134, Page 82, states
17 that the Staff found Entergy's AMP met the Staff's
18 guidance for corrective actions because detected
19 conditions not satisfied in the examination acceptance
20 criteria will be processed through the plant's
21 corrective action programs. And I guess I'll start
22 with the Staff considering it's your exhibit. What's
23 your understanding of how the plant's corrective
24 action program works and interacts with the AMP for
25 reactor vessel internals?

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1 DR. HISER: This is Allen Hiser of the
2 Staff. The corrective action program would be
3 initiated if there's an inspection finding that
4 exceeds the inspection acceptance criteria, which
5 we've discussed previously. I believe it's Table 5-5
6 of the RVI Inspection Plan from Indian Point. The
7 corrective action program would require that the
8 condition be assessed, I guess in maybe two or three
9 different ways.

10 One is, is the condition that was
11 identified, that condition needs to be resolved, is it
12 acceptable maybe through engineering evaluation, is
13 repair required, is replacement required? So that
14 would be one path that would be followed by the
15 corrective action program. A second would be a
16 consideration of expansion of the inspections
17 consistent with the AMP. So that would follow.
18 Consideration of reinspection interval would be a part
19 of that evaluation as well. So the corrective action
20 program should consider pretty much any aspect that's
21 relevant to the finding itself, be it for that finding
22 or other components.

23 ADMIN. JUDGE WARDWELL: Okay, thank you.

24 DR. HISER: And that is required in
25 Appendix B to 10 CFR Part 50, so it is a regulated

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1 activity, a regulated program of the plant that the
2 NRC inspects periodically.

3 ADMIN. JUDGE WARDWELL: Thank you for your
4 understanding of the plant's corrective action. I'll
5 turn to Entergy and can you now explain how your
6 plant's corrective action program actually works and
7 interacts with the AMP or just state what differences
8 you might have with what Dr. Hiser just presented?

9 MR. AZEVEDO: Yes, this is Nelson Azevedo
10 for Entergy. What was just discussed is correct,
11 that's what we do. So we find an indication then we
12 put in our corrective action program to determine
13 whether we have to repair or replace it or whether
14 it's acceptable. We also do extended condition
15 inspections if it's warranted. So those are the
16 things we look at.

17 MR. DOLANSKY: I just want to -- this is
18 Bob Dolansky with Entergy. Just to add on something
19 I said earlier where I said Westinghouse was
20 developing acceptance criteria for us. The acceptance
21 criteria in the plan are the just evidence of a crack-
22 like indication. That would be in the inspection
23 procedure. We're additionally, right now, getting
24 additional acceptance criteria that if there was a
25 crack and it could be a certain size, that's what's

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1 being developed. So I misspoke a little bit before,
2 that's not the acceptance criteria in here. That's
3 the --

4 ADMIN. JUDGE WARDWELL: As it exists now.

5 MR. DOLANSKY: -- acceptance criteria after
6 it enters our corrective action program.

7 ADMIN. JUDGE WARDWELL: Okay, thank you.
8 Ready to rock and roll.

9 CHAIRMAN MCDADE: Okay. This may be a good
10 time to break for lunch. Do you have anything before
11 we break?

12 ADMIN. JUDGE KENNEDY: No, I do not.

13 CHAIRMAN MCDADE: Okay. The question is,
14 how long we break for lunch? And I'm not sure if
15 there's any difficulty in people getting lunch within
16 a relatively short period of time. I would propose to
17 come back at 1:30. Is that going to give enough time
18 for people to get lunch and take care of what they
19 need to? NRC?

20 MR. HARRIS: Yes, your honor.

21 CHAIRMAN MCDADE: Entergy?

22 MS. SUTTON: Yes, your honor.

23 CHAIRMAN MCDADE: New York?

24 MR. SIPOS: New York, yes, your honor.

25 CHAIRMAN MCDADE: Riverkeeper?

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1 MS. BRANCATO: Yes, thank you.

2 CHAIRMAN MCDADE: Okay. Do any of the
3 witnesses perceive a problem with restarting at 1:30?
4 Apparently not, we're in recess. We'll come back --

5 DR. LAHEY: No, your honor.

6 CHAIRMAN MCDADE: -- at 1:30. Thank you.

7 (Whereupon, the above-entitled matter went
8 off the record at 12:19 p.m. and resumed at 1:34 p.m.)

9 CHAIRMAN MCDADE: The hearing will come to
10 order. There are a couple of, or a few matters I
11 guess, out there that I just wanted to address before
12 we move forward. I believe there was a question, Mr.
13 Dolansky, to you, as to whether or not you could
14 provide other examples of monitoring of aging effects
15 not observable by inspection. Were you --

16 MR. DOLANSKY: Just the one. Just the one
17 that I gave.

18 CHAIRMAN MCDADE: Okay. And there was a
19 question to Mr. Poehler about an EPRI report and
20 whether or not that was a publically available report.

21 MR. POEHLER: Yes, this is Jeffrey Poehler
22 of the Staff. That report is publically available and
23 it's Exhibit NRC 000208, A through E, there's five
24 parts.

25 CHAIRMAN MCDADE: Okay. And what is the

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1 EPRI report number?

2 MR. POEHLER: It's an MRP letter actually,
3 MRP --

4 CHAIRMAN MCDADE: Okay.

5 MR. POEHLER: -- Letter 2014-09.

6 CHAIRMAN MCDADE: Okay. Thank you.

7 MR. POEHLER: You're welcome.

8 CHAIRMAN MCDADE: And, Dr. Lahey, you were
9 asked with regard to questions on Table 5-5 of New
10 York 496. Did you have an opportunity to review that?

11 DR. LAHEY: No, your honor, I haven't been
12 able to get access to it yet.

13 CHAIRMAN MCDADE: Okay. At our next break,
14 we will make sure that you get access to that.

15 DR. LAHEY: Okay. Thank you.

16 CHAIRMAN MCDADE: Mr. Sipos, it looked like
17 you had a question.

18 MR. SIPOS: I had a procedural question,
19 your honor. And it concerns scheduling of New York's
20 second expert, Dr. David Duquette, who is an expert on
21 Contention 38. And I was wondering if the Board could
22 provide any guidance as to when you would like to --
23 or when the Board might start Contention 38? And it's
24 purely a logistical question as to when --

25 CHAIRMAN MCDADE: No, I understand.

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1 MR. SIPOS: -- to tell him to get in the
2 car and --

3 CHAIRMAN MCDADE: And my best estimate at
4 this point in time would be our start time on Thursday
5 morning. That we're still, it's Tuesday afternoon,
6 we're still working on 25, 26 we should get started
7 maybe later today, should run most if not all of
8 tomorrow. And a lot of what had been in 38, is in 38,
9 we have touched in on the testimony on 25 and will
10 touch on some more in the testimony of 26. So, from
11 my standpoint, and I haven't, you just asked the
12 question, I haven't discussed it with my colleagues,
13 I would, for planning purposes, plan on starting on 38
14 on Thursday morning at 8:00.

15 ADMIN. JUDGE WARDWELL: Yes, I guess we
16 just talk out loud. Yes, I would concur, in fact, to
17 the point that even if we got done 26 early tomorrow,
18 it would probably still be later in the day, that we
19 could just not plan on starting 38 until Thursday
20 morning.

21 MR. SIPOS: That's very helpful, thank you.

22 CHAIRMAN MCDADE: Dr. Kennedy?

23 ADMIN. JUDGE KENNEDY: That's fine with me.

24 ADMIN. JUDGE WARDWELL: And do you agree
25 with that, that we just wouldn't --

1 CHAIRMAN MCDADE: Yes. I mean, I think for
2 planning purposes, we're certainly not going to get
3 done with 26 early tomorrow. So, if we did finish
4 with 26 before 6:00, I don't think anybody would
5 complain if we leave it at 5:50 instead of 6:00. And
6 having Dr. Duquette get here for a relatively short
7 period of time --

8 ADMIN. JUDGE WARDWELL: You want to check
9 with the other parties to make sure they're
10 comfortable with that too? If we waste a couple hours
11 tomorrow afternoon by not starting 38, is that --

12 CHAIRMAN MCDADE: I mean, I don't think
13 it'll be wasting a couple of hours, I think it'll be
14 a few minutes, if anything. And we may still be on
15 26. You all can gauge how well we are keeping a
16 schedule. Ms. Sutton?

17 MS. SUTTON: Yes, your honor. That's fine,
18 we don't have any issues with that.

19 MR. HARRIS: The Staff has no issues with
20 that, your honor.

21 CHAIRMAN MCDADE: Okay.

22 MS. BRANCATO: Riverkeeper has no issues,
23 thanks.

24 MR. SIPOS: Thank you.

25 CHAIRMAN MCDADE: Okay.

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1 ADMIN. JUDGE WARDWELL: Well, I have no
2 more questions on 25.

3 MR. SIPOS: We'll start 38?

4 CHAIRMAN MCDADE: There's no questions on
5 26?

6 MR. SIPOS: All right, let's start 38.

7 CHAIRMAN MCDADE: We're in recess until
8 Thursday morning.

9 (Laughter.)

10 ADMIN. JUDGE WARDWELL: Now, we're going to
11 start looking at some specific materials and
12 components associated with the RVI and starting off
13 with control rods and J-groove welds. Entergy
14 testimony, 616, Answer 98, Page 56, the Inspection
15 Plan NL12-037 Attachment 2 at 62 through 64, provides
16 a complete and corrected list of the RVI subassemblies
17 at Indian Point and breaks those subassemblies down to
18 their constituent components. New York State's
19 testimony, 482, Page 13, states the control rods and
20 the associated components are very important RPV
21 internals and their integrity is an extremely
22 important safety concern. In my opinion, omitting the
23 control rod assemblies and associated fittings from an
24 RPV internals Aging Management Program is a serious
25 and indefensible omission.

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1 Entergy's testimony, 616, Answer 99, Page
2 56, states that control rods are not subject to aging
3 management review for two reasons. First, they
4 perform their intended function with moving parts or
5 a change in configuration. Thus, as the NRC Staff
6 concluded, the control rods are active components not
7 subject to aging management review. Second, control
8 rods are considered consumables and the NRC has
9 excluded from the license renewal review process those
10 components that are subject to replacement based on a
11 qualified life or a specified time period. And I
12 guess I'd ask Dr. Lahey, do you now agree that control
13 rods are not subject to aging management review?

14 DR. LAHEY: I agree that's the rule that
15 has been put in place. I still have the concern that,
16 because I'm looking at everything through the prism of
17 reactor safety, so I have the concern that if you have
18 a significant shock load, you can fracture these
19 highly, highly embrittled structures and they will
20 relocate in some way and you don't know how. And they
21 don't care if they're moving or not, I mean, they're
22 going to be at risk. So I think the reason for the
23 rule is because of what I call silos. Things are
24 being thought of quite separately, rather than in an
25 integrated way.

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1 ADMIN. JUDGE WARDWELL: Thank you.

2 CHAIRMAN MCDADE: But, Dr. Lahey, as I
3 understand the position of Entergy and the NRC Staff,
4 these are consumables. Therefore, they don't need an
5 aging management plan, you are of necessity going to
6 be replacing them at set intervals. So, what would an
7 aging management plan consist of since you're already
8 going to replace them?

9 DR. LAHEY: No, I understand that's why
10 they view it the way they do. What I'm saying though
11 is, let's say a week before they're going to replace
12 them and they're in really bad shape in terms of
13 embrittlement, you have an event which causes them to
14 fail. This causes a big problem. So, I personally
15 believe that when you look at aging management, you
16 ought to look at all the things that affect the safety
17 of the plant, the safety of the plant during the
18 extended operation.

19 CHAIRMAN MCDADE: But the handling of those
20 control rods would be no different during the period
21 of extended operation than during the original
22 license. They'd be subject to the same replacement
23 criteria, would they not? So why does this have to do
24 with the aging management and whether or not there
25 should be a period of extended operation as opposed to

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1 just the current operating license of the plant?

2 DR. LAHEY: Well, I'm concerned with what
3 happens during the period of extended operation. And
4 this is a possible event that can happen, it's no
5 different than some of the static components. And
6 just because you can replace them doesn't mean that
7 they couldn't be at risk if you have an event which
8 causes a significant shock load.

9 CHAIRMAN MCDADE: Okay. But my question
10 is, why would that be any different during the period
11 of extended operation than it is during the original
12 licensing period?

13 DR. LAHEY: Oh, I misinterpreted your
14 question. It wouldn't, not for the control rods
15 themselves.

16 CHAIRMAN MCDADE: Okay. Thank you. Dr.
17 Wardwell?

18 ADMIN. JUDGE WARDWELL: Entergy's
19 testimony, 616, Answer 100, Page 57, "the control rod
20 guide tube assemblies, including the guide plates
21 (CRGTs) and the lower flange welds are subject to
22 aging management review and the effects of aging on
23 these components are managed through the RVI AMP."
24 And they're citing again NL12-037 Attachment 2 at 4 to
25 5 and Attachment 1 at 6 to 8. And those two

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1 attachments, if we remember, are the Inspection Plan
2 and the AMP, respectively and that's New York State
3 496. Dr. Lahey, therefore, is incorrect when he
4 asserts that Entergy has claimed that the guide tubes,
5 plates, pins, and welds associated with control rods
6 are not RVIs. Dr. Lahey, do you now agree that the
7 control rod guide tube assemblies, including the guide
8 plates and the lower flange welds are in fact subject
9 to aging management review and part of the AMP for
10 RVIs?

11 DR. LAHEY: Yes, I believe they are.

12 ADMIN. JUDGE WARDWELL: Okay.

13 DR. LAHEY: And they should be.

14 ADMIN. JUDGE WARDWELL: Thanks. New York
15 State's testimony, 482, Page 45, Lines 3 through 9,
16 because of geometric considerations, many pressure
17 water reactors, including IP2 and IP3, cannot meet the
18 U.S. NRC's required minimum coverage for the non-
19 destructive testing of so-called J-groove welds. And,
20 thus, the integrity of these important CRD stub tube
21 welds cannot be directly confirmed by inspection.
22 I'll start with you, Dr. Lahey, and what do you mean
23 by the CRD stub tube welds?

24 DR. LAHEY: Well, this is one of the issues
25 we talked about this morning, when we were talking

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1 about the possibility of a leakage forming and boron
2 and water and forming boric acid and that sort of
3 thing. So this is the weld on the inside. And as I
4 understand it, they cannot get a complete inspection
5 of this.

6 ADMIN. JUDGE WARDWELL: Okay. And what
7 does that CRD stand for or --

8 DR. LAHEY: Oh, I'm sorry.

9 ADMIN. JUDGE WARDWELL: No, that's true, I
10 appreciate what you've answered so far, that helped.
11 But I also want to know what is the --

12 DR. LAHEY: Control rod drive.

13 ADMIN. JUDGE WARDWELL: Got you. Got you,
14 okay. Thank you. Entergy's testimony on 616, Answer
15 101, Page 57 and 58, the reactor pressure vessel head
16 penetration nozzle welds, sometimes referred to as J-
17 groove welds, are not RVIs or even part of the reactor
18 vessel pressure, but instead part of the reactor
19 pressure vessel head. Aging effects applicable to the
20 J-groove welds on the, and this must mean control rod
21 drive M, head penetrations are managed under the
22 reactor vessel head penetration inspection AMP. So,
23 Entergy, what is the M of the control rod drive stand
24 for?

25 MR. COX: The M -- this is Alan Cox for

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1 Entergy. The M stands for mechanism.

2 ADMIN. JUDGE WARDWELL: Okay, mechanism.
3 And, so, back to you, Dr. Lahey, and I think we
4 covered this morning, do you now agree that these are
5 managed under a different Aging Management Program and
6 are not really part of this Contention?

7 DR. LAHEY: Well, they are reactor vessel
8 internals. I mean, they're in the vessel, they're
9 subject to aging. How they want to deal with it is
10 not a great concern to me, as long as it's dealt with.

11 ADMIN. JUDGE WARDWELL: Good, thank you.
12 Let's move on to a couple of materials we're dealing
13 with. The first one we'll deal with is wrought
14 Austenitic stainless steel. Entergy's testimony on
15 Exhibit 616, Answer 105, Page 61, says that the
16 majority of the Indian Point reactor vessel internal
17 components are fabricated from wrought Austenitic
18 stainless steels. Even though an increase in strength
19 and decrease in toughness do occur when exposed to
20 neutron irradiation, these materials retain their
21 resistance to fast fracture within the operating
22 temperature of interest for PWRs. The only exceptions
23 are wrought Austenitic stainless steel materials with
24 high amounts of cold working, and that's greater than
25 20 percent of cold working, but these materials are

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1 not present at Indian Point. And I think my first
2 question for Entergy would be that, what do you mean
3 by this cold working and what percentage do you have
4 here at Indian Point?

5 DR. LOTT: Cold working is basically the
6 rolling of the material or the stretching of the
7 material, the working of the material to increase its
8 yield strength. The more you -- for instance, you
9 would take a plate and reduce the area by rolling it,
10 the higher the strength becomes. In general, the
11 reactor internals are not cold worked beyond about 15
12 percent, they're controlled. That's one of our
13 screening criteria that we have been in fact
14 evaluating for.

15 ADMIN. JUDGE WARDWELL: Okay. Thank you.
16 And, Dr. Lahey, do you have any issues with those
17 statements made in their original testimony or what
18 was -- as amplified here?

19 DR. LAHEY: Are you asking me if I agree
20 with the percentage of cold work they have or --

21 ADMIN. JUDGE WARDWELL: Yes. And with
22 that, why they don't see the issue with the Austenitic
23 steel that is exhibited when cold working is greater
24 than 20 percent.

25 DR. LAHEY: But my understanding is, maybe

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1 I misunderstood the statement you read, it was focused
2 on that stainless steel is not subject to stress
3 corrosion or embrittlement if it's not cold worked.
4 Did I misunderstand that?

5 ADMIN. JUDGE WARDWELL: No, this dealt
6 mostly -- well, let me repeat it again. The majority
7 of the reactor vessel components are fabricated from
8 wrought Austenitic stainless steel. Do you agree with
9 that?

10 DR. LAHEY: I agree with that, absolutely.

11 ADMIN. JUDGE WARDWELL: And even though an
12 increase in strength and decrease in toughness do
13 occur when exposed to neutron irradiation --

14 DR. LAHEY: Okay.

15 ADMIN. JUDGE WARDWELL: -- these materials
16 retain their resistance to fast fracture within the
17 operating range of interest for PWRs.

18 DR. LAHEY: I don't agree with that. I
19 mean, certainly, there are components that we've
20 talked about that are highly embrittled and do not
21 satisfy that.

22 ADMIN. JUDGE WARDWELL: Okay. And they say
23 that the only exception are those wrought Austenitic
24 stainless steels with high amounts of cold working,
25 greater than 20 percent. And would you agree that if

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1 you had cold rolling steels greater than 20 percent,
2 they wouldn't necessarily show an increase in strength
3 or decrease in toughness and retain their resistance
4 to fast fractures within the operating temperatures?

5 DR. LAHEY: No, I would not.

6 ADMIN. JUDGE WARDWELL: You would not? So
7 you think they still would retain theirs even if you
8 did have cold working --

9 DR. LAHEY: Yes, I think if they're highly
10 embrittled, they are subject to fracture.

11 ADMIN. JUDGE WARDWELL: Right. So then you
12 would agree that, that is an exception from their
13 abilities to resist fast fracturing?

14 DR. LAHEY: I guess. I mean, I think if
15 you have a material that's stainless steel and it has
16 fluence above a certain level, and we talked about
17 that level this morning, it becomes embrittled and
18 then if subjected to the right kind of load, it can in
19 fact fail. And we can talk about dimple failure,
20 fracture versus --

21 ADMIN. JUDGE WARDWELL: We will in a
22 minute.

23 DR. LAHEY: -- to me that's semantics, it
24 failed.

25 ADMIN. JUDGE WARDWELL: Thank you.

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1 CHAIRMAN MCDADE: A quick question, this is
2 probably going to seem very basic to you all. We've
3 been talking about Austenitic stainless steel, what
4 does that mean? What is Austenitic stainless steel?
5 Dr. Lahey or Dr. Lott or anybody can offer what that
6 definition is as opposed to just stainless steel.

7 MR. GORDON: This is Barry Gordon from
8 Entergy. Austenitic stainless steel is a -- it's
9 named after the fellow who discovered the micro-
10 structure. It's a face centered cubic structure.
11 Austenitic stainless steel is not magnetic, a magnet
12 will not stick to it, and it can only be strengthened
13 by cold working. You can't heat treat it like you can
14 some other alloys, like low alloy steel, you can only
15 strengthen it by cold working it to some extent.

16 CHAIRMAN MCDADE: What are the different
17 characteristics of Austenitic stainless steel as
18 opposed to just your typical stainless steel? Are
19 there significant differences?

20 MR. GORDON: Well, there is a ferritic
21 stainless steel and there's a martensitic stainless
22 steel. Martensitic stainless steels can be hardened
23 and that's what -- like you have a stainless steel
24 cutlery at home, those are martensitic stainless
25 steels. And they'll stick, you have a magnetic board

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1 and you can put your knives on it. But Austenitic
2 stainless steel is not a magnetic material.

3 CHAIRMAN MCDADE: Okay. For our purposes
4 right here in the way that it reacts, not how you put
5 it together, not how you work it, but how it reacts
6 over time, is there any specific distinction with it
7 being Austenitic stainless steel?

8 MR. GORDON: It's a very ductile material,
9 it can be embrittled, like Dr. Lahey said, by
10 irradiation, and it can be strengthened by cold
11 working also, and also by irradiation.

12 CHAIRMAN MCDADE: Okay, thank you.

13 ADMIN. JUDGE WARDWELL: As a follow-up --

14 MR. GRIESBACH: Your honor, this is Tim
15 Griesbach --

16 CHAIRMAN MCDADE: I'm sorry, who?

17 ADMIN. JUDGE WARDWELL: A follow-up
18 question on that, which is extremely important to
19 cover. When I buy some stainless steel fittings and
20 stuff, sometimes a magnet will stick, to say, washer
21 fenders and sometimes it won't. Now, it won't be
22 strong, but some of them there's nothing and other
23 times there is and, yet, it's supposed to be a
24 stainless steel. What am I getting?

25 MR. GORDON: It really depends. There's

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1 six families of stainless steels and there's also a
2 new family called the super stainless steels that have
3 more alloying elements in it. If you go to like a
4 Best Buy --

5 ADMIN. JUDGE WARDWELL: Yes, I'm going to
6 an Ace Hardware.

7 MR. GORDON: -- that's supposed to be a
8 stainless steel refrigerator and you can bring a
9 magnet if you want -- you really probably want
10 Austenitic stainless steel and that's probably what
11 you want in your sink also. But if you can bring a
12 magnet along, you can see if it's really Austenitic or
13 maybe ferritic stainless steel.

14 ADMIN. JUDGE WARDWELL: But, yet, I've
15 bought these fender washers --

16 MR. GORDON: Yes.

17 ADMIN. JUDGE WARDWELL: -- and some of them
18 it won't stick and other times it'll stick a little
19 bit, it won't stick heavy, but it's not going to be
20 like a --

21 MR. GORDON: Well, some of them, if you
22 could work Austenitic stainless steel, you get this
23 diffuseness reaction, which you get martensite in the
24 Austenitic stainless steel. Part of it will be
25 transfer -- and you can measure this magnetically.

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1 And this means you're -- it's a way of even measuring
2 the amount of cold working you have by how much
3 martensite you have in the Austenite.

4 ADMIN. JUDGE WARDWELL: So when I bring my
5 magnet to my local Ace Hardware dealer, I can impress
6 him, finally --

7 MR. GORDON: Yes. I mean --

8 ADMIN. JUDGE WARDWELL: -- instead of
9 looking like a fool in the hardware store with my
10 magnet go, oh, well, that one's had some cold working
11 and this is pure --

12 MR. GORDON: Right.

13 ADMIN. JUDGE WARDWELL: -- Austenitic
14 steel.

15 MR. GORDON: That's right. And steel comes
16 --

17 ADMIN. JUDGE WARDWELL: Thank you.

18 MR. GORDON: -- these manufacturers make a
19 stainless steel looking thing, but it's actually made
20 out of carbon steel, but they just put a finish on it.
21 So bring your magnet.

22 ADMIN. JUDGE WARDWELL: I thought we
23 weren't going to get anything out of this hearing and
24 I have been proven wrong.

25 (Laughter.)

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1 ADMIN. JUDGE WARDWELL: Especially when I
2 tell him, gee, I wonder if this is a cast Austenitic
3 stainless steel or a CASS. Which brings us a nice
4 segue into NRC's testimony, 197, Answer 161, Page 92,
5 where the A/LAI, Action Item 7 requires an applicant
6 or a licensee to perform a plant specific analysis of
7 cast RVI components to demonstrate the components will
8 remain capable of performing their intended functions
9 during the period of extended operation. I guess my
10 question for Entergy is that citing your testimony on
11 Answer 175, Page 114, does not the Action Level 7
12 require that this analysis account for the potential
13 loss of fracture toughness of the components due to
14 both thermal embrittlement and irradiation
15 embrittlement?

16 DR. LOTT: Give me a minute to get
17 organized here. Can you give me the citation again?

18 ADMIN. JUDGE WARDWELL: Sure, the citation
19 that it was citing was your testimony, Answer 175,
20 Page 114 in response to that. I'm just asking, does
21 not the A/LAI Number 7, which again you see in MRP 227
22 or in the Aging Management Plan, I may be able to find
23 that, but does not that require, A/LAI 7, does that
24 not require that the analysis account for the
25 potential loss of fracture toughness of the components

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1 due to both thermal embrittlement, or TE as we'll call
2 it, and irradiation embrittlement, IE as we'll call
3 it?

4 MR. DOLANSKY: This is Bob Dolansky for
5 Entergy. The answer's yes.

6 ADMIN. JUDGE WARDWELL: Say again?

7 MR. DOLANSKY: The answer is yes.

8 ADMIN. JUDGE WARDWELL: Okay. It does --

9 MR. DOLANSKY: Yes.

10 ADMIN. JUDGE WARDWELL: -- require that,
11 okay. New York State in their testimony, 576, Page 5,
12 Lines 1 through 17, and through Page 6, Lines 11
13 through 20, that in regards to NUREG/CR-7184, New York
14 State contends that the following observations support
15 previous opinions and testimony. And one of those,
16 the first observation is that for cast materials,
17 synergies may exist between TE, the thermal
18 embrittlement, and the irradiation embrittlement.
19 And, two, embrittled cast materials were observed to
20 experience transgranular brittle cleavage and ductile
21 tearing. And I guess the first question I will have
22 for Entergy is, what does transgranular brittle
23 cleavage and ductile tearing look like and how are
24 they formed and when are they formed and when are they
25 an issue?

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1 DR. LOTT: Okay. We talked earlier about
2 Austenitic stainless steels and ferritic stainless
3 steels, or ferritic steels in general. For instance,
4 a reactor pressure vessel steel is a ferritic steel.
5 It's subject to a brittle fracture at low temperatures
6 that cuts across the grain because it's a very flat
7 surface, it's essentially a cleaving of the crystal
8 structure in the grain, a very brittle failure. That
9 does not tend to happen in the Austenitic stainless
10 steels where the failures remain ductile, they fail by
11 stretching of the material and eventually finding
12 small dimples or ruptures in the material and pulling
13 it apart. So there's a difference in the fracture
14 process between a cleavage failure, which is a very
15 low ductility, lower shelf reactor pressure vessel
16 kind of failure, and the failures we see normally in
17 stainless steels.

18 ADMIN. JUDGE WARDWELL: But say again, what
19 is that transgranular brittle cleavage look like? It
20 looks like a cut surface or a sheared surface or --

21 DR. LOTT: Yes. There's no deformation on
22 the surface, it's very clearly flat and sometimes
23 stepped.

24 ADMIN. JUDGE WARDWELL: So it just looks
25 like a break in the surface?

1 DR. LOTT: Yes, it's a very -- it's a clean
2 break, I guess is the best way to say it.

3 ADMIN. JUDGE WARDWELL: A crevice in a rock
4 type of thing?

5 DR. LOTT: What's the best way to describe
6 this?

7 ADMIN. JUDGE WARDWELL: Or a crack in a
8 rock?

9 DR. LOTT: Yes. Certain rocks you would
10 fail by cleavage, that's true.

11 ADMIN. JUDGE WARDWELL: And so what is
12 ductile tearing? Is that what the --

13 DR. LOTT: Ductile tearing is the manner in
14 which a crack in a ductile material would advance. So
15 when this begins to fail, you begin to slowly -- it
16 would continue to deform or continue to show some --
17 reconnected and you'd form small voids that would
18 grown into little pockets that would give you these
19 dimpled rupture effects on the surface of the
20 specimen.

21 ADMIN. JUDGE WARDWELL: And so usually
22 you'd say this ductile tearing is associated with
23 dimples at the surface?

24 DR. LOTT: Yes. You can tell by looking at
25 the surface that it's failed in this manner, under a

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1 microscope, not necessarily -- well, you might be able
2 to tell by eye.

3 ADMIN. JUDGE WARDWELL: Okay. And this
4 dimpled surface will appear before or after the
5 tearing? I mean, can't you just tell by the split in
6 the tearing or do you see the tear or --

7 DR. LOTT: Well, you can tell, obviously,
8 by the load -- if you're tearing this part and you're
9 measuring the load displacement, you can see that it's
10 continually taking new force to pull it apart.
11 Whereas a brittle fracture, a cleavage fracture, will
12 obviously be real sudden.

13 ADMIN. JUDGE WARDWELL: So a transgranular
14 brittle cleavage would be a definitive break, is that
15 a fair assessment? Where the ductile tearing, you may
16 not see a separation of the material, it just may be
17 a necking down and possibly this dimpling on the
18 surface that you talk about?

19 DR. LOTT: Well, eventually you will form,
20 after it's necked down, you'll begin eventually to
21 form cracks and those cracks will have these dimpled
22 ruptured surface. We're talking about the fracture
23 surface of the specimen, when it separates and you
24 look at it, that's where you'd see the dimples.

25 ADMIN. JUDGE WARDWELL: Okay, thank you.

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1 MR. STROSNIDER: Your honor, this is Jack
2 Strosnider from Entergy. And maybe this will help you
3 visualize it. When you have a cleavage fracture, it's
4 flat because when it's transgranular, it's going along
5 the atoms. Basically it's a shiny, when you look at
6 that surface when it fails, it's shiny because it's
7 very flat. When you have the ductile failure, because
8 of the dimpled, because you have to break little
9 pieces of material, it's got a duller surface and you
10 can see it's not the flat sort of surface that you
11 would see in a cleavage fracture.

12 ADMIN. JUDGE WARDWELL: But both of them
13 are failure surfaces though that you're looking at?

14 MR. STROSNIDER: Oh, yes.

15 ADMIN. JUDGE WARDWELL: Okay.

16 MR. STROSNIDER: It comes apart.

17 ADMIN. JUDGE WARDWELL: Great. Thank you.
18 Now, do you agree with New York's statements in
19 regards to the observations from this NUREG 7184 that
20 the Cast materials synergies may exist between thermal
21 embrittlement and irradiation embrittlement and, two,
22 the embrittled Cast materials were observed to
23 experience these two types of failures?

24 DR. LOTT: I'm not sure that I -- I don't
25 think I do agree with the term synergism. I think

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1 that has a meaning to me that I don't see proven in
2 any of the data. I do agree that irradiation
3 embrittlement and thermal embrittlement may both --
4 either one may happen in a Cast material.

5 ADMIN. JUDGE WARDWELL: Either one or both?

6 DR. LOTT: Well, certainly a material can
7 be subject to both these conditions at the same time.
8 It's just not clear that they interact to me
9 synergistically.

10 ADMIN. JUDGE WARDWELL: Okay. Dr. Lahey,
11 I want to ask you, did the NUREG 7181 use the term
12 synergy between them or how did you -- what did they
13 say in regards to the reference, I guess, to your
14 first statement that for Cast materials synergies may
15 exist between TE and IE?

16 DR. LAHEY: Your honor, this is Richard
17 Lahey, New York. I would actually have to go back and
18 look at it to see if it used that word. This word is
19 used often, in fact it was one of the things that
20 Judge McDade gave me as a homework to read something
21 and it asked about the synergy between these two
22 effects for cast stainless steel. And so it's not
23 something I made up. It may or may not be in NUREG
24 7184, I'd have to check.

25 ADMIN. JUDGE WARDWELL: So that could be

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1 your wording in regards to interpreting what they said

2 --

3 DR. LAHEY: Yes. I mean, my --

4 ADMIN. JUDGE WARDWELL: -- in regards to
5 the interaction between the TE and the IE?

6 DR. LAHEY: My personal belief is that you
7 certainly can have both of them and the effect can be
8 larger than each one separate. That's what I mean by
9 synergy.

10 ADMIN. JUDGE WARDWELL: And say that again,
11 what you mean by synergy?

12 DR. LAHEY: Synergy means that they
13 reinforce each other and the combination is more than
14 each effect separate.

15 ADMIN. JUDGE WARDWELL: But wouldn't it be
16 more than just the sum also?

17 DR. LAHEY: Yes.

18 ADMIN. JUDGE WARDWELL: Because that would
19 be the synergy --

20 DR. LAHEY: That's what I meant, I'm sorry.

21 ADMIN. JUDGE WARDWELL: -- you take this
22 TE, you take IE and yes it's more than either one of
23 them --

24 DR. LAHEY: Right.

25 ADMIN. JUDGE WARDWELL: -- but likewise,

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1 it's more than the sum of the whole.

2 DR. LAHEY: Exactly.

3 ADMIN. JUDGE WARDWELL: Okay. Thank you.

4 DR. LOTT: Your honor --

5 ADMIN. JUDGE WARDWELL: Yes.

6 DR. LOTT: -- I think in that document,
7 7184, I have some notes on it here. It basically did
8 show that irradiation, relatively low doses 0.08 dpa,
9 can trigger a response in the material that similar to
10 thermal embrittlement, these materials that are
11 normally subject to thermal embrittlement. And what
12 happened effectively was that thermal embrittlement by
13 itself would produce an effect, the irradiation
14 produced a similar effect without the thermal
15 embrittlement, materials that were combined showed
16 about the same. So that's why I'm concerned that they
17 were not necessarily a synergistic effect. Yes, there
18 was an effect of thermal embrittlement, yes, there was
19 an effect of irradiation embrittlement, but to me, the
20 suggestion that it's a synergistic effect would say
21 that it could be larger combined than it is
22 individually.

23 ADMIN. JUDGE WARDWELL: Okay thank you.

24 CHAIRMAN MCDADE: Are you saying that it
25 isn't or you don't know?

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1 DR. LOTT: I just don't -- it doesn't meet
2 my definition for what I would call synergistic.

3 CHAIRMAN MCDADE: Okay. As I understood
4 that, the definition you would use is that it's larger
5 than the sum of the individual parts.

6 DR. LOTT: Right. If I had both, in the
7 specimen if I had both irradiation and thermal
8 embrittlement, the decrease was about the same as it
9 was just due to irradiation and thermal embrittlement
10 alone. I think that's Figure 142 in the document.
11 That's probably 14.2, my handwriting is very bad, I'm
12 sorry.

13 ADMIN. JUDGE WARDWELL: And, Dr. Lahey, I
14 will leave you with this comment, that if you would
15 like to explore 7184 and come up with the wording that
16 they use that would support the synergistic effects of
17 this, meaning that there's some words in there that
18 state that the TE and the IE amplify one another to
19 the point that the effect is greater than the sum of
20 the two, then feel free to present that to us --

21 DR. LAHEY: Yes, sir.

22 ADMIN. JUDGE WARDWELL: -- whenever you
23 have a chance to review that further within the
24 context of why we're here this week.

25 DR. LAHEY: Yes, sir, I will. In fact

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1 though, I've read that in a number of Argonne reports
2 from researchers at Argonne.

3 ADMIN. JUDGE WARDWELL: Well, I'm mostly
4 interested in -- I'm only interested in this regard in
5 --

6 DR. LAHEY: Okay.

7 ADMIN. JUDGE WARDWELL: -- regards to this
8 as applied to 7184. Thank you.

9 DR. LAHEY: Thank you.

10 CHAIRMAN MCDADE: Okay. And, Dr. Lott, you
11 referenced Figure 142? Is that what you said?

12 DR. LOTT: We're looking it up right now.
13 Can we get back to perhaps in a --

14 CHAIRMAN MCDADE: Sure.

15 ADMIN. JUDGE WARDWELL: Entergy's
16 testimony, 616 again, Answer 106, Page 64, although
17 stainless steel and nickel alloy RVI materials are
18 also subject to irradiation embrittlement, they do not
19 undergo a ductile to brittle transition or fail by
20 brittle cleavage, even though the neutron exposure
21 levels are much higher than those of the vessel.
22 However, at fluences above the MRPA 175 screening
23 threshold, it is recognized that these Austenitic
24 stainless steels will experience decreases in fracture
25 initiation toughness and in the resistance to ductile

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1 tearing. These effects have been explicitly
2 considered in the MRP 227-A guidelines and in the RVI
3 AMP implementation at Indian Point. And I guess my
4 question for Entergy, I just want to confirm that your
5 use of the word brittle cleavage is the same as this
6 transgranular brittle cleavage that we were talking
7 about earlier?

8 MR. STROSNIDER: Your honor, this is Jack
9 Strosnider for Entergy. That's correct, but --

10 ADMIN. JUDGE WARDWELL: Thank you.

11 MR. STROSNIDER: -- I think the point here
12 that needs to be understood, the point that's being
13 made, we continue to discuss about highly embrittled
14 materials. These Austenitic materials are embrittled
15 and there is a reduction in fracture toughness. The
16 thing you need to understand is when they test that
17 fracture toughness, it still shows ductility, it's not
18 failing by cleavage fracture. They're developing
19 what's called a J-R curve, which requires some
20 ductility in order to fail it. So, I just want to put
21 this highly embrittled in context. There's
22 embrittlement, but there's still ductility in these
23 specimens, they're not failing by cleavage fracture,
24 they don't go through the transition that the ferritic
25 materials go through. It's very important in

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1 understanding how these materials can respond to
2 various loads, including the accident loads.

3 ADMIN. JUDGE WARDWELL: And in this Answer
4 106 on Page 64, you say that they do not undergo
5 ductile to brittle transition or failure by, I'm
6 inserting now, the transgranular brittle cleavage,
7 correct?

8 MR. STROSNIDER: Right.

9 ADMIN. JUDGE WARDWELL: So they don't fail
10 by brittle cleavage, but they do still have resistance
11 to ductile tearing, is that correct?

12 MR. STROSNIDER: Jack Strosnider for
13 Entergy. Yes, that is correct.

14 ADMIN. JUDGE WARDWELL: Thank you. So in
15 summary, the aging effects of RVIs do not include
16 transgranular brittle cleavage, but do include ductile
17 tearing. But how about some of the other effects that
18 we've talked about? And I think they include
19 cracking, dimensional changes, wearing, dimpling,
20 stress relaxation, and void swelling cracking. Do
21 they exhibit those types of effects? And we can stay
22 with you, Mr. Jack, I can't see your name so I can't
23 --

24 MR. STROSNIDER: Jack Strosnider for
25 Entergy. Yes, they do. Those are the type of effects

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1 that are identified in the program and managed by the
2 program.

3 ADMIN. JUDGE WARDWELL: Okay, thank you.
4 Entergy's testimony, 722, Answer 8, Page 5, says the
5 existing research also suggests that combined thermal
6 aging and irradiation of representative CASS materials
7 does not appear to lower toughness below what is
8 expected for thermal embrittlement alone. And I guess
9 I'd ask, what's the basis for this statement? Of
10 anyone from Entergy that would like to respond.

11 DR. LOTT: Let me first respond by
12 correcting my previous figure number. It's Figure 98
13 on Page 142. I had them switched in my notes.

14 ADMIN. JUDGE WARDWELL: Okay. Thank you.

15 DR. LOTT: And in fact, that figure I think
16 actually makes the same point that he just said and
17 that I said earlier, which was that the effect of
18 thermal embrittlement and irradiation embrittlement in
19 these high ferrite materials, and we haven't talked
20 about necessarily high ferrite and low ferrite
21 materials, these relatively high ferrite materials do
22 show thermal aging and irradiation caused a similar
23 effect.

24 MR. GRIESBACH: Your honor, this is Tim
25 Griesbach from Entergy. I think one thing that we

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1 should point out is that the materials we're talking
2 about at Indian Point in the lower support columns are
3 known to be low in delta ferrite. It's that delta
4 ferrite content that causes the thermal embrittlement
5 that we keep referring to and the materials in these
6 plants are known to not be susceptible to thermal
7 embrittlement based on their low delta ferrite. So,
8 by saying that, they should also not be affected by
9 the synergistic effects of thermal and irradiation
10 embrittlement.

11 ADMIN. JUDGE WARDWELL: Okay. Let me, I
12 guess -- I'm getting swamped by too much information
13 here, I think. And then diversion over to one chart
14 and then I didn't know whether they answered my
15 question or not is the way I interpreted it. You're
16 testimony, Entergy's testimony, 722, Answer 8, Page 5,
17 says the existing research also suggests that the
18 combined thermal aging and irradiation of
19 representative CASS materials does not appear to lower
20 toughness below what is expected for thermal
21 embrittlement alone. And my question to you is, what
22 is the basis for that statement?

23 DR. LOTT: And, again, I think it's
24 illustrated -- I was trying to answer your question
25 with my previous answer. In the data that was shown,

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1 it shows exactly what --

2 ADMIN. JUDGE WARDWELL: And I'm sorry, I
3 can't --

4 DR. LOTT: The data that's shown in that
5 figure shows that you start -- and again, for three
6 different materials, all high ferrite materials, where
7 thermal embrittlement would potentially happen, they
8 were either irradiated or thermally treated and the
9 decrease in toughness in the J-integral toughness was
10 basically the same in both cases. In other words, the
11 thermal embrittlement and the irradiation
12 embrittlement and the three of them together all gave
13 very similar results.

14 ADMIN. JUDGE WARDWELL: But the cast
15 materials that we're dealing with aren't high ferric
16 are they?

17 DR. LOTT: The cast materials we're dealing
18 are low ferrite, so we would not expect to see thermal
19 embrittlement, nor would we expect to see any large
20 amount of irradiation embrittlement by the same
21 mechanism.

22 ADMIN. JUDGE WARDWELL: So why does that
23 figure, which deals with high ferric, provide a basis
24 for your statement that the existing research suggests
25 that combined thermal aging and irradiation of

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1 representative CASS materials did not appear to lower
2 toughness below what is expected for thermal
3 embrittlement alone?

4 MR. STROSNIDER: This is Jack Strosnider
5 for Entergy and let me see if I can clarify this.

6 ADMIN. JUDGE WARDWELL: Sure.

7 MR. STROSNIDER: I think the first part of
8 the answer that Dr. Lott gave is a generic discussion
9 about the laboratory data --

10 ADMIN. JUDGE WARDWELL: Fine.

11 MR. STROSNIDER: -- which includes high
12 delta ferrite materials. When we talk about the
13 material at Indian Point, in particular the lower
14 columns, they are low delta ferrite not susceptible to
15 thermal aging, and, therefore, this -- what you see in
16 the generic data is really not applicable at Indian
17 Point because of the specific material that's at
18 Indian Point. So a generic part of the response and
19 a plant specific part of the response.

20 ADMIN. JUDGE WARDWELL: And so the plant
21 specific, you've made a statement that, again, I'll
22 read for the third time. The existing research also
23 suggests that combined thermal aging and irradiation
24 of representative CASS materials, which is what you
25 have at Indian Point, correct?

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1 MR. STROSNIDER: Read that again, please?

2 MR. GRIESBACH: This is Tim Griesbach. The

3 --

4 ADMIN. JUDGE WARDWELL: CASS material, you
5 have -- you're dealing with CASS material. For those
6 CASS materials at Indian Point, do not appear to lower
7 toughness below what is expected for thermal
8 embrittlement alone. That was your statement. My
9 question is, where did that come from?

10 MR. DOLANSKY: This is Bob --

11 ADMIN. JUDGE WARDWELL: What is the basis
12 for it? Point me to a graph that demonstrates not
13 what it isn't, I want to see a graph for what it is or
14 some other discussion of why you came up with that
15 statement or how you came up with that statement.

16 MR. DOLANSKY: This is Bob Dolansky with
17 Entergy. I believe the graph that Dr. Lott pointed to
18 contains CF-8 material and that is --

19 ADMIN. JUDGE WARDWELL: Whoa, what's CF-8
20 material? Now we've got another material.

21 (Laughter.)

22 MR. DOLANSKY: -- which that is what we
23 have at Indian Point.

24 ADMIN. JUDGE WARDWELL: That's CASS?

25 MR. DOLANSKY: That's CASS and it's --

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1 ADMIN. JUDGE WARDWELL: Great.

2 MR. DOLANSKY: -- low delta ferrite.

3 ADMIN. JUDGE WARDWELL: Yes, great.

4 MR. DOLANSKY: That is, I believe, and Dr.

5 Lott can correct me if I'm wrong, but that figure that

6 he gave you contains the low delta ferrite CF-8

7 material that's CASS that we have at Indian Point.

8 ADMIN. JUDGE WARDWELL: Okay. And you're
9 referring to Figure 98 on Page 142?

10 MR. DOLANSKY: Yes.

11 ADMIN. JUDGE WARDWELL: Okay. Because by
12 the time we get with putting the record together and
13 look at the transcript, we want to make sure we have
14 it.

15 MR. DOLANSKY: This figure here.

16 ADMIN. JUDGE WARDWELL: And so it's on our
17 screen now?

18 DR. LOTT: Yes.

19 ADMIN. JUDGE WARDWELL: Okay. Right? Is
20 that the one you're referring to?

21 MR. DOLANSKY: Yes.

22 DR. LOTT: Yes.

23 ADMIN. JUDGE WARDWELL: Okay. So how does
24 that support this statement that CASS materials do not
25 appear to lower toughness below what is expected for

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1 thermal embrittlement alone?

2 DR. LOTT: Well, I'm not sure what part of
3 your question I'm missing. I mean, if you look at the
4 data here, both irradiation and aging produce a
5 similar decrease in toughness and the material that is
6 both irradiated and aged has a very similar,
7 particularly in the CF-8 material, is a similar
8 toughness. Now, in the CF-8 materials in Indian
9 Point, we don't expect to see these decreases due to
10 thermal aging because the CF-8 material there is low
11 ferrite.

12 MR. COX: This is Alan Cox with Entergy.
13 And let me give you my layman's interpretation of what
14 this drawing shows. It shows --

15 ADMIN. JUDGE WARDWELL: Sure, just get a
16 little closer to your mic though because I can hear
17 you better.

18 MR. COX: The tall bar on the graph is the
19 material at the beginning and then the arrows show --

20 ADMIN. JUDGE WARDWELL: And we're looking
21 at the blue tall bar, which we're going to focus only
22 on the CF-8, is that correct?

23 MR. COX: Sure. I'm just -- the response
24 is similar in all three cases. But if you --

25 ADMIN. JUDGE WARDWELL: Sure.

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1 MR. COX: -- the center one, the blue tall
2 bar is the starting condition. The dotted line that
3 says irradiation shows the decrease in the fracture
4 toughness as you irradiate the material. The dotted
5 line that says aging is the thermal aging. And you
6 can see it lowers -- both of those effects cause a
7 drop in the fracture toughness. The third bar, you
8 see another irradiation on the dotted line that goes
9 from the shorter blue bar to the pink/red colored bar
10 in front, that's the additional effect, that's
11 basically the combined effect of the --

12 ADMIN. JUDGE WARDWELL: Got you.

13 MR. COX: -- thermal aging and then the
14 irradiation. And you see it has a slightly lower
15 value than the irradiation alone, a little bit lower
16 than the thermal alone, but it's certainly not greater
17 than the sum of the two effects.

18 ADMIN. JUDGE WARDWELL: And what is CF-3
19 material?

20 DR. LOTT: It's just a different
21 specification of cast stainless steel.

22 ADMIN. JUDGE WARDWELL: Okay. So all of
23 these are cast stainless steel materials?

24 DR. LOTT: Yes.

25 ADMIN. JUDGE WARDWELL: Dr. Lahey, any

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1 comments on how these graphs apply to what CASS
2 materials appear to do in regards to lowering
3 toughness below what is expected for thermal
4 embrittlement alone when you combine thermal aging
5 with irradiation of those?

6 DR. LAHEY: Just a request for a little bit
7 more information from Entergy. My understanding is
8 the delta ferrite in IP2 is like 14.6 percent, is that
9 correct?

10 ADMIN. JUDGE WARDWELL: Well, why don't I
11 ask the question. You tell me what you're interested
12 in and -- I want to make sure you're not --

13 DR. LAHEY: Well, the screening criteria is
14 15 percent and I'm trying to understand if that's what
15 they mean by low delta ferrite, the 14.6.

16 ADMIN. JUDGE WARDWELL: What do you mean by
17 low delta ferrite?

18 MR. AZEVEDO: Yes, your honor. This is
19 Nelson Azevedo for Entergy. It is true that both
20 Units 2 and 3 have low delta ferrite as measured by
21 the screening criteria 15 percent. So they're both
22 below 15 percent.

23 ADMIN. JUDGE WARDWELL: And do you have any
24 idea how far below?

25 MR. AZEVEDO: Yes. Unit 2 is 14 and

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1 change, Unit 3 is a little bit lower, like 11, 12.

2 ADMIN. JUDGE WARDWELL: Okay. Thank you.

3 Dr. Lahey, any other comments or --

4 DR. LAHEY: Yes. My comment is I wish my
5 colleague Dr. Duquette was here because this is his
6 field, he's a world class metallurgist. And he would
7 have a lot of comment on this and all I can give you
8 is secondhand information because this is not my
9 field.

10 ADMIN. JUDGE WARDWELL: But he's not even
11 a witness for this Contention, so even if he was here,
12 he would be a spectator.

13 DR. LAHEY: Okay. Well, I can tell you
14 what he would say if you want to hear that.

15 ADMIN. JUDGE WARDWELL: No. No, I'd like
16 to hear --

17 CHAIRMAN MCDADE: Just tell us what you
18 would say.

19 ADMIN. JUDGE WARDWELL: -- what your
20 professional interpretation might be of anything, but
21 only from what you're comfortable saying in regards to
22 your professional background.

23 DR. LAHEY: Well, concerning the data that
24 we have on the screen, the data speaks for itself. If
25 this is good data, that's what it is.

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1 ADMIN. JUDGE WARDWELL: Okay. Thank you.

2 CHAIRMAN MCDADE: Okay. It may speak for
3 itself, but it doesn't speak loud enough for me to
4 understand it. Okay. We start off --

5 ADMIN. JUDGE WARDWELL: You're never going
6 to understand this chart.

7 (Laughter.)

8 CHAIRMAN MCDADE: Okay. The low delta
9 ferrite, start from the premise that it's below 15
10 percent, it's 14 or 11 percent. How does that inform
11 your conclusion here?

12 DR. LAHEY: Well, if you want me to give
13 you some secondhand information, then I can do that.
14 But I can't give you any firsthand information other
15 than looking at the graph and what it shows to me is
16 there's obviously no synergism shown in this data.

17 CHAIRMAN MCDADE: Okay. There's no
18 synergism shown in this data, but from your
19 experience, do you believe when you have the low delta
20 ferrite that you would expect synergism?

21 DR. LAHEY: Not necessarily. I think it
22 depends on how the duplex structure is arranged. If
23 it's arranged in a certain way, it can have a
24 different effect than if it's arranged in a different
25 way. And unfortunately the only way you know that is

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1 with a destructive examination. So, I think you do
2 have to rely on data that shows, here -- when I am
3 talking about synergism, there's a number of other
4 experiments, not necessarily for these type of
5 percentages of delta ferrite, which do show synergism.
6 But it may be, apparently is, for the materials used
7 in Indian Point, this is the result you get.

8 CHAIRMAN MCDADE: So you're saying that
9 based on data that you have observed, if the
10 percentage was not 11 percent, but was 20 percent or
11 40 percent, it would have a different effect on your
12 conclusion with regard to synergism?

13 DR. LAHEY: That's my understanding of the
14 reading that I've done, yes.

15 CHAIRMAN MCDADE: Okay, thank you.

16 ADMIN. JUDGE KENNEDY: Dr. Lahey, this is
17 Judge Kennedy. If I looked at the material CF-3, look
18 at the data there, does that show more synergism than
19 CF-8 does?

20 DR. LAHEY: Well, if I understand the way
21 they're doing it, it would show less. The one on the
22 right, the little pink or red or whatever color that
23 is on the right is lower than the one on the left. So
24 it's a little odd that the thermal aging plus
25 irradiation would give you lower, but it depends on

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1 the level of irradiation, I suppose.

2 ADMIN. JUDGE KENNEDY: All right, thank
3 you.

4 ADMIN. JUDGE WARDWELL: Yes. I guess that
5 raises a question I hadn't really come up with. What
6 is this J-integral that we're plotting on the Y axis?

7 DR. LOTT: It's a measure of the ductile
8 fracture toughness.

9 ADMIN. JUDGE WARDWELL: So that's the
10 measure of the toughness?

11 DR. LOTT: The toughness being the
12 resistance to crack initiation. And, again, I'll use
13 that word, let me qualify. In a J-integral test, you
14 would start with a crack specimen and you would
15 basically be measuring how much it would take to
16 reinitiate and grow that crack.

17 ADMIN. JUDGE WARDWELL: To reinitiate and
18 what that crack?

19 DR. LOTT: Grow it.

20 ADMIN. JUDGE WARDWELL: Grow that crack.
21 So what do low values of J mean? That it's not
22 susceptible to cracking or susceptible to crack or --

23 DR. LOTT: It's not the susceptibility to
24 cracking, it's susceptibility -- the impact of
25 cracking on the ability to maintain a load.

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1 ADMIN. JUDGE WARDWELL: On the ability --
2 so what are --

3 MR. STROSNIDER: This is Jack --

4 ADMIN. JUDGE WARDWELL: -- the low values
5 mean?

6 MR. STROSNIDER: This is Jack Strosnider
7 for Entergy, let me see if -- first of all, in terms
8 of the J-integral and what it is, it can be related to
9 the amount of energy that's required to allow the
10 crack to tear through the material, the preexisting
11 crack. It can be related to the energy for that. So
12 the lower the J value, the less energy it takes. But
13 this J-integral approach was developed specifically
14 for ductile materials. If the material is not
15 ductile, if it's going to fail in the cleavage mode
16 that we talked about earlier, there's a different
17 measure that's used for that. So, in this case, it's
18 related to energy, the lower that value, the lower the
19 energy. But in every case, it's showing some
20 ductility.

21 ADMIN. JUDGE WARDWELL: And so, while the
22 CF-8 shows that we reach the same level of the J-
23 integral with irradiation as we do with aging and
24 irradiation, the CF-3 material shows that we end up
25 with a lower value with the combination of the aging

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1 and the irradiation --

2 MR. STROSNIDER: Right.

3 ADMIN. JUDGE WARDWELL: -- than just
4 irradiation, which means less energy is needed to grow
5 the crack. Am I interpreting that correctly?

6 DR. LOTT: I supposed you could interpret
7 it that way. I must admit, I think it's within the
8 scatter in the data, within the accuracy of the data.
9 To make that conclusion would be difficult in my mind.

10 CHAIRMAN MCDADE: Okay, Dr. Lott, excuse
11 me. Could you either move yourself closer to the
12 microphone or the microphone closer to you?

13 DR. LOTT: Okay, sorry.

14 CHAIRMAN MCDADE: Okay, thank you.

15 ADMIN. JUDGE WARDWELL: So you think that
16 the data is plus or minus almost 100 percent because
17 it seems to be about half of what it is before and if
18 that's the noise, then that's accuracy of what we're
19 dealing with here in this graph? Can you see how I
20 reached that conclusion?

21 DR. LOTT: Yes, I see how you reached that
22 conclusion. It's hard for me to answer that question.

23 ADMIN. JUDGE WARDWELL: Fine, thank you.

24 DR. LOTT: Again, I think it's important to
25 point out that basically the materials that we're

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1 dealing with, we don't expect to see large amounts of
2 thermal embrittlement at all. Now, these materials
3 are higher in ferrite and we would expect to see that
4 happen. I think all materials measured at least at
5 levels greater than 20 percent.

6 ADMIN. JUDGE WARDWELL: Boy, you had me
7 right to the very end. These materials, what are you
8 referring to as these materials?

9 DR. LOTT: The materials in this graph, the
10 CF-3, the CF-8, and the CF-8M. The particular
11 materials that were tested.

12 ADMIN. JUDGE WARDWELL: But all of these --
13 now we're back to where we started I think.

14 DR. LOTT: I'm sorry.

15 ADMIN. JUDGE WARDWELL: What is the ferric
16 content of these materials on this graph?

17 DR. LOTT: The ferrite content in all three
18 cases I believe is greater than 20 percent, measured.

19 MR. DOLANSKY: Your honor, maybe I could
20 help a little bit. This is Bob Dolansky with Entergy.
21 CF-8 can have a range of delta ferrite. Indian Point
22 3 has CF-8 materials. We actually went and did the
23 research, pulled our CMTRs, our delta ferrite was
24 below 15 percent at both IPEC units. That doesn't
25 mean that all CF-8 is below 15 percent. Does that

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1 help?

2 ADMIN. JUDGE WARDWELL: And so, if I looked
3 at the rest of this --

4 MR. COX: This is Alan Cox --

5 ADMIN. JUDGE WARDWELL: -- Exhibit 488B, is
6 that what it is? And that is an 83 page report, it
7 would tell me what the ferric content of this is?

8 DR. LOTT: I believe so.

9 MR. COX: Judge Wardwell, this is Alan Cox
10 for Entergy. The paragraph immediately above this
11 graph says that all the samples tested were high delta
12 ferrite samples. And the report may say somewhere
13 what that is in terms of a number, but it does say
14 it's high delta ferrite.

15 DR. HISER: Dr. Wardwell, the information
16 you're looking for is in New York State 488A, Page 5,
17 Table 1, provides chemical composition of the
18 materials. And for the CF-3, it's measured 24
19 percent, CF-8 measured 23 percent, and the 8M is 28
20 percent.

21 ADMIN. JUDGE WARDWELL: So would -- now I'm
22 going to go back to Entergy. Thank you for that, Dr.
23 Hiser, from the Staff. Back to Entergy, you would
24 call these samples that were used to generate this
25 figure in 488 high ferric content samples?

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1 DR. LOTT: And perhaps I could offer
2 further explanation. In the evaluation not in the
3 reactor internals, but in other reactor components,
4 particularly piping components, the guidelines are
5 effectively to consider thermal embrittlement in
6 materials containing more than 20 percent ferrite.
7 So, in our minds I guess, that is the threshold. I'm
8 not sure there's an absolute threshold, but certainly
9 there's no requirement in analyzing piping materials
10 to consider the loss of toughness due to thermal aging
11 for materials that are less than 20 percent ferrite.

12 ADMIN. JUDGE WARDWELL: So this graph is
13 not representative of the CASS materials we have in
14 the reactor vessel internals at Indian Point?

15 DR. LOTT: No, because we would not in that
16 case expect to see thermal embrittlement, or certainly
17 not this level of thermal embrittlement.

18 ADMIN. JUDGE WARDWELL: So, which gets me
19 back to the original question I had.

20 DR. LOTT: Well, I guess I could only
21 suggest that the only data had to offer one way or the
22 other on the original question, which was is there a
23 synergistic effect, was this data. I don't see,
24 again, in this data -- what it suggests to me quite
25 frankly is that the properties of the duplex steel,

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1 this material that has 80 percent Austenite and 20
2 percent ferrite or whatever, is affected by the
3 embrittlement of the ferrite phase. There are two
4 ways that you could end up embrittling the ferrite
5 phase. One is by thermal aging, the other is by
6 irradiation. This would indicate that it doesn't
7 really matter what you do to embrittle that phase,
8 once you have it embrittled, you have a similar effect
9 on the material itself. But that's an interpretation
10 --

11 CHAIRMAN MCDADE: Okay. Following --

12 DR. LOTT: -- the best I can give you.

13 CHAIRMAN MCDADE: Following up, Dr. Lott,
14 using this chart. The delta ferrite for the CF-8, 23
15 percent based on the testimony that Dr. Hiser just
16 gave, when you look at the difference between the
17 effect of irradiation and aging plus irradiation, you
18 have very little difference, minimal, drawing your
19 conclusion that there is no synergistic effect or
20 minimal synergistic effect. In the Indian Point
21 situation, we have, at IP3, the delta ferrite is
22 approximately 11 percent. So this chart suggests to
23 you there is no synergistic effect, but the fact that
24 there's a lower delta ferrite, meaning it would be
25 even less susceptible to the heat aging, would

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1 indicate to you that there would be even a lesser
2 impact on the metal used at Indian Point 2 and 3 at 14
3 and 11 percent?

4 DR. LOTT: Yes.

5 CHAIRMAN MCDADE: Am I --

6 DR. LOTT: Yes. I --

7 CHAIRMAN MCDADE: I just want to -- I
8 repeat this just to make sure that I'm hearing what
9 you're saying and there's not something --

10 DR. LOTT: I believe you've well
11 interpreted what I'm trying to say.

12 CHAIRMAN MCDADE: Okay, thank you.

13 ADMIN. JUDGE WARDWELL: But then I'll go
14 back to my original question based on your original
15 statement in your testimony, which this is where I'm
16 trying to get to. This chart does not apply to Indian
17 Point materials, correct?

18 DR. LOTT: No, we have no measurements on
19 the Indian Point materials.

20 ADMIN. JUDGE WARDWELL: The statement that
21 was made on your testimony, 722, Answer 8, Page 5,
22 you've made the statement, the existing research also
23 suggests that combined thermal aging and irradiation
24 of representative CASS materials, and I assume you
25 mean representative of what's there at Indian Point,

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1 does not appear to lower toughness below what is
2 expected for thermal embrittlement alone. And so my
3 question is, what is the basis for that statement?
4 And if you're going to use this figure, I'd like to
5 know why you can use this figure to extrapolate for
6 something that isn't representative of what's at
7 Indian Point.

8 MR. COX: Let me take a shot at that and
9 then Dr. Lott can chime in. But I think the way that
10 I would look at that graph is that if you have little
11 thermal aging, I mean, you can imagine the aging line
12 on the graph would show much less of a decrease than
13 what you show there. So it seems very reasonable to
14 say if you have a lot of irradiation embrittlement, a
15 lot of thermal embrittlement, and you see very little
16 difference in the combined effect than you do from the
17 irradiation effect, if you reduce the thermal aging
18 embrittlement, like you would expect to see from
19 material with a low delta ferrite, you would have no
20 reason to expect a larger difference when you combine
21 irradiation with the thermal.

22 So, I mean, I think this is not the exact
23 same material, but knowing what we know about the
24 behavior of the material under irradiation and thermal
25 embrittlement, we would expect the same result. And

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1 that is very little change when you combine the two
2 effects since the thermal embrittlement would be even
3 less of an effect, there would be very little change
4 from the combined effect and what you see from the
5 irradiation effect alone.

6 DR. LOTT: Can I request -- I offered this
7 slide because I thought it was going to quickly
8 address your issue, obviously it did not. If we could
9 have some time to look at the answer to your question
10 and come back to you with it, because I think it's
11 going to require us to go through more than one
12 document in order to put the answer together.

13 ADMIN. JUDGE WARDWELL: That's fine.

14 DR. LAHEY: Your honor --

15 ADMIN. JUDGE WARDWELL: Yes.

16 DR. LAHEY: -- could I say, if I understand
17 this graph correctly now, the CF-3 shows the synergism
18 that you are asking about, whereas the CF-8 does not.
19 And so I think that's what they're talking about, but
20 for a lower percentage. But over here you can clearly
21 see the synergism in terms of the integral or the J,
22 it puts the onset of the crack occurs.

23 ADMIN. JUDGE WARDWELL: In your opinion?

24 DR. LAHEY: Well, if I believe the heights,
25 you go down with irradiation, you go down with thermal

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1 aging, and if you add on the irradiation, you're
2 significantly below than just each one.

3 CHAIRMAN MCDADE: But what you're saying,
4 and again, I'm repeating this to make sure I hear what
5 you're saying and understand it, is that the CF-3
6 shows the synergy even though the CF-8 does not on
7 this graph.

8 DR. LAHEY: It appears so.

9 CHAIRMAN MCDADE: Okay. And would you
10 explain the rationale for, theoretically, why the CF-3
11 would show apparently some synergistic effect whereas
12 the CF-8 did not? Dr. Lott?

13 DR. LOTT: Well, I think there's two issues
14 here. One, as I indicated before, there's a fair
15 amount of scatter in any measurement of toughness and
16 in CASS materials in particular. So I'm not sure
17 about the -- I'm not trying to cut these numbers that
18 fine. And, again, I'm not sure that -- and I don't
19 want to get into a semantic argument about the meaning
20 of synergism, but again, these effects are not larger
21 than the combined individual effects. The effects
22 seem to be similar for a large portion of the
23 behavior.

24 ADMIN. JUDGE WARDWELL: But to also be sure
25 that I'm clear here that my question had nothing

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1 necessarily to do -- my question had nothing to do
2 with synergism. My question had to do with where is
3 the basis for your statement that you made in your
4 testimony? And if it's a professional estimate,
5 that's fine. If it's a wild guess, that's fine. If
6 it's based on something else, I would like to hear
7 about it. Thank you.

8 Entergy's testimony, 722, same Answer on
9 the same Page, because it goes on to state, we may
10 have to pull this back too, that given the ongoing
11 research in this area, the Electric Power Research
12 Institute (EPRI) Materials Reliability Program (MRP)
13 developed conservative screening criteria to identify
14 components that are potentially susceptible to the
15 effects of such mechanisms. And let me ask you, are
16 these such mechanisms the thermal embrittlement and
17 the irradiation embrittlement and the combination of
18 the two? Is that what is meant by the such
19 mechanisms?

20 DR. LOTT: Yes, I believe that's true.

21 ADMIN. JUDGE WARDWELL: And what is that
22 conservative screening criteria that EPRI developed?
23 Was that the 15 percent screening criteria or is it
24 some other criteria?

25 DR. LOTT: The screening criteria that EPRI

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1 has proposed I believe is that 20 percent value with
2 a fluence level of about one dpa.

3 ADMIN. JUDGE WARDWELL: You tailed off at
4 the end and --

5 DR. LOTT: I'm sorry, my voice is tender.
6 No, I do not believe it's the 15 percent. I believe
7 the EPRI proposal is 20 percent. I might have to
8 check to see if that number is not in our file
9 testimony. I'll have to look and see.

10 ADMIN. JUDGE WARDWELL: What screening
11 criteria are we talking about that EPRI is proposing?
12 A screening for what?

13 DR. LOTT: Basically a screening for
14 thermal and irradiation embrittlement that's used to
15 identify components that would be -- again, we'd have
16 to look at the effect of -- when we go to the -- first
17 of all, when we identified in our screening process
18 originally for MRP 227, we identified all of the cast
19 materials as potentially susceptible to thermal
20 embrittlement because we did not have any ferrite
21 contents for them. And so we couldn't say if they
22 were even above or below 20 percent.

23 Since that time, we've done a large amount
24 of working with customers such as Entergy and we've
25 identified that no materials that are greater than 20

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1 percent in the Westinghouse internals components that
2 are cast stainless steel. So, that would be -- but
3 that's not in our -- it's a conservatism, because
4 we've never undid the questions about thermal
5 embrittlement. And, in fact, that's what the EPRI
6 concerns are about is the, what are the threshold
7 values for identifying thermal and irradiation
8 embrittlement? Should there be a different fluence
9 level for determining irradiation embrittlement
10 susceptibility in cast stainless steels?

11 ADMIN. JUDGE WARDWELL: And do you need to
12 time to also --

13 DR. LOTT: Let me locate that --

14 ADMIN. JUDGE WARDWELL: -- determine what
15 that EPRI screening criteria is?

16 DR. LOTT: Yes, right. Yes, let me --

17 ADMIN. JUDGE WARDWELL: Can I ask this
18 question of, I don't know who answered it before, who
19 stated it before, but about a half hour ago when we
20 started on these two simple questions that I thought
21 we were going to zoom by --

22 DR. LOTT: Yes.

23 ADMIN. JUDGE WARDWELL: -- this 15 percent
24 of ferric content was brought up as a screening
25 criteria. Is that a different screening criteria or

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1 did I hear that wrong or where did that come from?

2 MR. GRIESBACH: This is Tim Griesbach from
3 Entergy. Molybdenum also plays a big part in this
4 thermal embrittlement of cast materials. So there is
5 --

6 ADMIN. JUDGE WARDWELL: How are you
7 simplifying this discussion?

8 (Laughter.)

9 MR. GRIESBACH: There are two different
10 screening criteria depending on the molybdenum
11 content. If it's less than one half percent or
12 greater than one half percent. If it's greater than
13 one half percent --

14 ADMIN. JUDGE WARDWELL: Of molybdenum?

15 MR. GRIESBACH: -- of molybdenum and high
16 or low delta ferrite, there are different criteria.
17 And then there's a separate criteria based on fluence
18 also. So we will produce that for you and hopefully
19 that will simplify things, especially as it applies to
20 the Indian Point materials.

21 ADMIN. JUDGE WARDWELL: Can I get one of my
22 questions out of the way beforehand, and that is, what
23 was this 15 percent we brought and should I just
24 forget about that and you'll trump it with more
25 specific --

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1 MR. AZEVEDO: Yes, your honor --

2 ADMIN. JUDGE WARDWELL: I see Mr. Azevedo
3 warming up to the old mic.

4 MR. AZEVEDO: This is Nelson Azevedo for
5 Entergy. Yes, so let me see if I can explain real
6 shortly. The 20 percent came from EPRI, that's EPRI
7 developed. The 15 percent came from the NRC.

8 ADMIN. JUDGE WARDWELL: And the 20 percent
9 is ferric content?

10 MR. AZEVEDO: Ferrite content, right. So
11 EPRI proposed 20 percent, the NRC used 15 percent.

12 ADMIN. JUDGE WARDWELL: Dr. Hiser, do you
13 agree that you used 15 percent and EPRI used 20
14 percent for a screening criteria?

15 DR. HISER: Yes, that's correct.

16 ADMIN. JUDGE WARDWELL: Okay.

17 DR. HISER: Fifteen percent is for
18 irradiated cast stainless steel.

19 ADMIN. JUDGE WARDWELL: Okay. Great. And
20 so you will still get back to us with the molybdenum
21 and anything else you want to add to that, for
22 whatever you want to? Great. Moving on to other
23 welds, New York State testimony, 576, Page 4, Line 8
24 through 23, and moving through to Page 5, Lines 1
25 through 17, states that in regard to NUREG/CR--7185,

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1 New York State contends that, one, cast and Austenitic
2 stainless steel welds have a duplex structure and may
3 experience thermal embrittlement, which may increase
4 the hardness and tensile strength of a material, but
5 decrease ductility, fracture toughness, and impact
6 strength of cast materials and Austenitic stainless
7 steel welds.

8 Two, IE is a concern for CASS components
9 for fluences greater than two times ten to the 20, and
10 that's N per square centimeters, so I believe that's
11 neutrons per square centimeter, allegedly equivalent
12 to ten displacements per atom, or dpa, and irradiation
13 makes cast materials and Austenitic stainless steel
14 welds more susceptible to irradiation assisted stress
15 corrosion cracking, or the IASCC. And, three, that
16 IASCC increases the crack growth rate of cracks
17 induced by stress corrosion cracking, but there is
18 allegedly virtually no data above the ten dpa,
19 although some reactor vessel internal components may
20 experience several hundred dpa.

21 And, fourth, that there is possibly
22 synergy between TE and IE, although the report
23 stresses the need for more information to develop
24 reliable failure curves. And, five, that TE could
25 make the welds associated with the pressurizer spray

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1 nozzles vulnerable to seismic and thermal pressure
2 shock loads. Let me start with Dr. Lahey who made
3 this statement. To your knowledge, is a pressurizer
4 spray nozzle an RVI component covered by the RVI AMP
5 within the list of those components?

6 DR. LAHEY: Not --

7 ADMIN. JUDGE WARDWELL: Or you don't know
8 for sure?

9 DR. LAHEY: It's not a reactor vessel
10 internal at all. It's an external pressure boundary.

11 ADMIN. JUDGE WARDWELL: Okay.

12 DR. LAHEY: And I never called it an RVI.

13 ADMIN. JUDGE WARDWELL: Okay.

14 DR. LAHEY: Also, there was a typo in my
15 thing, it's not ten dpa. If you look at that chart we
16 showed before, it's more like 0.3 and that was pointed
17 out by Entergy --

18 ADMIN. JUDGE WARDWELL: Okay.

19 DR. LAHEY: -- and rightly so. So, other
20 than that, the new information to me that I didn't
21 have when I expressed this concern was the composition
22 of the weld rods that they actually used. They used
23 308 weld rods for stainless steel 304 and 309 weld
24 rods for stainless steel 316. And this does give a
25 duplex structure, but the net effect is more like less

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1 than ten percent. So it's likely not subject to
2 thermal embrittlement. And what I was made aware of
3 based on the feedback from Entergy or NRC, I don't
4 recall which one, was that Dr. Chopra had a very high
5 delta ferrite content in his welds. And that made the
6 difference.

7 ADMIN. JUDGE WARDWELL: So is your net
8 conclusion that you don't believe this is an issue
9 now?

10 DR. LAHEY: I don't believe the thermal
11 embrittlement of those particular welds is an issue,
12 if in fact that is how they did their welds.

13 ADMIN. JUDGE WARDWELL: Okay. And I'll
14 turn to Entergy, as just represented by Dr. Lahey, is
15 that how the welds were done? Or do you have some
16 other nuances to discuss in regards to how the welds
17 were performed?

18 MR. AZEVEDO: This is Nelson Azevedo for
19 Entergy. No, your honor, what's been said is correct.

20 ADMIN. JUDGE WARDWELL: Okay. Thank you.
21 So there was a list that I have here, without reading
22 through it I guess -- if you don't believe that welds
23 are now an issue, you're comfortable with the welds
24 that they were performed as represented by Entergy?

25 DR. LAHEY: Well, the welds we were just

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1 talking about were the welds associated with the
2 pressurizer spray nozzle. There may be concern with
3 the welds inside of the reactor vessel internal --

4 ADMIN. JUDGE WARDWELL: Okay.

5 DR. LAHEY: -- component welds, like the
6 core barrel.

7 ADMIN. JUDGE WARDWELL: Okay, good. So
8 let's continue then. I guess I'll go with Staff now.
9 Are the pressurized spray nozzles to safe end welds
10 considered part of RVIs?

11 MR. POEHLER: This is Jeffrey Poehler for
12 the Staff. No, they are not considered part of RVI.

13 ADMIN. JUDGE WARDWELL: And are they
14 handled under some other Aging Management Program?

15 MR. POEHLER: Yes.

16 ADMIN. JUDGE WARDWELL: Do you agree that
17 there is a decrease in ductility, fracture toughness,
18 and impact strength of cast materials and Austenitic
19 stainless steel weld? And, if so, does this drive any
20 changes need to thermal embrittlement screening
21 criteria or other aging management procedures?

22 MR. POEHLER: Can you clarify -- under what
23 conditions are you referring to? Combined irradiation
24 and thermal exposure or one or the other?

25 ADMIN. JUDGE WARDWELL: One or the other.

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1 MR. POEHLER: In cast Austenitic stainless
2 steel, yes, we agree there is a decrease in fracture
3 toughness that can occur to either irradiation or due
4 to thermal aging.

5 ADMIN. JUDGE WARDWELL: Maybe I should back
6 up a bit because I'm a little bit confused. What
7 welds are left that are part of the RVIs? Are there
8 a whole host of them or are there only a few isolated
9 ones that part of RVIs or --

10 MR. POEHLER: Are we discussing welds or
11 castings?

12 ADMIN. JUDGE WARDWELL: Well, I believe it
13 was welding of cast material.

14 MR. POEHLER: Yes, there are some welds in
15 cast materials, such as the lower support columns.

16 ADMIN. JUDGE WARDWELL: Such as the what?

17 MR. POEHLER: The lower core support
18 columns.

19 ADMIN. JUDGE WARDWELL: And are those -- do
20 you handle those as separate or do you handle them
21 within the component itself, the support column
22 itself?

23 MR. POEHLER: We handle those as part of
24 the component itself.

25 ADMIN. JUDGE WARDWELL: In regards to those

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1 welds, though -- well, let me ask Dr. Lahey. In
2 regards to welds as cast material, given the
3 representation of Entergy on how those welds were
4 performed, is it your understand that, that is also
5 how the reactor vessel internals were welded, for any
6 welds that were needed for reactor vessel internals?

7 DR. LAHEY: Your honor, what we were
8 talking about before was welds outside of the pressure
9 vessel using wrought Austenitic stainless steel and
10 the type of weld rods that they used to perform that.
11 Which was one of my concerns until I understood what
12 they actually did. Inside the reactor pressure vessel
13 for some of these other components, it's a different
14 story.

15 ADMIN. JUDGE WARDWELL: And is that story
16 the same story you believe applies to the welds as
17 well as the -- that you also have for the internals
18 themselves?

19 DR. LAHEY: Well, depending on the delta
20 ferrite content, as long as it's above a certain
21 level, you heard 15 percent, then you could have this
22 thermal embrittlement as well as irradiation
23 embrittlement. And there's certainly welds that can
24 be subjected to both of those effects.

25 ADMIN. JUDGE WARDWELL: But if it's below

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1 the -- if it's screened out below the 15 percent
2 ferric content, then you believe that thermal
3 embrittlement is not an issue, it's just the
4 irradiation embrittlement?

5 DR. LAHEY: Generally, yes, but there are
6 some exceptions if you have a linkage within the weld
7 material itself of the delta ferrite. But generally
8 you have to have more of it to have this effect.

9 ADMIN. JUDGE WARDWELL: Let me turn to
10 Staff, how would anyone handle leakage out of a weld
11 and the impacts of that? Is there a need to evaluate
12 potential leakage out of a weld?

13 MR. POEHLER: This is Jeffrey Poehler from
14 the Staff. Are you referring to pressure boundary
15 welds or --

16 ADMIN. JUDGE WARDWELL: I'm referring to
17 welds of the RVIs that we're dealing with under the
18 RVI AMP, whatever they are.

19 MR. POEHLER: Since the welds in the RVI do
20 not serve a pressure boundary function, then leakage
21 is not a failure criteria for those welds.

22 ADMIN. JUDGE WARDWELL: And in your review
23 of the AMP and the components that are in the RVI AMP,
24 have any of the components been welded such that the
25 weld and the component itself have a higher ferric

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1 content than 15 percent? Or were they all screened
2 out?

3 MR. POEHLER: We didn't look at the ferrite
4 content of the welds. So weld filler metals used for
5 Austenitic stainless steel welds, they tend to have
6 lower ferrite content in general than cast stainless
7 steels. So thermal aging is not generally an issue,
8 has not generally been considered an issue for those
9 welds. So in the screening criteria used to develop
10 the AMP at Indian Point and MRP 227-A, they didn't
11 screen-in thermal embrittlement for the welds.

12 ADMIN. JUDGE WARDWELL: How many RVIs are
13 made out of -- are composed of cast materials?

14 MR. POEHLER: Basically, there's a handful
15 of components, the lower core support columns and then
16 at Indian Point it's only the upper portion of those
17 columns, which they call the column cap, is cast
18 stainless steel. You also have the lower core support
19 forging at the very bottom of the core barrel. There
20 may be a couple other ones, but those are the main
21 ones.

22 ADMIN. JUDGE WARDWELL: Let me turn to
23 Entergy and see if they want to clarify. Well, let's
24 start off with, how many of the RVIs are, to your
25 knowledge, cast materials versus the wrought

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1 Austenitic?

2 DR. LOTT: I believe that we identified
3 that in our filed testimony. I'm looking at Page 62,
4 I think it's Question 105, and it identifies the upper
5 instrumentation conduit supports --

6 ADMIN. JUDGE WARDWELL: Sorry, you're going
7 to have speak into the mic and a little slower.

8 DR. LOTT: Okay. It identifies the upper
9 instrumentation conduits and supports, upper support
10 column assemblies, the lower support casting. That
11 should be lower support column assemblies. Oh, no,
12 I'm sorry, that's right. The upper instrumentation
13 conduits, upper support column assemblies, and the
14 lower support casting.

15 ADMIN. JUDGE WARDWELL: And how many of
16 those were screened out due to ferric content? Or
17 moly content or whatever?

18 DR. LOTT: In the original screening
19 process, none of them were screened out because
20 everything was screened in based on lack of knowledge
21 at that time of the ferric content.

22 ADMIN. JUDGE WARDWELL: Okay. I'll wait,
23 I guess, until I get to those individual components.
24 Because I thought somewhere, it was my impression that
25 only those upper caps of the lower supports were cast

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1 materials that were part of the aging management plan,
2 but I don't know that. I'll have to --

3 DR. LOTT: But they are cast materials part
4 of the aging management plan, but they were not
5 necessarily -- well, first of all, most of them are
6 not irradiated at all. So this question of
7 irradiation embrittlement doesn't come in. And I
8 think there was also -- some of them were screened out
9 based on lack of structural requirement. In other
10 words, there were just no --

11 ADMIN. JUDGE WARDWELL: Well, I'll be able
12 to get to that quote once I get to it. I just can't
13 find it and I don't want to spend time looking for it.
14 I'll come upon it as I work my way through. But I
15 want to get back to welds, I think. How many -- how
16 do you handle the welds in your AMP, for both the
17 wrought and the cast materials? Are they part of the
18 individual component or are they considered
19 separately?

20 DR. LOTT: There are some key welds that
21 are considered separately. And those welds were, for
22 instance, the core barrel welds, we knew we were
23 concerned about them, they're identified separate.
24 There are other components that contain welds and in
25 the screening process, one of the things we identified

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1 was which components contained welds and which did
2 not. And then the primary concern with welds was
3 large structural welds where concern for stress
4 corrosion cracking, not necessarily embrittlement.

5 ADMIN. JUDGE WARDWELL: And, so, how many
6 of these special welds were designated as individual
7 components when you split this out?

8 DR. LOTT: I'd have to go back and count,
9 I --

10 ADMIN. JUDGE WARDWELL: Okay.

11 DR. LOTT: -- couldn't answer that.

12 MR. DOLANSKY: This is Bob Dolansky from
13 Entergy. The Table 1 on Page 87 of our testimony
14 lists the primary components and the expansion
15 components. The primary components lists if it's a
16 weld or not. Does that answer your question?

17 ADMIN. JUDGE WARDWELL: To a certain
18 degree. I was hoping you had an approximate number of
19 those that were there that related to split out welds,
20 but that's fine. I don't need that right now.

21 MR. DOLANSKY: Okay.

22 ADMIN. JUDGE WARDWELL: I would like that
23 number to get a feeling for how many there are and
24 what's being -- so I can then refer to that table to
25 see what's being handled for them.

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1 MR. DOLANSKY: I could go through this
2 table if you wanted and --

3 ADMIN. JUDGE WARDWELL: Yes, at some point
4 and then just come up with a number and that will be
5 sufficient so I make sure I see the same number that
6 you do when I -- if it does come up in our decision
7 writing, I'm able to refer to that and handle any
8 discussion associated with it.

9 MR. DOLANSKY: Just to clarify, what I'll
10 do the research on is for each primary component, if
11 it's a weld, I'll tell you how many there are.

12 ADMIN. JUDGE WARDWELL: Okay.

13 MR. DOLANSKY: That's basically what you're
14 looking for --

15 ADMIN. JUDGE WARDWELL: That would be
16 great.

17 MR. DOLANSKY: -- to understand?

18 ADMIN. JUDGE WARDWELL: Thank you.

19 MR. DOLANSKY: Okay.

20 ADMIN. JUDGE WARDWELL: Yes, let's do it
21 now.

22 CHAIRMAN MCDADE: Okay. It might be an
23 appropriate time to take a short ten minute break. A
24 couple of things. First of all, Mr. Sipos, we had a
25 discussion with Dr. Lahey about the Table 5-5 and he

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1 hadn't had an opportunity to review it. Do you have
2 handy New York 496, which is the document that Table
3 5-5 is in? If not, I've got it right here and I can
4 provide it to you for Dr. Lahey to look at.

5 MR. SIPOS: Your honor, I believe we have
6 it with us. Thank you.

7 CHAIRMAN MCDADE: Okay. If you don't, then
8 at the next break I can provide it to you and --

9 MR. SIPOS: Thank you.

10 CHAIRMAN MCDADE: -- you can give that to
11 Dr. Lahey. Another thing that I actually should have
12 mentioned earlier, in Exhibit 616, which Entergy
13 provided, at the beginning of it, there's a table of
14 abbreviations, which is extremely helpful. Whoever
15 prepared it, I really want to thank them. I just
16 wanted to mention it, as the court reporter is going
17 through this, if you have not reviewed it, Exhibit
18 616, the table of abbreviations I think is going to be
19 very helpful to you in make sure that you -- well,
20 okay. Then that isn't necessary, apparently he found
21 it without my assistance. Do we have anything else we
22 need to take up before we take a short break?

23 ADMIN. JUDGE WARDWELL: But I think ISR was
24 missing from that table though, but I echo how much I
25 did use that for both other testimony, I would go back

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1 to the Entergy abbreviations or the NRC ones, whoever
2 had them --

3 CHAIRMAN MCDADE: Okay. So it's ten
4 minutes after 3:00, we'll break until 20 minutes after
5 3:00. Thank you.

6 (Whereupon, the above-entitled matter went
7 off the record at 3:09 p.m. and resumed at 3:23 p.m.)

8 CHAIRMAN MCDADE: Let's get started. The
9 hearing will come to order.

10 ADMIN. JUDGE WARDWELL: Okay. Moving on to
11 baffle former bolts, the NRC testimony, 197, Answer
12 80, Page 59, says, an example of an augmented
13 inspection is the baseline volumetric examination
14 using ultrasound testing, UT, of the baffle former
15 bolts between 25 and 35 effective full power years,
16 which you use the acronym with the letters E-F-P-Y,
17 there's probably some fancy way to say that, that I
18 don't know, within a subset examination on a ten year
19 interval, as specified in Table 4.3 of MRP 227-A.

20 CHAIRMAN MCDADE: Wait, whose testimony is
21 this?

22 ADMIN. JUDGE WARDWELL: I'm sorry?

23 CHAIRMAN MCDADE: Which exhibit are you
24 reading from?

25 ADMIN. JUDGE WARDWELL: This is NRC's

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1 Exhibit 197, A 80, Page 59.

2 CHAIRMAN MCDADE: NRC's?

3 ADMIN. JUDGE WARDWELL: Yes. And I guess
4 I'd ask Entergy, how long -- have you initiated any UT
5 testing of the baffle former bolts at Indian Point?

6 MR. DOLANSKY: This is Bob Dolansky for
7 Entergy. No.

8 ADMIN. JUDGE WARDWELL: And has the
9 industry itself and do you have data on that?

10 MR. DOLANSKY: The industry has performed
11 inspections on baffle former bolts. They have -- when
12 you say, do we have data on that, what kind of data
13 are you looking for?

14 ADMIN. JUDGE WARDWELL: I'm just curious on
15 what the experience is with any of the failure rates
16 associated with these in other Westinghouse reactors.

17 MR. DOLANSKY: I would characterize it as
18 most people who have inspected have found some
19 degraded bolts, but not enough that they were required
20 to replace any bolts.

21 ADMIN. JUDGE WARDWELL: Okay, thank you.

22 DR. LOTT: May I suggest, there is some
23 data on that in Entergy Exhibit 650, which summarizes
24 the experience to date with various reactor internal
25 exams, including the baffle bolt exams.

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1 ADMIN. JUDGE WARDWELL: Okay, thank you.
2 NRC's testimony on 197, Question 222, Page 124,
3 states, what does this operating experience tell us
4 about the probability of cracks existing in the PWR
5 RVIs? And the Answer says, this result summarized in
6 the presentation indicate no cracking has been found
7 with the exception of some cracking of bolts, about
8 1.5 percent of Westinghouse baffle former bolts. And
9 there I might ask Staff, what might be the cite for
10 this 1.5 percent cracking rate for the baffle former
11 bolts that you state in your testimony?

12 DR. HISER: This is Allen Hiser of the
13 Staff. I believe it's NRC 207.

14 ADMIN. JUDGE WARDWELL: Okay. And does
15 that also give the total number of baffle bolts that
16 they looked at in regards to this, that generated the
17 1.5 percent figure?

18 DR. HISER: If you'll indulge me, I can
19 pull it up and review it real quickly.

20 ADMIN. JUDGE WARDWELL: Okay. And what are
21 you pulling up now?

22 DR. HISER: From Exhibit 207.

23 ADMIN. JUDGE WARDWELL: Okay. As you're
24 pulling that up, let me ask this question also, is it
25 your understanding or do you know if this industry

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1 experience with the inspection of baffle former bolts
2 is also documented in Appendix A of MRP 227, which is
3 NRC 114C?

4 DR. HISER: It is document in the MRP 227,
5 but that was as of several years ago. The Exhibit 207
6 represents data through the fall of 2014.

7 ADMIN. JUDGE WARDWELL: Okay.

8 DR. HISER: So it's probably the most
9 recent information. And this indicates that 8,887
10 baffle bolts have been UT inspected.

11 ADMIN. JUDGE WARDWELL: And that's
12 generated the 1.5 percent in regards to the cracking
13 rate?

14 DR. HISER: Yes, that's correct.

15 ADMIN. JUDGE WARDWELL: And do you know
16 what was the criteria used to say that a bolt had been
17 cracked? Is there any parameters that was given?
18 Does it have to be separated, loose? Is there just a
19 crack detected? Or a visual crack would apply to
20 that?

21 DR. HISER: In this case, I would expect it
22 at least was any indication of a crack from the UT
23 exam.

24 ADMIN. JUDGE WARDWELL: Dr. Lahey, it seems
25 like this experience has shown that very few cracked

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1 or failed baffle former bolts have been detected
2 during these examinations and in most cases no cracked
3 or failed bolts were detected at all. Do you have any
4 other experience that dictates that they are more of
5 an issue --

6 DR. LAHEY: Well, there have been --

7 ADMIN. JUDGE WARDWELL: -- of these than
8 there seem to be?

9 DR. LAHEY: There have been failures
10 reported overseas as well. So, it's not been massive
11 failures, but there have definitely been failures.
12 While we're talking about baffle bolts, I was asked to
13 look at Table 5-5 and if you want me to -- which
14 includes the acceptance criteria for such things as
15 baffle bolts. Do you want me to report on that now or
16 not?

17 ADMIN. JUDGE WARDWELL: That was one of
18 your homework assignments wasn't it?

19 DR. LAHEY: During the break, I thought.

20 ADMIN. JUDGE WARDWELL: Yes. Well, we
21 allow homework to be done during a break --

22 DR. LAHEY: Right.

23 ADMIN. JUDGE WARDWELL: -- we don't
24 restrict that.

25 DR. LAHEY: Shall I report on that?

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1 ADMIN. JUDGE WARDWELL: Sure. This is
2 probably as good an opportunity.

3 DR. LAHEY: Okay. And it has to do -- I
4 looked at the various items in the Table 5-5 and the
5 one that I have some concern about is the baffle
6 bolts. And, in particular, when it talks about
7 additional examination acceptance criteria, it's not
8 yet specified. It says, the examination acceptance
9 criteria for the UT of the bolts shall be established
10 as part of the examination technical justification.
11 So it's still sort of open-ended and since it's such
12 an important component and has safety significance.
13 That's a little unsettling.

14 ADMIN. JUDGE WARDWELL: And that's the
15 examination criteria, is that correct?

16 DR. LAHEY: Yes.

17 ADMIN. JUDGE WARDWELL: And may I turn --

18 DR. LAHEY: Table 5-5.

19 ADMIN. JUDGE WARDWELL: Yes. Turn to
20 Entergy in regards to that examination criteria. What
21 does that mean in regards to the statement made in
22 Table 5-5 for the baffle former bolts? For Entergy,
23 anyone at Entergy who wants to answer.

24 MR. DOLANSKY: The examination acceptance
25 criteria for baffle former bolts would be any

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1 indication of cracking.

2 ADMIN. JUDGE WARDWELL: And what is the --
3 is there a difference between examination criteria and
4 inspection criteria or acceptance -- I guess we have
5 acceptance criteria and examination criteria. Are
6 they different or are those two sayings for the same
7 thing?

8 MR. AZEVEDO: This is Nelson Azevedo for
9 Entergy. The examination criteria is the criteria for
10 the inspectors. So anything that exceeds the
11 examination criteria, they must report it and then we
12 enter into our corrective action process. The
13 acceptance criteria or the engineering acceptance
14 criteria, if you will, it's how many bolts, for
15 example, can we afford to lose without impacting the
16 ability of the structure to perform its intended
17 safety function?

18 ADMIN. JUDGE WARDWELL: Great. Thank you
19 for that clarification. And did you have anything
20 more, Dr. Lahey, that you wanted to talk about in
21 regards to Table 5-5?

22 DR. LAHEY: No. With regards to that
23 table, that was our specific concern, the number of
24 bolts, because that is significant.

25 ADMIN. JUDGE WARDWELL: And then just to

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1 close the other item, to make sure -- you don't have
2 any hard numbers in regards to percent of these baffle
3 bolts that failed overseas or anywhere else that would
4 contradict the 1.5 percent that was observed by
5 Westinghouse?

6 DR. LAHEY: I've never tabulated it, no.

7 ADMIN. JUDGE WARDWELL: Okay. Thank you.
8 NRC's testimony, 147, Page 47, in order to maintain
9 the intended function, only about 20 to 30 percent of
10 the baffle former bolts need to remain intact. And I
11 guess I'll ask Entergy -- well, it's an NRC statement,
12 so I'll ask NRC. What's the basis for this 20 to 30
13 percent figure? And if it's just that it came from
14 the Applicant, so say, or is it something that you are
15 familiar with in regards to the generation of these
16 particular values?

17 MR. POEHLER: Right. This is Jeffrey
18 Poehler from the Staff. It did not come from the
19 Applicant. It is based on some -- well, there's a
20 couple of Topical Reports, WCAP reports, where they
21 provide a methodology for performing these types of
22 minimum pattern analyses for the baffle former bolts.
23 Several plants have actually used that methodology and
24 the results came out in the 20 to 30 percent range of
25 intact bolts needed.

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1 ADMIN. JUDGE WARDWELL: What do you mean
2 by, they used that and came out with a 20 to 30
3 percent?

4 MR. POEHLER: They used a preapproved --
5 the NRC had approved the methodology for doing these
6 analyses and it was submitted as a Topical Report --

7 ADMIN. JUDGE WARDWELL: And this is --

8 MR. POEHLER: -- to the NRC.

9 ADMIN. JUDGE WARDWELL: This is an
10 engineering analysis, it has nothing to do with
11 inspection or anything or number of bolts, it's just
12 -- number of bolts that have cracked or anything, this
13 has strictly an analysis of how many are needed to
14 maintain the intended function of the baffle, is that
15 correct?

16 MR. POEHLER: Correct. And how many and in
17 what positions, what type of patterns --

18 ADMIN. JUDGE WARDWELL: Okay.

19 MR. POEHLER: -- that would be needed to
20 maintain the design function of the baffle former
21 assembly.

22 ADMIN. JUDGE WARDWELL: And that analysis
23 resulted in the 20 to 30 percent needed?

24 MR. POEHLER: When that methodology was
25 applied for specific plants.

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1 ADMIN. JUDGE WARDWELL: Has that -- was
2 Indian Point one of those specific plants?

3 MR. POEHLER: I don't -- to my knowledge,
4 they weren't. If they've done that type of analysis,
5 I'm not aware that their results have been submitted.

6 ADMIN. JUDGE WARDWELL: Okay. Well, let's
7 turn to Entergy. Has such an analysis been done at
8 Entergy or do you just use that 20 to 30 percent as an
9 accepted figure based on the analysis that has been
10 done by others?

11 MR. DOLANSKY: This is Bob Dolansky from
12 Entergy. We're having a plant specific acceptable
13 bolting pattern analysis performed for us right now
14 that will determine plant specific. So the
15 methodology that -- the Topical Report is a general
16 methodology. We then took that general methodology
17 and put in our specific accident loads, LOCA loads,
18 all those things, and did the analysis. Well, it's
19 ongoing. It'll be ready before we perform the
20 inspections in the spring.

21 ADMIN. JUDGE WARDWELL: Do the --

22 MR. STROSNIDER: This Jack Strosnider for
23 Entergy. If I just could, this question has come up
24 a number of time about Topical Reports. I just want
25 to make sure people understand how that process works,

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1 if I could take just a second? When the industry sees
2 a generic issue, such as this issue, and they know
3 that a lot of plants are going to have to deal with
4 it, they'll go contract the vendor, like Westinghouse
5 or somebody, to develop a methodology to do some pilot
6 plants to do a case study. And then they'll submit
7 that to the NRC.

8 The NRC reviews that and, if they approve
9 it with whatever approvals they make, then a specific
10 plant, a utility, can come in and reference that
11 report when they do their plant specific analysis.
12 And the important part of that is that the methodology
13 has been approved by NRC. So as was just indicated,
14 that includes all the loading and how you do the
15 calculations and how you demonstrate functionality.
16 So what's happening is, at the plant specific level
17 then is just to do the plant specific evaluation.
18 When the NRC issues their safety evaluation, they will
19 include in it any specific action items that have to
20 be addressed on a plant specific basis. So I hope
21 that's of help to you because there's a number of
22 questions that have come up on various Topical Reports
23 and that's how that whole process works.

24 ADMIN. JUDGE WARDWELL: Thank you. And,
25 Dr. Hiser, has NRC approved this methodology for

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1 determining the number of bolts needed and the
2 patterns for the baffle former bolts?

3 DR. HISER: Yes, we have. And the exhibits
4 are ENT 654 and 655.

5 ADMIN. JUDGE WARDWELL: Thank you. And
6 previously, if Indian Point is consistent with what
7 was done before, they should arrive at -- if it's
8 consistent with what our understanding is now, it
9 would be 20 to 30 percent of the bolts are needed, is
10 that correct?

11 DR. HISER: I would expect that to be the
12 case.

13 ADMIN. JUDGE WARDWELL: I think I'll go
14 back to Entergy though to ask this question. Do you
15 know if that 20 to 30 percent -- does not the intended
16 function of a component, like the baffles and the
17 former bolts that are attached to it, include some
18 type of, in my field I'd call it a safety factor,
19 other people will consider it an error margin or
20 whatever else? Isn't there some sort of safety factor
21 or error margin applied when you estimate how many of
22 the bolts are needed?

23 MR. DOLANSKY: Yes. If I could just take
24 one minute and explain? We're getting a site specific
25 acceptable bolting pattern analysis performed. That's

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1 going to tell us some very small number of bolts that
2 are allowed to be degraded without requiring
3 additional analysis. So let's just say one -- there's
4 832 baffle former bolts. Let's just say one, so we
5 could find one and we would be okay. But if we find
6 more than one, then we will have to do a thing called
7 a real time analysis and that basically is, they take
8 the actual place that we found the degraded bolts and
9 they put them into the analysis.

10 A big part of -- it's taken roughly a year
11 to do this analysis. They develop a computer program,
12 they'll then take the specific bolts that we actually
13 found degraded, put those into the computer program,
14 run it with our specific loads and site specific
15 requirements, and come out with, is that actual what
16 we found acceptable or not?

17 ADMIN. JUDGE WARDWELL: And by acceptable,
18 does that have an error margin or a safety margin
19 around it?

20 MR. DOLANSKY: Yes, it does.

21 ADMIN. JUDGE WARDWELL: And my question is,
22 do you know if the 20 to 30 percent figure of the
23 acceptable bolts that have been done in the past, that
24 number generated in the past, does that include that
25 safety factor or could it possibly be that, that is

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1 what needed with a safety factor of only one?

2 MR. DOLANSKY: I can't answer that.

3 ADMIN. JUDGE WARDWELL: Okay. Staff, would
4 you be able to answer that question?

5 DR. HISER: This is Allen Hiser of the
6 Staff. In the generic methodology, Topical Report,
7 there would be safety factors included in that.

8 ADMIN. JUDGE WARDWELL: So you believe that
9 --

10 DR. HISER: It includes safety factors.

11 ADMIN. JUDGE WARDWELL: -- the 20 to 30
12 percent includes some sort of safety factor such that
13 it could be even less and the thing would still hold
14 together?

15 DR. HISER: If you use a safety factor of
16 one, yes, I expect you could go to fewer bolts than
17 the 20 to 30 percent.

18 ADMIN. JUDGE WARDWELL: Right. Or
19 conversely, if the safety factor was two that they
20 actually used, you could really go down to 10 to 15
21 percent?

22 DR. HISER: Well, safety factor is not on
23 the number of bolts --

24 ADMIN. JUDGE WARDWELL: Just in general
25 terms, just to put a handle on --

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1 DR. HISER: Yes, that's correct. It would
2 be a lower number.

3 ADMIN. JUDGE WARDWELL: The point I'm
4 trying to get is I want to make sure that, that 20 to
5 30 percent doesn't pertain to a safety factor of one.
6 And, likewise, when you do your analysis, I'm asking
7 Entergy, will a number you have be the number that is
8 absolutely needed in order to maintain safety with no
9 extra margin or will it include some margin associated
10 with it?

11 MR. DOLANSKY: This is Bob Dolansky with
12 Entergy. First, when we're doing all this, we're
13 really concerned about reactor safety, maintaining
14 core coolability, maintaining the ability to insert
15 the control rods. That's factored into the analysis
16 and there are safety margins on that safety analysis.

17 MR. STROSNIDER: This is Jack Strosnider --

18 ADMIN. JUDGE WARDWELL: So when you -- no,
19 I'd like to stay with my thoughts. When you come up
20 with an acceptable pattern, that pattern will have
21 some margin built into it, such that in actuality if
22 you knew truth, you could end up with lesser number of
23 bolts, but because we don't know truth, you're going
24 to have some margin in there that allows for the
25 uncertainty associated with not knowing truth in that

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1 pattern. Is that a fair assessment?

2 MR. DOLANSKY: Yes. And the reason why I
3 spoke before about the real time analysis is we don't
4 want to know, when we don't know what we actually
5 have, come up with some bolting pattern analysis. We
6 want to wait until we find out what we actually have
7 out there and then run it through the program and make
8 sure that it's robust and is perfectly acceptable. So
9 that's why we actually run the real time analysis.

10 MR. AZEVEDO: Your honor, this is Nelson
11 Azevedo. If I may add, we use the NRC approved
12 methodologies, so the same safety margins are going to
13 be used.

14 MR. STROSNIDER: And this is Jack
15 Strosnider. Just to expand on that, typically what
16 you're going to see in these Topical Reports when they
17 do this type of analysis, is they're going to work to
18 maintain the safety margins that were in the original
19 licensing basis. So in this case, if you're talking
20 about the structural criteria, it's going to be the
21 ASME code factors of safety during normal and accident
22 conditions. And when you look at the other aspect of
23 this, we get into some of the core cooling and
24 accident evaluations and they would need to maintain
25 the margins that are in that licensing basis in terms

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1 of margin to core damage and that sort of thing. So
2 they work to maintain the current licensing basis and
3 the margins that were in those.

4 ADMIN. JUDGE WARDWELL: And so it's your
5 professional opinion that the 20 to 30 percent that
6 has historically been generated by Westinghouse at
7 other plants includes those safety factors associated
8 with the ASME code?

9 MR. STROSNIDER: Yes, it would have those
10 margins in it.

11 ADMIN. JUDGE WARDWELL: Thank you. Your
12 testimony, Entergy, 616, Answer 152, Page 99, says, to
13 prepare for these inspections, as explained in the
14 Supplemented SER Number 2, that the UT examination
15 acceptance criteria for the baffle former bolts will
16 be developed as part of the technical justification
17 for the inspections. Page 100, Answer 154, that the
18 examination acceptance criteria for the individual
19 baffle former bolts will be no defect that could be
20 detectable via UT inspections. And in parentheses,
21 you say that detectable versus UT inspections are a
22 defect exceeding 30 percent of the bolt cross-
23 sectional area.

24 The TJ will merely demonstrate that the UT
25 inspections at Indian Point will be capable of

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1 detecting such cracking. And I guess my first
2 question to you is, from where did this 30 percent of
3 the cross-sectional area come from in regards to -- I
4 gather that is what is needed before you're able to
5 detect it with the UT inspections.

6 DR. LOTT: I believe the last thing you
7 said is basically true, that the UT inspections, a
8 standard UT inspection, very reliably detect 30
9 percent. I believe that the requirement is stated in
10 MRP 228, if I'm not mistaken, that, that minimum 30
11 percent is there based on the judgement of the
12 inspectors.

13 ADMIN. JUDGE WARDWELL: But that's a result
14 of what you can get out of it. That's what you need
15 before you're -- that's the sensitivity of your UT
16 device --

17 DR. LOTT: Right.

18 ADMIN. JUDGE WARDWELL: -- if you will. Is
19 that correct?

20 DR. LOTT: Yes.

21 ADMIN. JUDGE WARDWELL: And, so, that means
22 that anything under that won't be detected, is that
23 correct?

24 DR. LOTT: Well, maybe not necessarily
25 won't, but might not be.

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1 ADMIN. JUDGE WARDWELL: The odds are it
2 won't. I mean, there will be some that needs more
3 than 30 percent that won't be detected also, using the
4 same phraseology?

5 DR. LOTT: Yes. It's a very high
6 probability of detection, I believe, at 30 percent.

7 ADMIN. JUDGE WARDWELL: And is this
8 acceptance criteria -- has the 30 percent figure shown
9 up anywhere in the Inspection Plan or anything else?
10 Or is that just part of the testimony that you've
11 created here for this hearing?

12 MR. DOLANSKY: This is Bob Dolansky with
13 Entergy. I believe that 30 percent will be in the
14 technical justification --

15 ADMIN. JUDGE WARDWELL: Okay.

16 MR. DOLANSKY: -- that will be used by --
17 that has to be documented and reviewed by our NDE
18 Level III at the site before they perform the
19 inspection.

20 ADMIN. JUDGE WARDWELL: This is all stuff
21 you're going to get prepared and done prior to
22 starting your inspection, I think you talked about
23 earlier today.

24 MR. DOLANSKY: Correct.

25 ADMIN. JUDGE WARDWELL: Dr. Lahey, do you

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1 have any comments on what you heard in regards to the
2 baffle former bolts --

3 DR. LAHEY: Yes.

4 ADMIN. JUDGE WARDWELL: -- inspection and
5 --

6 DR. LAHEY: Yes, your honor. This was a
7 very interesting discussion for me. I have not seen
8 that report or the results, I'd be very interested to
9 see it. In particular, I heard nothing about the type
10 of loads that were applied to assure the integrity of
11 these patterns with reduced number of bolts and would
12 be very interested in hearing about what type of
13 impulsive loads were used, if they were used. And
14 what type of codes might have been used to generate
15 these.

16 ADMIN. JUDGE WARDWELL: Okay, thank you.

17 DR. LOTT: Some of that information, I will
18 suggest, would be available in ENT 0655, which is
19 basically the same document that Dr. Hiser just
20 referred to in terms of the methodology for
21 determining acceptable bolt patterns. It discusses
22 the types of loads that are included, particular the
23 multi flex code and how they're transferred to the --

24 ADMIN. JUDGE WARDWELL: Have those loads
25 been documented in the Topical Reports that the NRC

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1 has approved?

2 DR. LOTT: Yes, in great detail.

3 CHAIRMAN MCDADE: Okay. Dr. Lott, what
4 exhibit did you just reference?

5 DR. LOTT: Entergy 655.

6 CHAIRMAN MCDADE: Thank you.

7 ADMIN. JUDGE WARDWELL: When did you start
8 this endeavor in regards to planning for the
9 inspections of the baffles and going through this site
10 specific process of determining your pattern for the
11 baffle bolts?

12 MR. DOLANSKY: Just the baffle former bolts
13 --

14 ADMIN. JUDGE WARDWELL: Yes.

15 MR. DOLANSKY: -- you're asking about?

16 ADMIN. JUDGE WARDWELL: Yes.

17 MR. DOLANSKY: This is Bob Dolansky for
18 Entergy. The contract for the inspection of the
19 baffle former bolts was issued, I'm going to say in
20 spring of 2015. The contract to develop the
21 acceptable bolting pattern analysis, I think, was
22 January. It takes a little over a year to develop
23 that acceptable bolting pattern analysis. So I'm
24 pretty sure it was January and the final report will
25 be ready for us in February before our inspections in

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1 March.

2 ADMIN. JUDGE WARDWELL: For Dr. Hiser of
3 the NRC, when was the Topical Report approved by you
4 that --

5 DR. HISER: I believe it was --

6 ADMIN. JUDGE WARDWELL: -- highlighted
7 these inspection procedures or the whole methodology,
8 is what I guess the best word is?

9 DR. HISER: This is Allen Hiser of the
10 Staff. Is the question the methodology used to
11 demonstrate the minimum bolt pattern?

12 ADMIN. JUDGE WARDWELL: Yes.

13 DR. HISER: That was I believe 1999.

14 ADMIN. JUDGE WARDWELL: So my question to
15 Entergy will be, why haven't you started earlier in
16 this process then in order to -- if the methodology
17 has been outlined in regards to coming up with this
18 pattern, why wasn't it done earlier considering your
19 License Renewal Application was submitted in 2007?

20 MR. DOLANSKY: We didn't feel that we
21 needed the acceptable bolting pattern analysis -- Bob
22 Dolansky with Entergy -- until we were going to
23 perform the inspection. Basically, until you perform
24 the inspection and determine if you have any degraded
25 bolts, the acceptable bolting pattern analysis doesn't

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1 do anything for you. You don't -- there's no value to
2 it until you --

3 ADMIN. JUDGE WARDWELL: I guess that gets
4 back to the question I asked earlier, why didn't you
5 start to do the inspection on the bolts earlier?
6 Which I think we've already talked about, so, okay.

7 MR. AZEVEDO: Your honor --

8 ADMIN. JUDGE WARDWELL: Mr. Azevedo, it
9 looked like you were -- you weren't, you were just
10 stretching or something?

11 MR. AZEVEDO: No, I was going to say what
12 Mr. Dolansky just said.

13 ADMIN. JUDGE WARDWELL: Okay. That's a cop
14 out. No, I believe you.

15 MR. KUYLER: Your honor, if I may? I
16 believe a moment ago Dr. Lott may have misspoke. The
17 Exhibit that I think he might have been referring to
18 is Entergy 654, that provides the accident loads.

19 DR. LOTT: Yes, 655 is the non-proprietary
20 version.

21 ADMIN. JUDGE WARDWELL: Okay.

22 DR. LOTT: Either way it works.

23 CHAIRMAN MCDADE: Dr. Lott had mentioned
24 655 and counsel is suggesting it was actually Entergy
25 654, is that --

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1 MR. KUYLER: Yes, your honor.

2 CHAIRMAN MCDADE: Okay, thank you.

3 ADMIN. JUDGE WARDWELL: Moving on to the
4 clevis bolt --

5 CHAIRMAN MCDADE: Actually, could I clear
6 something up before --

7 ADMIN. JUDGE WARDWELL: Sure.

8 CHAIRMAN MCDADE: -- you move on to --

9 ADMIN. JUDGE WARDWELL: Yes.

10 CHAIRMAN MCDADE: -- a new topic, just
11 really quickly. Mr. Dolansky, before the break, you
12 were asked with regard -- questioned on Table 1, Page
13 87, regarding welds. And that particular document,
14 it's Entergy Exhibit 616, it identifies four different
15 kinds of welds. The upper core baffle flange, the
16 barrel cylinder girth welds, the lower core barrel to
17 lower support casting welds, and the core barrel
18 outlet nozzle welds. But it doesn't have any
19 indication as to for each of these categories, how
20 many welds we're talking about. Are we talking about
21 a single weld each time or are we talking about scores
22 or hundreds or thousands?

23 MR. DOLANSKY: This is Bob Dolansky with
24 Entergy. Looking at Table 87, the upper core barrel
25 flange weld is a single weld. The upper and lower

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1 core barrel cylinder girth welds are two individual
2 welds, an upper and a lower core barrel cylinder girth
3 weld. The lower core barrel to support casting weld
4 is a single weld. The only ones that are multiple
5 welds are the lower flange welds on the control rod
6 guide tubes, which are at the top there, the second
7 box. That -- give me one second and if we could bring
8 up on the screen, let's see what, number seven -- NRC
9 114A through C and we're actually going to be looking
10 at 114B, Bravo, I believe. And we want Page 4-60.
11 It'll help clarify.

12 CHAIRMAN MCDADE: 4-60?

13 MR. DOLANSKY: 4-60, yes, your honor. Yes.
14 Stop right there, that's fine. So, this is a
15 depiction of the control rod guide tube assembly. If
16 you look on the bottom, so what we call the lower
17 flange welds in the table on Page 87, if you look on
18 the bottom of that, it shows two arrows pointing to
19 lower flange welds, the bottom one, let's say, there's
20 discrete, very small ribs and each of those ribs has
21 welds. So these components have multiple welds on
22 each component. But that's the only one that really
23 has multiple welds on each component.

24 CHAIRMAN MCDADE: Okay, thank you. And I
25 wondered, since we're at a break right here, pose a

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1 question to -- I'm sorry, Mr. Cox, did you have a --

2 MR. COX: Yes, I was just going to clarify
3 that the next page of that exhibit shows the other
4 welds that you had asked about. Mr. Dolansky
5 indicated there were one or two welds in those cases.
6 I just wanted to point out, those welds are around the
7 entire circumference of the core barrel, so it's -- I
8 mean, some of these guys could probably tell you how
9 many inches of weld that is, but it's several hundred
10 probably.

11 MR. DOLANSKY: Right. They're large -- I'm
12 sorry, I didn't mean to imply that they were small
13 welds. They're very large, long welds around a big
14 robust component.

15 CHAIRMAN MCDADE: Okay.

16 ADMIN. JUDGE WARDWELL: Does one guy do
17 them? Or do they have multiple guys?

18 MR. DOLANSKY: Well, if they're EVT1, they
19 have to -- because there's criteria on scanning speed
20 and so forth, it's actually done by special tooling.
21 But there are people watching screens for each of
22 them.

23 ADMIN. JUDGE WARDWELL: But the guy who
24 first built it, was it one guy doing one weld and he
25 can take ownership of that weld and say, there's my

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1 weld?

2 MR. DOLANSKY: Probably. Back then,
3 probably true.

4 ADMIN. JUDGE WARDWELL: Okay.

5 CHAIRMAN MCDADE: Okay. And the other
6 thing I wanted to do is just pose a question, not be
7 answered right now, but to move on with Judge
8 Wardwell's question, but to raise it for Dr. Lott and
9 Dr. Lahey who had testified earlier, addressing New
10 York Exhibit 488, which is a NUREG/CR-7184, it's from
11 December of 2014. And, basically, my question is
12 this, we've had testimony that for these low ferrite
13 stainless steel material, they won't show a meaningful
14 combined effect from thermal aging and irradiation.

15 And in that NUREG it seems to suggest,
16 well, it states, the radiation and the reduction of
17 fracture toughness was more significant in the unaged
18 than in the thermally aged specimens. And it goes on
19 to have a further discussion of that. And I'd like
20 to, perhaps at the beginning of tomorrow, come back
21 and discuss whether or not this supports the
22 hypothesis of the -- Dr. Lahey's hypothesis or whether
23 or not there's an explanation explaining why this
24 doesn't support the synergistic effect of the thermal
25 aging and the neutron embrittlement. But I don't want

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1 to take that up right now, I just wanted to address
2 that particular document to you so you would have a
3 chance to look at it this evening and perhaps you
4 could take it up briefly tomorrow. Dr. Lahey?

5 DR. LAHEY: Yes, this is Richard Lahey, New
6 York. You had asked me to look at this report, NUREG-
7 7184, and to look at the word synergistic and I did
8 look at this report and it's very interesting, the
9 later version of it was redlined out. It was
10 synergistic, but it was redlined out and combined
11 effect was put it its place. So at one point it said
12 synergistic and I guess the final issue would have
13 said combined effect.

14 CHAIRMAN MCDADE: Okay. But you would view
15 those two words as synonyms, but I don't want to take
16 it up right now and I want to let --

17 DR. LAHEY: Right.

18 CHAIRMAN MCDADE: -- Judge Wardwell move
19 on. But what I'm looking for is to whether or not,
20 not just a particular word, but whether or not this
21 NUREG and the data presented there, what impact, if
22 any, does it have on the hypothesis of the synergistic
23 effects? And, again, I don't want to take it up right
24 now, we want to move on. Take a look at it, have Dr.
25 Lott and Dr. Hiser take a look at it as well overnight

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1 and we can discuss it very briefly in the morning.

2 DR. HISER: Judge McDade, quick question on
3 that. Allen Hiser of the Staff. What page number of
4 7185 were you quoting from?

5 CHAIRMAN MCDADE: Well, I was quoting from
6 the abstract --

7 DR. HISER: Okay.

8 CHAIRMAN MCDADE: -- which is I think
9 especially like a little I or a little double I --

10 DR. HISER: Okay.

11 CHAIRMAN MCDADE: -- I was just quoting
12 from the abstract, but it then goes on.

13 MR. SIPOS: And your honor, for New York,
14 I think --

15 CHAIRMAN MCDADE: I didn't say that, I said
16 I was quoting from the abstract.

17 MR. SIPOS: Your honor, John Sipos for the
18 record. I think you were referring to 7184. I just
19 want to make sure that's clear for the record, rather
20 than 7185, which I think Dr. Hiser just mentioned.

21 CHAIRMAN MCDADE: Wait, now --

22 ADMIN. JUDGE WARDWELL: You initially said
23 7184.

24 MR. SIPOS: And that is Exhibit New York
25 488 --

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1 CHAIRMAN MCDADE: Hold on one second.

2 MR. SIPOS: -- I believe.

3 ADMIN. JUDGE WARDWELL: While you're doing
4 that, I want to correct something else that you put
5 words in Dr. Lahey's mouth and he said right and I
6 want to verify he meant to say right to what you said.
7 Judge McDade said that you believe that synergism and
8 combined are the same. That isn't what I heard you
9 say earlier today. I heard you say today synergism
10 was more than the combined.

11 DR. LAHEY: My understanding of what he
12 said and why I said right, was he indicated that they
13 were the same as far as I was concerned. What I
14 thought was synergism and what they called combined
15 was the same.

16 ADMIN. JUDGE WARDWELL: But it's not the
17 sum of the two components in your opinion is
18 synergism. Synergism is more than that, is it not?

19 DR. LAHEY: I think it can be, yes. But it
20 may also be the same.

21 ADMIN. JUDGE WARDWELL: Be what?

22 DR. LAHEY: Well, no, I think it can be
23 either one.

24 ADMIN. JUDGE WARDWELL: You think synergism
25 can be just the sum of the two?

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1 DR. LAHEY: Can have two things --
2 synergism can mean two things going on at the same
3 time or --

4 ADMIN. JUDGE WARDWELL: And it's equal to
5 only the sum of the two individual contributions?

6 DR. LAHEY: It can be, I believe, and it
7 can be --

8 ADMIN. JUDGE WARDWELL: Greater?

9 DR. LAHEY: -- more.

10 ADMIN. JUDGE WARDWELL: Okay. So you
11 believe it's both the sum and/or?

12 DR. LAHEY: I believe so. I don't know
13 what the author or --

14 ADMIN. JUDGE WARDWELL: No, what I'm asking
15 you is what's your --

16 DR. LAHEY: Yes.

17 ADMIN. JUDGE WARDWELL: -- when you say the
18 word synergism --

19 DR. LAHEY: That's my view.

20 ADMIN. JUDGE WARDWELL: -- do you mean it
21 has to be more than the sum or can it be the sum or
22 more?

23 DR. LAHEY: Yes.

24 ADMIN. JUDGE WARDWELL: No, those are
25 choices.

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1 (Laughter.)

2 DR. LAHEY: It can be either or.

3 ADMIN. JUDGE WARDWELL: Thank you. Moving
4 on to see if we can confuse some other stuff or I can
5 confuse some other stuff. I want to go back to the --

6 CHAIRMAN MCDADE: Well, let me clarify. I
7 was referring to New York Exhibit 488, NUREG/CR-7184.

8 ADMIN. JUDGE WARDWELL: Right.

9 CHAIRMAN MCDADE: If I said something
10 different, I just misspoke and I apologize.

11 ADMIN. JUDGE WARDWELL: Well, you said it
12 right, Dr. Hiser said 85 and we wanted to make sure --

13 DR. HISER: I apologize.

14 MR. COX: Could I add a clarification on
15 the report numbers?

16 (Laughter.)

17 CHAIRMAN MCDADE: Pardon?

18 MR. COX: I just -- this is Alan Cox with
19 Entergy. I just wanted to point out there's two
20 versions of the NUREG/CR-7184.

21 CHAIRMAN MCDADE: I was reading from the
22 December 2014. Is that the latest?

23 MR. COX: There is I believe a later
24 version. It is New York State, you said 574?

25 CHAIRMAN MCDADE: No, I said 488.

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1 MR. COX: Okay. There's a 574, it's also,
2 it's a New York State 000574, it's NUREG/CR-7184. And
3 I think Dr. Lahey alluded to two versions of this
4 report, so those may be the two versions. One of
5 those may have the word synergy and the other may not.

6 CHAIRMAN MCDADE: Okay. Thank you, Mr.
7 Cox.

8 ADMIN. JUDGE WARDWELL: Now we get to move
9 to what we've already discussed, but I want to clarify
10 again in regards to the clevis bolts that New York
11 State testimony, 482, Page 56 to 57, and 56 it's Lines
12 20 to 23 and 57 it moves on to Lines 1 through 9. It
13 says that failures of the clevis insert bolts
14 apparently caused by PWSCC were detected at a
15 Westinghouse designed reactor in 2010. Out of the 48
16 bolts in this reactor, 29 were partially or completely
17 fractured, but only seven of those damaged bolts were
18 visually detected as having failed.

19 Despite this high rate of failure, about
20 60 percent of the total bolts were damaged, and a low
21 rate of visual detection, only 24 percent of the
22 damaged bolts were detected, the Applicant proposes to
23 managing the aging degradation of clevis insert bolts
24 with visual VT3 inspections rather than preemptive
25 replacement. And I guess I'll reaffirm again that,

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1 Entergy, do you agree with these numbers in regards to
2 what was previously reported from Westinghouse?

3 DR. LOTT: I agree with the scale of the
4 numbers, I haven't checked the actual --

5 ADMIN. JUDGE WARDWELL: There's no reason
6 not to believe those numbers?

7 DR. LOTT: No reason not to believe those
8 numbers.

9 ADMIN. JUDGE WARDWELL: And how does that
10 low percentage, again, support the use of VT3 as an
11 inspection, when in fact almost three-quarters of
12 damaged ones will go undetected?

13 DR. LOTT: It was never our intention to
14 inspect the bolts, it was our intention to verify the
15 stability and location of the clevis itself. As we
16 talked before, the clevis can function perfectly well
17 without the bolts if it's in place. So, again, our
18 inspection is basically -- and we made recommendations
19 in the Tech Bulletin that we issued on this subject to
20 basically inspect the clevis for its seating into the
21 lug on the vessel wall and to make sure that it had
22 not moved, that there was not undue wear on the
23 surfaces that would indicate that it had moved or was
24 free to move. But we did not anticipate that a visual
25 inspection would necessarily detect cracking of a

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1 bolt.

2 ADMIN. JUDGE WARDWELL: But did you not
3 also go on and testify that you're considering or
4 evaluating whether or not to replace any of the bolts
5 that may have been damaged?

6 DR. LOTT: Well, first of all, at that
7 particular plant a number of the bolts were replaced.
8 They were replaced, again, because of our concern
9 about the commercial aspects, the potential that those
10 clevises might become dislodged, which would make it
11 difficult for them to, as we said, reinsert the
12 barrel, restart the plant. So we certainly were
13 advising them, and I think it explains this in the
14 Technical Bulletin, that it might be wise to replace
15 the bolts, but not because of a safety concern.

16 ADMIN. JUDGE WARDWELL: Dr. Lahey, in your
17 testimony, 482, Page 58, Lines 5 through 9, you state
18 that rather than taking proactive steps to replace the
19 degraded clevis bolts prior to failure, the Applicant
20 proposes to wait for failures to occur before taking
21 steps to address the problem, an approach that is
22 totally unacceptable in my opinion. Hearing what you
23 heard now, do you still believe that your demand for
24 wholesale replacement of these bolts are a reasonable
25 expenditure of effort?

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1 DR. LAHEY: Your honor, this is Richard
2 Lahey from New York. When we had this discussion
3 earlier today, it was my understanding that to replace
4 a few of the bolts is straightforward, if you have a
5 lot of the bolts, it requires a massive effort in
6 terms of realignment. And, so, I believe based on
7 that and the safety significance of it, it would
8 really depend on the degree of failure of the bolts.
9 What would make sense in any event, you don't want
10 loose parts rattling around.

11 ADMIN. JUDGE WARDWELL: In regards to that
12 last statement, Entergy, do these failures of the
13 bolts end up with loose parts? Or are they kind of
14 contained with the --

15 DR. LOTT: It's contained within the
16 system. It's difficult for the bolt head -- first of
17 all, there's locking bars. If there was wear through
18 or failure of the locking bars, still the bolt head
19 could not escape and the threaded part of the bolt
20 can't get past the head.

21 ADMIN. JUDGE WARDWELL: Thank you. Just
22 reading through here to -- Staff, is there any place
23 within your SER or SE that you evaluated the clevis
24 insert bolts and what is an appropriate action level,
25 if any, for these documented --

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1 MR. POEHLER: This is Jeffrey Poehler for
2 the Staff. Yes, we do address that in our SER in the
3 discussion of operating experience, which is located
4 right after the ten element discussion. And we --
5 yes, we reviewed that quite extensively and we agreed
6 with continuing to do VT3 examination as an acceptable
7 means of managing the potential for bolt failures.

8 ADMIN. JUDGE WARDWELL: Okay, thank you.
9 New York State's testimony, 482, Page 57, Line 20
10 through 23, and then moving over to 58, Line 1, says,
11 the Applicant's analysis of the effects of clevis bolt
12 failures assumes that all of the components will be
13 functioning according to their design specification
14 and does not consider the fact that other components
15 may also be undergoing degradation from various
16 interacting mechanisms.

17 Entergy's testimony, Exhibit 616, Answer
18 166, Page 107, says, Entergy is not required to assume
19 without evidence that other components that are within
20 the scope of the reactor vessel internals AMP or any
21 other AMP are also degraded when it evaluates the
22 functionality of the clevis insert bolts. And I guess
23 considering we have the two competing statements, I'll
24 go to Staff and ask them. What do you look for and
25 what do you consider in regards to the potential for

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1 other components outside of the AMP, the RVI AMP, that
2 might not be functioning along with these clevis bolts
3 and how are they assessed? Or is there no requirement
4 to do that and no need for safety to do that?

5 MR. POEHLER: This is Jeffrey Poehler from
6 the Staff. We would not require them to assume that,
7 for instance, the part that interfaces with the clevis
8 insert is called the radial key and that's attached to
9 the bottom of the core barrel, and we would not
10 require them to assume that, that had failed or expect
11 them to do that when doing their functionality
12 evaluation of the clevis or the lower radial support
13 system. And in addition to that, they're both
14 redundant components, both the clevis inserts and the
15 radial keys, I believe there's six. So the likelihood
16 of a significant number of those failing at once is
17 low. And the radial keys were not even a -- they were
18 a no additional measure component, which means there
19 were no inspection requirements in MRP 227-A.

20 ADMIN. JUDGE WARDWELL: Are there any
21 components that do have inspection requirements that
22 are associated with one another where you have looked
23 at the potential failure of both in the reactor vessel
24 internals?

25 DR. HISER: In general --

1 ADMIN. JUDGE WARDWELL: Not necessarily
2 with the clevis system.

3 DR. HISER: This is Allen Hiser with the
4 Staff. We do not require postulation of failures of
5 other components when assessing a finding of a
6 degraded component. That's not a part of the
7 regulatory process.

8 ADMIN. JUDGE WARDWELL: And do you know any
9 technical basis for supporting that position?

10 DR. HISER: I think technical basis is just
11 Commission position that it's not required as a part
12 of the license renewal review and that annotation of
13 license renewal.

14 ADMIN. JUDGE WARDWELL: Thank you. Let's
15 move on to the lower support columns. NRC's
16 testimony, 197, Answer 27 on Pages 35 to 36, the fuel
17 assemblies are supported inside the lower internals
18 assembly on top of the lower core plate, that's LCP,
19 and the function of the LCP are to position and
20 support the core and provide a metered control of
21 reactor coolant flow into each fuel assembly. The
22 support columns transmit vertical fuel assembly loads
23 from the LCP to the much thicker lower support casing.
24 The function of the lower support casing is to provide
25 support for the core. My question to Staff,

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1 considering it is your testimony, are these support
2 columns you're referring to the lower support columns?
3 Are they one and the same?

4 MR. POEHLER: This is Jeffrey Poehler of
5 the Staff. That's correct.

6 ADMIN. JUDGE WARDWELL: And for these
7 columns, what is the primary mechanism for developing
8 flaws from aging? Is it driven by normal operating
9 conditions?

10 MR. POEHLER: It would be normal operating
11 conditions.

12 ADMIN. JUDGE WARDWELL: And would other
13 operating conditions, such like seismic or LOCA
14 events, likely be the primary contributor to service
15 induced flaws and, if not, why not?

16 MR. POEHLER: No, those other events, like
17 seismic events would not be a significant contributor
18 because those events occur very infrequently. So the
19 --

20 ADMIN. JUDGE WARDWELL: Your testimony on
21 197, Answer 171, Page 92, says that the Action Level
22 7 requires an applicant or a licensee to perform a
23 plant specific analysis of the cast Austenitic
24 stainless steel RVI components to demonstrate that
25 components will remain capable of performing their

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1 intended functions through the end of the plant life.
2 Your Answer on 163, Page 93, goes on to state that
3 Entergy identified the only components requiring a
4 response to Action Level 7 for IP2 and 2 are the lower
5 support columns.

6 Only the upper portion of the lower
7 support columns, known as the column cap, is made from
8 CASS. The lower support columns are an expansion
9 component of MRP 227-A and the associated linked
10 primary component is a control rod guide tube lower
11 flange welds. So, let me make sure I understand this
12 correctly. Is this not saying to me that the only
13 CASS materials in the population of reactor vessel
14 internals are the upper portion of the lower support
15 columns, i.e., what's called the column cap?

16 MR. POEHLER: It's not the only CASS
17 component in the internals, or the only type of CASS
18 component, I should say, at Indian Point. It is the
19 one that is of most concern to the Staff because of
20 the high irradiation levels that parts of it can
21 experience.

22 DR. HISER: Dr. Wardwell, this is Allen
23 Hiser of the Staff. Action Item 7 specifically
24 identifies the lower support column bodies as within
25 the scope of that Action Item. And it is due to the

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1 potential for thermal embrittlement and irradiation
2 embrittlement of those. And those are the only ones
3 that were identified that would be within the scope of
4 irradiation embrittlement. So that's why it's limited
5 only to the lower core support columns.

6 ADMIN. JUDGE WARDWELL: But does the Action
7 Level 7 state that only that component is required or
8 is it more general that it requires an applicant or a
9 licensee to perform a plant specific analysis of CASS
10 components?

11 DR. HISER: Those are specified within the
12 Action Item, the lower core support columns for
13 Westinghouse plants. The intent of that Action Item
14 was to identify CASS that's within the high fluence
15 field that could lead to irradiation embrittlement.
16 Within the context of what was evaluated in MRP 227,
17 that was the only generic CASS component. Referring
18 back to Action Item 2, where plants are to evaluate
19 differences between the plant specific configuration
20 and MRP 227, if CASS was atypically used in a place at
21 Indian Point different from MRP 227, then that would
22 have been identified in Action Item 2 and also should
23 show up in Action Item 7.

24 ADMIN. JUDGE WARDWELL: And so what's the
25 criteria for being under 2 again? For an applicant to

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1 highlight whether a CASS composed material, an
2 internal composed of CASS, that's the way I want to
3 say it, I guess, would or would not require the
4 additional attention brought on by Action Level 7?

5 DR. HISER: It says that applicants should
6 review the information in Tables 4-12 and 4-2 in MRP
7 189 Rev 1, Tables 4-4 and 4-5 in MRP 191, and identify
8 whether these tables contain all the RVI components
9 that are within the scope of license renewal for their
10 facilities. I think as a part of that, because
11 material is critical, that, that would be identified
12 as well as a difference between the plant specific
13 configuration and the MRP 227 assumptions.

14 ADMIN. JUDGE WARDWELL: I guess I'm still
15 a little confused. Are the upper portion of the lower
16 support columns the only RVIs under license renewal
17 that are made of CASS? And, if not, how did the
18 others get screened out and what was the criteria for
19 screening them out, for not being highlighted under
20 Action Level 7?

21 DR. HISER: This is Allen Hiser of the
22 Staff. For Indian Point, our understanding is those
23 are the only CASS components that are subject to
24 irradiation embrittlement above the threshold level
25 used in the development of MRP 227. So they would be

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1 the only CASS components that would be subject to the
2 potential susceptibility of thermal embrittlement and
3 irradiation embrittlement.

4 ADMIN. JUDGE WARDWELL: And what is that
5 screening criteria that would separate out those that
6 were and were not susceptible to thermal embrittlement
7 and irradiation embrittlement?

8 MR. POEHLER: This is Jeffrey Poehler of
9 the Staff. The MRP screening criteria was one dpa.

10 ADMIN. JUDGE WARDWELL: Okay. And
11 Westinghouse, is everything that was stated consistent
12 with your approach and is, as a net result, the upper
13 portion of the lower column supports, that is made of
14 CASS material, the only RVI that does not meet the
15 screening criteria of one dpa of fluence and,
16 therefore, is part of and falls under Action Level 7?

17 DR. LOTT: For the most part, I believe
18 that's true. I'm recalling --

19 ADMIN. JUDGE WARDWELL: Well, then the
20 other parts I'm interested in.

21 DR. LOTT: I know and I'm trying to get
22 there. I'm not -- really I'm trying to get there.
23 And there's one component that I need to check on and
24 that might be the upper support column, which I
25 believe in my previous testimony indicated that it was

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1 potentially CASS. I don't know if it is or not.

2 ADMIN. JUDGE WARDWELL: Let's put that on
3 your homework list for tomorrow morning then to
4 determine whether there are any RVIs --

5 DR. LOTT: Yes. I would point out that
6 there are some other CASS components in the system and
7 that part of the evaluation procedure that led to this
8 screening process in MRP 191 was an evaluation of the
9 impact of those components or of those degradation
10 mechanisms. Of course, they would have been
11 identified for thermal embrittlement anyway.

12 ADMIN. JUDGE WARDWELL: Do you agree that
13 the one dpa is the threshold screening criteria or is
14 it not?

15 DR. LOTT: Yes.

16 ADMIN. JUDGE WARDWELL: It is?

17 DR. LOTT: Yes, it is. But --

18 ADMIN. JUDGE WARDWELL: So we're back to --

19 DR. LOTT: -- what I would say, what the
20 classification process that identified components to
21 be in MRP 227 or not also had this evaluation of the
22 structural significance of the component. So it's
23 possible -- and as I understand the documentation in
24 Action Item 7, it basically said that the NRC had
25 reviewed those decisions in MRP 191 and said that if

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1 things were appropriately dealt with there, there was
2 not a need for functionality analysis under Action
3 Item 7. So it grandfathered in things that were
4 identified within MRP 191 as potentially CASS and
5 evaluated and screened out, are not required to go
6 through this process. And that I'm believe is true of
7 the upper support columns.

8 ADMIN. JUDGE WARDWELL: Well, that's -- I'm
9 interested in whether or not all of those that haven't
10 either been grandfathered out by 191 or haven't been
11 screened out due to the criteria of the one dpa are
12 now present in or not highlighted by 7 now, the
13 reasons why they aren't? Well, I do not want to read
14 that question in the transcript at all.

15 (Laughter.)

16 DR. LOTT: I think I can -- I don't think
17 that, that description you -- there are any components
18 that meet that description that you just said.

19 ADMIN. JUDGE WARDWELL: I just want to have
20 you verify that you have captured all of those that
21 need to be captured and that the lower support column
22 is the only one that needs to be captured by 7.

23 DR. LOTT: Okay. Action Item 7, that I
24 believe is true.

25 MR. STROSNIDER: This is Jack Strosnider

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1 for Entergy. I just want to say, one other parameter
2 that may come into consideration here is the
3 resistance of CASS material to any type of formation
4 of any type of corrosion cracks. And we haven't
5 talked about that, but this material, although it can
6 permeate and we talked about that earlier, depending
7 on the ferrite content, et cetera, but the good thing
8 about this material is that it's very hard to crack.
9 And I'm not sure that there's any operating experience
10 in which we actually have seen cracking in these CASS
11 materials. To my knowledge, we haven't, unless
12 there's something fairly recently. So, that may also
13 factor into how this is treated and we'll have to look
14 at that.

15 ADMIN. JUDGE WARDWELL: Thank you. Back to
16 Entergy again. The upper portion of the lower support
17 column is made of CASS, what's the lower portion made
18 of?

19 DR. LOTT: The wrought stainless steel.

20 ADMIN. JUDGE WARDWELL: The raw?

21 DR. LOTT: Wrought stainless steel. I'm
22 sorry, I'll get closer to the microphone again.

23 ADMIN. JUDGE WARDWELL: I thought I heard
24 you say raw. Okay, wrought stainless steel. Thank
25 you. Dr. Lahey, do you have any knowledge of any

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1 potential RVIs that you believe should fall under
2 A/LAI 7 in regards to the Aging Management Program?

3 DR. LAHEY: Your honor, I have reviewed
4 EPRI 191 and I'll have to look back on it, it's in the
5 other room. But my recollection is there were core
6 plates, upper and lower, that were castings, but I'll
7 have to verify that.

8 ADMIN. JUDGE WARDWELL: Okay. So, Entergy,
9 you might note that also that those plates are of
10 interest and comment on that if you would.

11 DR. LOTT: Okay.

12 ADMIN. JUDGE WARDWELL: Thank you, Dr.
13 Lahey. Answer of NRC's 197, 163 on Page 94, states
14 that the lower support columns for IP2 and 3 are made
15 from type CF-8 stainless steel, which is a low
16 molybdenum contact grade of cast stainless steel. Low
17 molybdenum cast grades are less susceptible to thermal
18 embrittlement than the high moly cast grades, such as
19 types CF-8M. Entergy determined the lower support
20 columns at IP2 and 3 were not susceptible to thermal
21 embrittlement. And, again, do these statement refer
22 only to the cap as being not susceptible to thermal
23 embrittlement because the lower wrought iron has
24 already been screened out, it's not part of A/LAI 7?

25 DR. LOTT: Yes. The lower cast of

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1 Austenitic stainless steel, wrought stainless steel,
2 is not subject to thermal embrittlement. It would
3 only be the upper cast portion.

4 ADMIN. JUDGE WARDWELL: And so whenever we
5 talk about -- whenever you reference lower support
6 under this section of the CASS portion, you mean just
7 the upper part? Let me rephrase that question. When
8 you are referring to the cap of the lower support
9 system, that's what you're referring to is that upper
10 part that's made out of CASS, is that correct?

11 DR. LOTT: Yes.

12 ADMIN. JUDGE WARDWELL: And is that the top
13 half of the column? Is it at the top little piece of
14 the column? Or is it a top quarter of the column?

15 DR. LOTT: It's more like quarter to a
16 third of the column. I don't think it --

17 ADMIN. JUDGE WARDWELL: But it's not that
18 little, I saw a diagram of the column and there's a
19 little rectangular piece on the top, that's not the
20 cap, it's more than that?

21 DR. LOTT: No, it's more than that.

22 ADMIN. JUDGE WARDWELL: It's a --

23 DR. LOTT: Yes.

24 ADMIN. JUDGE WARDWELL: -- major portion --

25 DR. LOTT: It's --

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1 ADMIN. JUDGE WARDWELL: -- a portion of
2 that --

3 DR. LOTT: Right.

4 ADMIN. JUDGE WARDWELL: -- entire column?

5 MR. DOLANSKY: It has some length to it.

6 ADMIN. JUDGE WARDWELL: Yes, okay. Just so
7 we have a feeling of it. And by screening it out as
8 being unsusceptible to thermal embrittlement, that by
9 necessity means that the caps cannot be susceptible to
10 the combined effects of irradiation embrittlement and
11 thermal embrittlement, it's just the irradiation
12 embrittlement, is that correct? Entergy?

13 MR. DOLANSKY: Yes, that's correct. This
14 is Bob Dolansky. Yes, that's correct.

15 ADMIN. JUDGE WARDWELL: And, Staff, as far
16 as you're concerned, you agree with that conclusion?

17 MR. POEHLER: This is Jeffrey Poehler with
18 the Staff. Yes, we agree with that conclusion.

19 ADMIN. JUDGE WARDWELL: Dr. Lahey, do you
20 agree that just the upper portion of this column cap
21 is --

22 DR. LAHEY: Yes, sir, that's my
23 understanding as well.

24 ADMIN. JUDGE WARDWELL: Thank you. The A
25 163, Page 95 goes on to say that screening criteria

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1 would allow the low molybdenum cast with delta ferrite
2 content of 20 percent or less to be screened out, that
3 is not susceptible to thermal embrittlement. Since
4 portions of the lower support column will have neutron
5 fluences at the end of life greater than one times ten
6 to the 17 neutrons per square centimeter, the Staff
7 did not accept Entergy's screening and the Staff
8 updated the criteria of low molybdenum statically cast
9 CASS with a ferric content of less than 15 percent can
10 be screened out for thermal embrittlement and any
11 synergistic effects of TE and IE and as low molybdenum
12 statically cast CASS is only susceptible to
13 irradiation embrittlement at fluences greater than one
14 times ten to the 21 neutrons per square centimeter or
15 1.5 displacements per atom.

16 Staff, could you try to condense that
17 whole confusing thing I just read, or a bit confusing
18 to me, in regards to how these lower columns were
19 specifically, and specifically the lower portion of
20 this that's called the cap -- the upper portion of the
21 lower column, were screened out and assessed by you?

22 DR. HISER: Okay. This is Allen Hiser of
23 the Staff. The top of that paragraph talks about the
24 20 percent or less screening for thermal
25 embrittlement.

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1 ADMIN. JUDGE WARDWELL: And that's for
2 delta ferrite content, correct?

3 DR. HISER: Right. That's correct. And
4 that was proposed for really CASS that was not subject
5 to neutron embrittlement. So it was subject to low
6 neutron fluence. With the possibility of higher
7 neutron fluence levels combined with the potential for
8 thermal embrittlement, we went back and looked at the
9 screening, the 20 percent, and concluded that we
10 should reduce that level by five percent to 15
11 percent. And we thought that, that was a reasonable
12 screen to preclude the potential synergism of thermal
13 embrittlement and irradiation embrittlement.

14 When Indian Point then came in with their
15 measured ferrite values, or their ferrite values for
16 their lower core support column caps, and it was below
17 15 percent, we thought it was reasonable to screen
18 that out then from potential synergistic effects of
19 thermal embrittlement and irradiation embrittlement.
20 So what that leaves then for those components is only
21 a concern with the irradiation embrittlement on the
22 fracture toughness for those materials.

23 ADMIN. JUDGE WARDWELL: And the fluence
24 screening and any molybdenum screening didn't play a
25 part in this?

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1 DR. HISER: The molybdenum screening did
2 not because this was a low molybdenum material. The
3 fluence level did from the perspective that the
4 fluence exceeded one dpa and, therefore, the 15
5 percent delta ferrite screening level was implemented
6 instead of the 20 percent that would apply for lower
7 fluence CASS material.

8 ADMIN. JUDGE WARDWELL: Thank you. Dr.
9 Lahey, do you agree that this was an appropriate
10 screening process and that the lower column caps have
11 been successfully screened and are being assessed in
12 the way they should be for irradiation embrittlement
13 alone?

14 DR. LAHEY: Yes, your honor. Given the
15 criteria that's been established, it sounds like it
16 has been properly done.

17 ADMIN. JUDGE WARDWELL: Thank you, sir.
18 New York State's testimony on 482, Page 18, Lines 16
19 through 22, discusses a recent report prepared by
20 Argonne National Laboratory for the U.S. NRC and
21 acknowledges with respect to CASS materials that are
22 used for the lower support column caps that combined
23 effect of thermal aging and irradiation embrittlement
24 could reduce the fracture resistance even further to
25 a level neither of these degrading mechanisms can

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1 impart alone.

2 And I guess I would just ask, and we've
3 already verified that it's been screened correctly, so
4 really what my question is here, I want to make sure
5 what Argonne National Laboratory work and report that
6 you were referring to in this statement. Do you
7 recall, Dr. Lahey? Is it NUREG/CR-7184 or is there
8 some other one? Because you go on, on Page 20, to
9 talk about NUREG-7184 and then even the Chopra report,
10 the degradation of light water reactor core internal
11 materials due to neutron irradiation, which is NUREG-
12 7027. And I'm just trying to sort out all these
13 reports.

14 DR. LAHEY: Your honor, I'd have to go back
15 and look to know for sure.

16 ADMIN. JUDGE WARDWELL: Okay. Add that on
17 to your list.

18 DR. LAHEY: Yes.

19 ADMIN. JUDGE WARDWELL: And do try to get
20 to bed by at least 3:00 a.m. if you could. Because
21 we're starting here tomorrow at 4:00 aren't we?

22 (Laughter.)

23 CHAIRMAN MCDADE: Thirty.

24 ADMIN. JUDGE WARDWELL: 4:30, I'm sorry.

25 (Laughter.)

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1 ADMIN. JUDGE WARDWELL: Yes, thank you.
2 And specifically to get back to that --

3 CHAIRMAN MCDADE: I digress for a second,
4 but Judge Wardwell has stayed on Central European Time
5 forever. So he insists that we do start early and
6 would prefer that we start at 4:00 Eastern.

7 ADMIN. JUDGE WARDWELL: No, because I
8 wouldn't be ready. I need that time for being ready.

9 (Laughter.)

10 ADMIN. JUDGE WARDWELL: It's your testimony
11 in 482 on Page 18, Line 16 through 22, and then it's
12 your testimony Page 20 on Lines 6 through 10 where
13 these various -- on 16 through 22, you talk about the
14 Argonne National Laboratory report and then you go on,
15 on Page 20 to cite both 7184 and 7027.

16 DR. LAHEY: Okay.

17 ADMIN. JUDGE WARDWELL: NRC's testimony on
18 197, Answer 164, Pages 96 to 97, states that the Staff
19 found that Entergy adequately addressed Action Level
20 7 based on the following. One, Entergy evaluated the
21 CASS components of the RVIs and that is limited to the
22 lower support column caps. Entergy screened the
23 column caps for TE and IE using plant specific
24 materials data and determined that the column caps are
25 not susceptible to TE. And Staff confirmed the

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1 results of the screening using its own screening
2 criteria.

3 Three, Entergy provided information on
4 fabrication, non-destructive NDE demonstrating that
5 preexisting flaws are unlikely to exist in the column
6 caps. Four, Entergy provided information on expected
7 stresses and neutron fluences for the column caps that
8 demonstrated the service induced cracking due to
9 irradiation assisted stress corrosion cracking is
10 unlikely. And, five, Entergy modified its reactor
11 vessel internals program to include a link to a lead
12 component that is an appropriate predictor of IASCC
13 and IE for column caps with an appropriate schedule
14 for performing the expansion inspection if necessary.

15 Therefore, the Staff found that the
16 formation provided by Entergy provides reasonable
17 assurances that the functionality in the column caps
18 will be maintained during this period of extended
19 operation. Entergy goes on in their testimony and
20 states in Exhibit 616 under Answer 197, Page 131, that
21 in regards to the inspection criteria, the lower core
22 barrel cylindrical girth weld reveals that it is more
23 likely to experience this irradiation assisted stress
24 corrosion cracking than the lower support column caps.
25 So it is appropriate to link the two with the weld as

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1 a primary component and the LSCC as the expansion
2 component.

3 And I guess I'll start with Staff on this
4 and say that, in your approval of this as summarized
5 in that, that I just read, you mentioned about linking
6 to a component that is the primary component and I
7 thought earlier, which I think I read, you stated that
8 the control rod guide tubes lower flange welds were
9 the primary link to the lower support column caps.
10 And now Entergy is claiming that it's the lower core
11 barrel cylinder girth weld is the one. Which is it?

12 MR. POEHLER: At this time, it's both
13 because they added the girth weld as a plant specific
14 primary link. So in MRP 227-A, the generic primary
15 link for the lower core support columns is the control
16 rod guide tube lower flange. When the Staff was
17 reviewing the Action Item 7 information submitted by
18 Entergy, we were satisfied with what they had given
19 us, but we still had a lingering concern that for
20 irradiation embrittlement, because irradiation
21 embrittlement still applies even though thermal
22 embrittlement was screened out, we still had a
23 lingering concern that irradiation embrittlement
24 wasn't appropriately predicted by the standard MRP
25 primary link.

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1 Because that control rod guide tube lower
2 flange weld is a relatively low fluence component,
3 didn't even screen-in for irradiation embrittlement or
4 irradiation assisted stress corrosion cracking, which
5 are two mechanisms that do apply to the lower support
6 columns. So we asked another RAI to Entergy regarding
7 an appropriate -- can you propose an appropriate
8 primary link for these mechanisms? And that's when
9 they proposed the lower core barrel girth weld. And
10 we reviewed that information that they submitted and
11 concluded that it was a more appropriate primary link
12 for those mechanisms of irradiation embrittlement and
13 irradiation assisted stress corrosion cracking.

14 ADMIN. JUDGE WARDWELL: Okay. Thank you.
15 Dr. Lahey, do you have any reason to not accept those
16 as appropriate primary links to these expansion
17 components?

18 DR. LAHEY: The use of the girth weld as a
19 proxy for the core cap, it seems an odd choice
20 actually because of the materials used and how they
21 would respond to thermal and irradiation effects. And
22 I know they needed to use something because they
23 weren't able to do an inspection of the core caps, but
24 it just seems it's a very odd choice. And I must say
25 when I was reading the ACRS testimony on this, they

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1 had exactly the same opinion. So I know what they
2 did, it just seems odd.

3 ADMIN. JUDGE WARDWELL: And do you feel
4 it's also odd to use the control rod guide tube lower
5 flange welds as the other primary?

6 DR. LAHEY: It's not a casting. Yes.

7 ADMIN. JUDGE WARDWELL: So, Entergy, why
8 have you proposed the lower core barrel cylinder girth
9 weld as the primary?

10 DR. LOTT: Well, as Mr. Poehler explained,
11 it was basically a request coming from the NRC to
12 consider an alternative to the lower control rod
13 guide, I can't say it either myself, the CRGT lower
14 flange welds. And we looked at similarities in
15 materials and we understood that -- we looked at the
16 lower support column caps as a low ferrite material,
17 not susceptible to thermal embrittlement. And we
18 looked at the core barrel weld material and realized
19 it also would have a duplex structure, a low ferrite
20 content, and then some very similar characteristics.
21 Both components had similar fluences and in an
22 abundance of caution here, I think even though we
23 probably could have demonstrated that it would screen-
24 out for irradiation assisted stress corrosion
25 cracking, I think we just wanted to make sure that we

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1 were looking for the most likely locations for cracks.

2 ADMIN. JUDGE WARDWELL: Okay.

3 DR. LOTT: And let me just one further --
4 I think the tipping point that made the core barrel
5 the primary location for this particular situation was
6 that based on the potential for residual stresses in
7 the core barrel weld, we expect the stresses,
8 particularly on the surface, to be much higher in the
9 core barrel weld, where as we've just explained, we
10 looked through the normal operating stresses in the
11 lower support columns and found they're very limited.
12 So we would expect to see cracking in these kinds of
13 materials at these fluences first in the core barrel
14 and later in the lower support column, if ever.

15 ADMIN. JUDGE WARDWELL: Okay. What about
16 the control rod guide tubes lower flange welds, will
17 they also show up any cracking prior to the lower
18 support column caps?

19 DR. LOTT: Well, again, they have some
20 potential to have some residual stresses and some
21 other concerns that might put them ahead on the list.
22 But because they weren't irradiated, we felt that this
23 addition that Entergy has of using both as a primary
24 component made the most sense.

25 ADMIN. JUDGE WARDWELL: Now, then for Staff

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1 --

2 CHAIRMAN MCDADE: If I could interrupt for
3 a second. Dr. Lott, when we come back to you, if you
4 could just state your name, otherwise --

5 DR. LAHEY: Okay.

6 CHAIRMAN MCDADE: -- Mr. Cox is going to
7 get --

8 DR. LAHEY: I'm sorry.

9 CHAIRMAN MCDADE: -- blamed in the
10 transcript for things that you say.

11 DR. LAHEY: Yes, I'm sorry.

12 CHAIRMAN MCDADE: Okay.

13 ADMIN. JUDGE WARDWELL: Take credit. Dr.
14 Hiser, this discussion raises a question in my mind,
15 why shouldn't these lower support column caps be
16 elevated to a primary component? And what is the
17 criteria that puts something as a primary component as
18 opposed to an expansion component, if I've used the
19 right two terminologies?

20 DR. HISER: This is Allen Hiser of the
21 Staff. One of the reasons is that the column caps are
22 a highly redundant structure. And, therefore, it
23 would require multiple failures for the functionality
24 of the lower core support system to be challenged. In
25 this case, as Dr. Lott mentioned, the residual

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1 stresses in the core barrel weld create a situation
2 where we expect that cracking would initiate much
3 sooner than in the column caps. Therefore, we believe
4 it's a reasonable linkage with the column caps being
5 an expansion component predicated on inspection
6 findings from the core barrel girth welds.

7 ADMIN. JUDGE WARDWELL: And why still hold
8 with the control rod guide tubes lower flange welds?
9 Why should that still be a primary for this? It
10 sounds like you don't feel comfortable that it will
11 supply any advanced notice of what might happen or
12 substitute notice for what might happen at the lower
13 support column caps.

14 DR. HISER: This is Allen Hiser with the
15 Staff. The CRGT welds, I believe, are still a primary
16 link for the column caps. Again, because of weld
17 residual stresses, we would expect the likelihood of
18 stress corrosion cracking to be higher there. So
19 they, again, if you were to look at a hierarchy of
20 where you expect things to occur first, the CRGT welds
21 and the lower core barrel girth weld would be higher
22 than the column caps.

23 ADMIN. JUDGE WARDWELL: Is it possible to
24 inspect the lower support column caps?

25 DR. HISER: From discussions we've had with

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1 Westinghouse, I believe it is possible, yes.

2 ADMIN. JUDGE WARDWELL: Okay.

3 DR. HISER: Our understanding is that it
4 would be an extremely difficult inspection to do, but
5 it is certainly possible and would be necessary
6 pending the results from the primary inspections, if
7 expansion was required then the plant would be
8 required to do those expansion inspections.

9 ADMIN. JUDGE WARDWELL: Dr. Lahey, after
10 hearing this additional explanation, do you have any
11 other comments in regards to the expansion monitoring
12 plan for the lower support column caps?

13 DR. LAHEY: No. I understand what they
14 said and I understand the rationale. Just personally,
15 I think if you're interested in core cap, it's better
16 to do the inspection on the core cap, even if it's a
17 more difficult inspection.

18 ADMIN. JUDGE WARDWELL: Okay, thank you.
19 New York State's testimony, 482, Page 59, Lines 1
20 through 3, states that the Applicant, based on a lack
21 of documented fractures of core support columns,
22 assumed that only a limited number of columns could
23 actually contain flaws of significant size. And I
24 guess I'll ask Entergy, did you assume only a limited
25 number of lower support column caps contained flaws or

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1 was this the result of any analysis or conclusion or
2 was it just an assumption?

3 DR. LOTT: I'm not sure exactly where we
4 think we -- my name is Randy Lott, I'm sorry, thank
5 you. I'm not sure exactly --

6 ADMIN. JUDGE WARDWELL: Alan doesn't want
7 to take credit for what you're saying or Mr. Cox
8 doesn't want to take credit for what you're saying.

9 DR. LOTT: I'm not sure exactly where we're
10 saying we made this assumption. We certainly did do
11 analyses as Dr. Hiser has suggested to look at
12 effectively the redundancy in the system, in the
13 system of calculations that are very similar to what's
14 done for the baffle former bolts to look at minimum
15 requirements, and found that there was a large degree
16 of redundancy in the system. That's all reported in
17 -- it's a proprietary report, but it's PWROG14-048,
18 which is ENT 667.

19 ADMIN. JUDGE WARDWELL: Did you have any
20 other knowledge of any potential flaws or lack thereof
21 in the lower support column caps?

22 DR. LOTT: We have no expectation of flaws.

23 MR. DOLANSKY: This is Bob Dolansky with
24 Entergy. I just want to add, we also -- for the lower
25 support column caps, when they were installed they had

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1 detailed NDE radiography performed on them, which
2 would give very, very high confidence that there were
3 no flaws in those when they were installed.

4 ADMIN. JUDGE WARDWELL: And what is that
5 testing composed o?

6 MR. DOLANSKY: Basically similar to an x-
7 ray on a person. It's an x-ray of the lower support
8 column cap, was performed on all column caps, and
9 determined that there was no flaws in -- it's the, I
10 don't want to say the best, but it's an extremely good
11 NDE technique used to verify that there's no flaws.

12 ADMIN. JUDGE WARDWELL: Thank you.

13 CHAIRMAN MCDADE: If I could jump in here
14 quick between questions and get something clarified.
15 A while ago, a few minutes, we were talking about, and
16 I believe that you said, Dr. Lahey, that you thought
17 it was an odd choice of using the core barrel girth
18 weld as a proxy for another item. Do you recall that
19 testimony?

20 DR. LAHEY: Yes.

21 CHAIRMAN MCDADE: Okay. And --

22 DR. LAHEY: For the column caps.

23 CHAIRMAN MCDADE: -- the control guide tube
24 flange, was it or --

25 DR. LAHEY: Well, I believe we were talking

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1 about that and the cast column cap that was --

2 CHAIRMAN MCDADE: Okay. But what I'm
3 trying to get at is, what I thought I heard you say is
4 that you thought that it was an odd proxy because of
5 the differences in the materials that they were made
6 out of. And then I thought I heard Dr. Lott testify
7 that part of the reason that they were chosen is
8 because of the similarity of the materials. So, let
9 me go to Dr. Lott, would you state for the record what
10 components we're talking about and what they're made
11 of?

12 DR. LOTT: Okay. This is Randy Lott for
13 Entergy. We're talking about the large structural
14 weld basically around the middle, I'll call it the
15 belt line, of the core barrel and these column caps,
16 which obviously we've been discussing all along, which
17 are CF-8 material, but with a relatively low ferrite
18 content of about 15 percent. They're castings, which
19 means that effectively they're melt, cast, and cooled
20 in the system, which gives us this duplex grain
21 structure. In fact, we need some duplex structure in
22 order to get a successful casting, so that's -- in a
23 weld, you get a very similar micro-structure or
24 material structure because, again, it's a material
25 that's welded and solidified.

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1 And you get very similar behavior in terms
2 of duplex construction of those material, albeit
3 sometimes a slightly lower ferrite content. So, in
4 the sense that they're both these duplex Austenitic
5 ferritic structures, there's some real similarities in
6 the contents. Particularly, it seemed to us, because
7 there was particularly low ferrite content at Indian
8 Point, it made sense to couple up these two materials.
9 Then, as I said, the controlling factor for us was the
10 large potential residual stresses, which would drive
11 much more cracking in the core barrel, much sooner,
12 than it would in the lower support columns.

13 CHAIRMAN MCDADE: Okay. Thank you, Dr.
14 Lott. And, Dr. Lahey, what were the dissimilarities
15 that you thought made it an odd proxy?

16 DR. LAHEY: This is Richard Lahey from New
17 York State. The dissimilarities are the metals
18 themselves. The weld has typically significantly
19 lower delta ferrite than would be in the casting. And
20 the stresses on the structure are significantly
21 different. As I understood it, one of the things they
22 liked about the two were the potential for corrosion
23 cracking. But it's a stretch, I just think it's quite
24 a stretch to look at one and say, it's going to happen
25 here before it happens there. So they're looking for

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1 the canary in the coal mine to decide what they might
2 want to do on the core cap. And I, frankly, I think
3 it's better to look at the coal mine, go down and
4 check the core cap.

5 CHAIRMAN MCDADE: Okay. Thank you, Dr.
6 Lahey.

7 ADMIN. JUDGE WARDWELL: Do you have any
8 reason to believe that the cracking would not occur
9 sooner in the lower core barrel cylinder girth weld
10 prior to anything happening with the lower support
11 column caps?

12 DR. LAHEY: Your honor, I think the
13 stresses on the things are -- there's no reason for
14 them to be similar. You have one loaded supporting
15 structure, you have the other one loaded in this way.
16 It's just -- to me it's a very odd choice. I heard
17 what they said, I do understand why they decided to do
18 it, but primarily I think it's driven by
19 accessibility.

20 ADMIN. JUDGE WARDWELL: Thank you.

21 DR. HISER: Judge Wardwell, could we
22 supplement that a little bit?

23 ADMIN. JUDGE WARDWELL: Yes, you may.

24 DR. HISER: I think you've heard a little
25 bit -- this is Allen Hiser of the Staff. You've heard

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1 a little bit about the reasons that the Applicant
2 thought that was acceptable. The Staff basis is sort
3 of similar, but there may be at least two additional
4 factors. As Dr. Lahey mentioned, the column caps will
5 be in compression. The core barrel girth weld, the
6 CRGT welds will not. So it's much more likely that
7 they will exhibit stress corrosion cracking because of
8 the weld residual stresses first and the higher
9 membrane stresses from the operational loads.

10 In addition, the column caps are cast
11 Austenitic stainless steel, which has generally been
12 found to have a very, very low likelihood of
13 initiating stress corrosion cracks. So, therefore,
14 the material in the column caps is much better from a
15 likelihood of stress corrosion cracking. The other
16 materials have much higher stresses and so they will
17 be much more likely to have cracking prior to the
18 column caps. So that provides a more complete
19 picture, I think, of the basis for the Staff finding
20 that to be acceptable.

21 ADMIN. JUDGE WARDWELL: Thank you, Dr.
22 Hiser. New York State's testimony, 482, Page 61,
23 Lines 11 through 17, states that the reactor vessel
24 internal components made from non-cast stainless steel
25 will also experience the combined effects of

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1 irradiation induced embrittlement, corrosion, and
2 other aging mechanisms. The Applicant has failed to
3 evaluate the mechanisms that occur for many of the
4 other important and vulnerable RVI components, such as
5 the core baffles, the baffle bolts, and the formers.

6 Entergy's testimony, Exhibit 616, Answer
7 202, Page 135 to 136, states that these components are
8 not made of cast materials, so they are not
9 susceptible to thermal embrittlement. MRP 227-A and
10 the reactor vessel internals AMP identify irradiation
11 assisted stress corrosion cracking which, as the name
12 implies, is actually the result of multiple underlying
13 mechanisms itself as the aging mechanism of concern
14 for these components, again referring to the core
15 baffles, baffle bolts, and formers. And that these
16 components are all designated for primary inspections
17 under the RVI AMP and Inspection Plan. And I guess
18 I'll start with Entergy just quickly to confirm that
19 when you were referring to these components, you were
20 referring to the core baffles, baffle bolts, and
21 formers that you claim are designated as primary
22 inspections under the RVI AMP and Inspection Plan. Is
23 that correct?

24 DR. LOTT: Yes, I believe that's true.

25 ADMIN. JUDGE WARDWELL: Say --

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1 DR. LOTT: Yes, I believe that's true.
2 This is Randy Lott.

3 ADMIN. JUDGE WARDWELL: Thank you. And,
4 Dr. Lahey, do you now agree that those core baffles
5 and the baffle bolts and the formers are handled by
6 the RVI AMP?

7 DR. LAHEY: It's clear that they are being
8 inspected using the techniques in MRP 227-A, if that's
9 what you mean.

10 ADMIN. JUDGE WARDWELL: Yes.

11 DR. LAHEY: Yes.

12 ADMIN. JUDGE WARDWELL: Okay. Do you have
13 any other comments on that? And they're being
14 inspected as the primary components, is that your
15 understanding also?

16 DR. LAHEY: Yes, that's my understanding.

17 ADMIN. JUDGE WARDWELL: Okay, thank you.
18 That's all I have.

19 ADMIN. JUDGE KENNEDY: This is Judge
20 Kennedy. Just going back to the baffle former bolts
21 and maybe this most recent discussion answered the
22 question, but earlier in today's testimony, you had a
23 colorful expression for the baffle former bolts being
24 subject to shock loads and you referred to unzipping
25 the rest of the bolting.

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1 DR. LAHEY: Yes.

2 ADMIN. JUDGE KENNEDY: Is this still a
3 concern of yours given what we've gone through this
4 afternoon and all the other testimony on the baffle
5 former bolts?

6 DR. LAHEY: Yes, your honor, it is.

7 ADMIN. JUDGE KENNEDY: Within your
8 testimony, do you have any support for the assertion
9 that these bolts, when subject to a shock loading,
10 would fail catastrophically?

11 DR. LAHEY: If they are significantly
12 weakened, we're talking as we get out in time and
13 they've been irradiated significantly, they've been
14 subjected to fatigue, they've been subjected to
15 irradiation assisted stress corrosion cracking, and if
16 they're significantly weakened in that way and they're
17 subjected to a strong shock load, yes, I have a
18 serious concern about it.

19 ADMIN. JUDGE KENNEDY: Is this combination
20 of aging mechanisms all applicable to these bolts?

21 DR. LAHEY: I'm sorry, could you --

22 ADMIN. JUDGE KENNEDY: Is this combination
23 of aging mechanisms all applicable to these --

24 DR. LAHEY: I believe they are, yes.

25 ADMIN. JUDGE KENNEDY: Entergy, do you feel

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1 that this combination of aging mechanisms would be
2 applicable to the baffle former bolts?

3 DR. LOTT: Yes. I mean, to the baffle
4 former bolts -- can you name the mechanisms again for
5 me -- I'm sorry, I'm -- they're subject to irradiation
6 embrittlement, they're subject to irradiation assisted
7 stress corrosion cracking, they're subject to
8 irradiation induced stress relaxation, they're
9 potentially subject to void swelling. So, yes,
10 they're -- and we model all of those components.

11 ADMIN. JUDGE KENNEDY: I guess the other
12 one I heard was metal fatigue. I don't know --

13 DR. LOTT: Metal fatigue is, yes, certainly
14 a possibility.

15 ADMIN. JUDGE KENNEDY: So is this now back
16 to the question of how much synergism there is between
17 all these aging mechanisms, if there is any?

18 DR. LOTT: Well, I mean, I will point out
19 that our experience with baffle -- we have experience
20 with failure rates in baffle former bolts, a fair
21 amount. We have a fair amount of data now on baffle
22 former bolts. So, we have -- I don't see a lot of
23 surprises coming forward in this testimony and because
24 we're monitoring, as we said, the effects and if we're
25 looking for the effects on cracking, whatever combined

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1 effects are there, are there in that data base or in
2 that operating experience.

3 ADMIN. JUDGE KENNEDY: Does this data
4 include bolts subjected to higher fluences, towards
5 the end of design life? Maybe not extended life, but
6 design life at least?

7 DR. LOTT: Yes. I mean, some of these
8 examinations have been performed as part of similar
9 plant life license renewal applications, PEOs. So,
10 yes, they've been towards the end of plant life.

11 ADMIN. JUDGE KENNEDY: So it does include
12 some bolting that has been examined during the period
13 of extended operation for other plants?

14 DR. LOTT: At or near.

15 ADMIN. JUDGE KENNEDY: Okay. At or near.
16 I don't want to put words in your mouth.

17 MR. STROSNIDER: This is Jack Strosnider
18 for Entergy. I'd like to come back to the first part
19 of your question on loads for just a minute if I
20 could.

21 ADMIN. JUDGE KENNEDY: Okay, sure.

22 MR. STROSNIDER: We talked earlier about
23 the WCAP report that NRC reviewed and approved with
24 regard to the methodology for establishing the bolting
25 patterns, et cetera. That WCAP report evaluated the

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1 design basis dynamic loads associated with design
2 basis accidents, such as the loss of coolant, et
3 cetera. So to the extent that Dr. Lahey's concern
4 about dynamic loads, that those loads are within the
5 original design basis, they have been addressed. If
6 there's something over and above what was in the
7 original design basis, I'm not -- it's not clear, to
8 me at least, what they are and also I would suggest
9 that they're outside the space of license renewal.
10 But it's just not clear what loads he's talking about
11 that would be over and above what's in the licensing
12 basis. And if they're within the licensing basis,
13 they were evaluated.

14 ADMIN. JUDGE KENNEDY: And would those
15 bolts that were subjected to the design basis loads
16 include the effects of these various aging mechanisms?
17 Consideration of the effects of these various aging
18 mechanisms? Which seems to be the other part of Dr.
19 Lahey's concern.

20 MR. GRIESBACH: Your honor, this is Tim
21 Griesbach for Entergy. If you're asking whether those
22 multiple aging mechanisms have been considered as part
23 of the Aging Management Program for the baffle former
24 bolts, as Dr. Lott said, the answer's definitely yes.
25 They've also been identified as primary components for

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1 inspections and, to the best of my knowledge, there's
2 been at least 19 PWR units that have performed those
3 inspections already for MRP 227 and very few failed
4 bolts have been found throughout those inspections.

5 ADMIN. JUDGE KENNEDY: Is the foundation of
6 the strength of this bolting subject to these aging
7 mechanisms the lack of cracking? I mean, if it hasn't
8 cracked, it still maintains its design fatigue life or
9 design life?

10 MR. GRIESBACH: This is Tim Griesbach again
11 for Entergy. The answer is yes. Those materials
12 undergo strengthening, in fact, due to the irradiation
13 effects. So they are stronger than they would have
14 been initially and still maintain the margins that
15 were there from the beginning for that reason, if they
16 are uncracked.

17 ADMIN. JUDGE KENNEDY: And we're back to
18 the beginning. All right. Thank you very much.

19 DR. LAHEY: Your honor, I think I've been
20 asked the question many times, are my loads different
21 than your loads? They're the same loads. The only
22 difference is how impulsive these loads are. So it
23 has to do with how they're calculated. I haven't seen
24 the document which gives the details on that. If they
25 have a shock capturing routine, like adaptive grid, or

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1 they're done by method of characteristics or some way
2 where they don't smear out things, instead of hitting
3 it with a hammer, you're hitting it with a powder
4 puff, then I'm happy that everything's surviving. But
5 I haven't seen that. And I've done a lot of work in
6 the past on RELAP and TRAC and RETRAN, so if you're
7 using those kinds of codes, it's more like a powder
8 puff than it is a hammer. So that's the difference.

9 ADMIN. JUDGE KENNEDY: Would Entergy like
10 to respond to that? I mean, again, this is a question
11 of how you analyze the dynamic loads.

12 DR. LOTT: Well, I guess --

13 CHAIRMAN MCDADE: Dr. Lott?

14 DR. LOTT: I'm sorry. This is Randy Lott.
15 That information, I think, is dealt with in the
16 methodology documents that we talked about earlier,
17 and I'm sorry I don't have the number right in front
18 of me, but I think we discussed earlier the approved
19 methodology for analysis of the bolts, the computer
20 programs and the process are in that document. We
21 believe it's more than adequate and consistent with
22 the licensing basis.

23 MR. STROSNIDER: This is Jack Strosnider
24 for Entergy. I'd like to add to that, that the codes
25 that are used for doing these analyses are codes that

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1 have been reviewed and approved by NRC as acceptable
2 for analyzing the design basis loads. So without
3 going into all the details of how those calculations
4 are done, which would require a code expert, you
5 should at least recognize that the NRC has done that
6 type of review and concluded that these codes are
7 acceptable for the application.

8 ADMIN. JUDGE KENNEDY: Thank you. Dr.
9 Lott, I believe earlier Entergy testified that the
10 Topical Report is an exhibit in this proceeding. Is
11 that true? The bolting methodology?

12 DR. LOTT: The approved -- yes.

13 ADMIN. JUDGE KENNEDY: Dr. Lahey, did you
14 get a chance to review this exhibit as part of your --

15 DR. LAHEY: You're talking about the WCAP
16 report that they --

17 ADMIN. JUDGE KENNEDY: Yes, sir.

18 DR. LAHEY: -- talked about? I haven't
19 seen it yet, I was planning to look at it this evening
20 if I can get my hands on it. I mean, one thing that
21 --

22 ADMIN. JUDGE KENNEDY: Did I miss one of
23 your homework assignments? Is this --

24 DR. LAHEY: Yes, I know, it's just adding
25 up. One thing you folks should know though is, I was

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1 very involved with the development of RELAP and TRAC.
2 So I'm very familiar with that methodology, what it
3 does and what it doesn't do. And let me say one last
4 time, hopefully the last time, after we assured
5 ourselves that these significant shock loads did not
6 distort the core geometry, we then focused on, do you
7 have the right mass in the right place, is the heat
8 transfer right, could you cool the core adequately?
9 That's what these codes are intended for. It's true,
10 they calculate pressure versus time and temperature
11 versus time, but they're in no way sharp shock load
12 codes. They're not intended for that purpose.

13 ADMIN. JUDGE KENNEDY: All right, thank
14 you. Appreciate it. I have nothing further.

15 CHAIRMAN MCDADE: Okay. Very quickly, this
16 may have been covered, but it's sort of a question in
17 my mind and I just want to clarify it. You've done
18 the UT examination on baffle former bolts for the past
19 20 years. Yet, in the testimony, it talks about the
20 UT examination acceptance criteria for the baffle
21 former bolts will be developed. And the question is,
22 what are you using now?

23 MR. DOLANSKY: This is Bob Dolansky with
24 Entergy. The plants that have performed UT of baffle
25 bolts would have that technical justification. Indian

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1 Point has not performed UT of baffle bolts yet. So
2 what we're getting is a plant specific technical
3 justification for the UT of the baffle bolts, that's
4 why we don't have it. So when we say that 8,000 bolts
5 have been inspected, the technical justifications for
6 those, I can't speak specifically for each plant, but
7 I would assume each plant has one. I know that when
8 we go to do our baffle bolts inspection, we will have
9 a plant specific technical justification. And that's
10 what's being developed for us now.

11 CHAIRMAN MCDADE: Okay. One of the
12 concerns that we have is the differentiation between
13 the development and implementation of a plan. That
14 the development of the plan being something to be done
15 that we can look at, the implementation is going to go
16 on and is going to be monitored by the NRC during the
17 period of extended operation if the license is
18 granted. But is there assurance that these acceptance
19 criteria that are to be developed will be adequate to
20 ensure the continued operation?

21 MR. DOLANSKY: I believe the acceptance
22 criteria is contained now in the AMP. This is Bob
23 Dolansky, I'm sorry. So if we go to our --

24 CHAIRMAN MCDADE: I mean, here's the thing,
25 and correct me if I'm wrong, any time you use the term

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1 will be developed, it sort of is a red flag for us.
2 And as I understand, the term that you're using is
3 that you basically have a procedure in existence now,
4 but the plan is that you will be using perhaps more up
5 to date technology down the road and that the
6 acceptance criteria will recognize that increased
7 data, increased knowledge at the time. But it's not
8 that there are no acceptance criteria now, it's that
9 just simply they're going to be updated based on newer
10 technology, additional information. Am I incorrect in
11 that?

12 MR. DOLANSKY: I want -- at the first part
13 of your question, you said that we have a procedure
14 now to perform baffle bolt inspections. Did I
15 understand you correctly, is that what --

16 CHAIRMAN MCDADE: Let me ask the question.
17 In the AMP as it exists right now, are there
18 acceptance criteria for the UT examination of the
19 baffle former bolts?

20 MR. DOLANSKY: No. Right now, the
21 examination acceptance criteria for UT of the baffle
22 former bolts shall be established as part of the exam
23 technical justification.

24 CHAIRMAN MCDADE: Okay. So to Dr. Hiser,
25 how does the NRC determine now that these acceptance

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1 criteria to be developed will be adequate to ensure
2 the proper functioning of the baffle former bolts over
3 the period of extended operation?

4 DR. HISER: This is Allen Hiser of the
5 Staff. Our understanding is that for individual
6 baffle bolt examinations, any indication of cracking
7 from the UT exam indicates that, that bolt is no
8 longer functional. So it represents a failure. I
9 believe the analysis that Mr. Dolansky is discussing
10 is post-inspection, when they have identified each
11 bolt, whether it is acceptable or unacceptable, and
12 they're looking more at the configuration whether it
13 is acceptable. So the acceptance criteria for the
14 final configuration post-inspection is, I believe,
15 what they are still working on. But for each
16 individual bolt, it's crack/no crack,
17 unacceptable/acceptable, is our understanding.

18 MR. DOLANSKY: That's correct. Any
19 indication of cracking will be considered a degraded
20 bolt and will be put into our corrective action
21 program.

22 DR. HISER: So I think -- this is Allen
23 Hiser again. I think there's just been a confusion
24 between acceptance criteria on a piece inspection
25 basis versus the assembly basis after one has

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1 inspected all of the bolts. And I think that the
2 terminology has gotten a little bit mixed up. So the
3 inspection acceptance criteria is any crack is a
4 failed bolt. The assembly acceptability criteria is
5 different. That is to be determined. From the NRC
6 perspective, that's a corrective action that is within
7 the purview of the applicant. If they require
8 approval of any of that, then they would come to the
9 NRC for that.

10 CHAIRMAN MCDADE: Okay. But the way you've
11 just described it, that corrective action may or may
12 not be adequate to ensure the continued viability and
13 the continued operation, the utility of that
14 particular part. So how does the NRC assure itself
15 now, and New York and Riverkeeper assure themselves
16 now, that something that still has to be developed
17 will be adequate? Do you understand what my concern
18 is?

19 DR. HISER: I think so. The corrective
20 actions, there are three potential paths that they
21 could take. If they were to find degraded bolts, they
22 could replace the bolts. Repair really is not an
23 option in this case, but they could replace the bolts.
24 If they wanted to continue to operate with degraded
25 bolts, they would need to submit an analysis to the

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1 NRC that justified their configuration that they want
2 to continue operating with. From that perspective, we
3 still have approval of any operation with the degraded
4 condition. So I think from that perspective, I
5 believe that there are sufficient controls on this.

6 MR. STROSNIDER: This is Jack Strosnider
7 for Entergy. The one other thing I think we should
8 add here is what we talked about earlier. The
9 methodology that's being used to develop the plant
10 specific bolting pattern, that acceptable bolting
11 pattern, that methodology was reviewed in the WCAP
12 report that was submitted to NRC, it's an extensive
13 review with all the Requests for Additional
14 Information, the back and forth, the safety evaluation
15 written. So they're using what the NRC has looked at
16 and concluded that, that's an acceptable methodology.
17 You do it on a plant specific basis to make sure that
18 if anything plant specific comes up that you've
19 accounted for it. But you should be able to move
20 forward with that methodology and come up with an
21 acceptable technical evaluation for the acceptable
22 bolting pattern.

23 MR. COX: This is Alan Cox --

24 MR. STROSNIDER: That's the whole purpose
25 of, as I explained earlier, the Topical Report process

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1 and reviewing these methodologies up front. The NRC
2 does not want to look at one of these -- do that same
3 review over and over and over again for every plant.
4 So they look at the generic methodology, if the plant
5 can apply it within the boundary conditions that, that
6 methodology is good for, then they can go do the plant
7 specific evaluation and you should have confidence in
8 it.

9 MR. COX: This is Alan Cox with Entergy.
10 Let me add one more thing. I believe the Standard
11 Review Plan provides for, when it talks about
12 acceptance criteria, it says the acceptance criteria
13 doesn't necessarily have to be a formal value. It can
14 be a description of the method that will be used to
15 establish that value. And I would say that it's not
16 practical to do all that in advance. You're talking
17 about finding a -- you're going to find a certain
18 pattern of bolts where you have a failed bolt, there's
19 832 bolts, you can't predict or it would be
20 impractical to try to do an analysis for every
21 combination of which bolt might be failed where.

22 So you have a method established, you take
23 the results of the inspection, you look at the bolts
24 that are failed, and you apply that data using the
25 method that's established and that's how you determine

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1 your acceptance criteria. It would be impractical to
2 evaluate all of those combinations ahead of time that
3 you could have with the inspection results.

4 MR. DOLANSKY: This is Bob Dolansky. I
5 just want to add one other thing. The inspection of
6 baffle bolts, the fact that it's been going on for
7 years and the fact that other plants have done it
8 means that all this stuff has been looked at before.
9 So, I mean, it's not like a first of its kind. We're
10 not the first ones doing it, other plants within the
11 industry have performed these inspections, they've had
12 NRC reviews of both during the inspection and after
13 the outage. So not only has the Topical Report been
14 reviewed by the Staff, but the actual implementation
15 has been reviewed by the Staff at other plants.

16 CHAIRMAN MCDADE: And the preface to my
17 question assumed that and recognized that these
18 inspections have been going on for more than 20 years
19 and that there has been a method established. And
20 what I'm trying to just make sure that I want to
21 cement in my mind is what is currently established and
22 what, if anything, by way of methodology still needs
23 to be developed? As Mr. Cox pointed out, I think it's
24 relatively obvious that you can't say what you're
25 going to do as the result of an inspection until you

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1 get the results of that inspection and then you have
2 to assess the meaning of that.

3 But in developing a plan that provides
4 assurances that you're going to have continued safe
5 operation, you look, is the methodology used adequate
6 to develop an appropriate response? And all I'm
7 trying to do is cement for the record of, what is the
8 current status of development? Again, the language
9 you used, will be developed, which sort of, well, more
10 than sort of, which suggests that there is still a
11 sort of, we'll figure this out in the future, we hope.
12 And from what Dr. Hiser has said, it isn't that and I
13 just wanted to get as clear as possible what we
14 currently have and what it is that still needs to be
15 done so we can determine whether or not there exists
16 now reasonable assurance of continued safe operation.
17 Can you elaborate on that?

18 MR. AZEVEDO: Yes, your honor. This is
19 Nelson Azevedo for Entergy. Maybe it's already clear,
20 but just to make sure it is clear. The methodology is
21 established, has been approved by the NRC, that's what
22 we're using. What is going on right now is taking
23 that methodology in developing a model specifically
24 for Indian Point. But the methodology itself, how it
25 is done, is established, it's been approved by the

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1 NRC, and it's what Indian Point is using.

2 CHAIRMAN MCDADE: And that's part of the
3 AMP for these baffle former bolts? Where do we look
4 to see where that methodology is and the fact that
5 it's been approved by the NRC?

6 MR. AZEVEDO: It's referenced in MRP 227,
7 that's what Mr. Cox was telling you.

8 MR. COX: This is Alan Cox. Chapter 6 of
9 MRP 227 has a discussion on evaluation of bolts and
10 pins. And basically it says that you don't have to do
11 the individual evaluation, you have to look at the
12 effect on the assembly. And then Section 6.4 gives
13 you the guidance on doing assembly level evaluations.

14 CHAIRMAN MCDADE: Okay. And, Dr. Hiser, if
15 that were to change, is that something that the
16 Applicant would be able to do and inform the NRC? Is
17 it something that would be subject to the 50.59
18 procedure? Or is it something that would require a
19 license amendment?

20 DR. HISER: This is Allen Hiser of the
21 Staff. My guess is it would be subject to 50.59.
22 Given the safety implications and -- my expectation
23 would be that it would not pass 50.59 and would
24 require a submittal to the NRC.

25 CHAIRMAN MCDADE: Okay. And once the plant

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1 specific details are worked out, what is the vehicle
2 for NRC review of that plant specific? Do they submit
3 it to you, is it subject to any kind of a formal
4 review and approval? Or is it simply a situation
5 where you would have the ability to review and
6 comment?

7 DR. HISER: This is Allen Hiser of NRC. My
8 expectation is that, that would require at a minimum
9 a submittal to the NRC. And could involve a license
10 amendment. But I'm not certain of that.

11 CHAIRMAN MCDADE: Okay. Two separate
12 things. One, we were talking about the methodology
13 set out in Chapter 6 of MRP 227. And we were talking
14 about what would be necessary if that methodology were
15 changed. My question right now is not the methodology
16 having been changed, but rather, as Entergy explained,
17 they are taking that methodology and are currently
18 working to make a plant specific program. And my
19 question is, once they have completed the details of
20 that plant specific, how is that subject to review by
21 the NRC?

22 DR. HISER: This is Allen Hiser. My prior
23 statement really still holds. Whether it's an
24 approved generic methodology or a plant specific
25 methodology would require the same approval, if

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1 approval is necessary. The only difference in that
2 case is for the plant specific methodology, we would
3 have to review the entire methodology instead of
4 relying on the generic approval from the generic
5 methodology that previously was approved.

6 CHAIRMAN MCDADE: And if you viewed it to
7 be unacceptable, would this be going at that point
8 through the 50.59 procedure or is this something less
9 than the 50.59 procedure?

10 DR. HISER: I'm sorry, if we found what to
11 be unacceptable?

12 CHAIRMAN MCDADE: Their plant specifics.
13 If you identified problems with the plant specifics,
14 how does that work through?

15 DR. HISER: If it is a license amendment
16 request, then they would need to modify their approach
17 to become acceptable. In the absence of approval of
18 the license amendment, they could replace the bolts
19 that they found to be degraded.

20 CHAIRMAN MCDADE: Okay. But I -- at least
21 I had not anticipated at the level of a -- if it's a
22 license amendment, then it's a situation where New
23 York gets a notice of an opportunity for a hearing and
24 has the opportunity to challenge the adequacy. What
25 I'm trying to get at is once they take the methodology

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1 that is in existence, that the NRC has reviewed, has
2 approved, is satisfied with, and apply it specifically
3 to the plant, what does the NRC do then and what is
4 the nature of review and the public aspect of that, if
5 any?

6 DR. HISER: This is Allen Hiser again. If
7 we can just discuss for a moment here.

8 CHAIRMAN MCDADE: Well, we're basically at
9 the end of the day. Do you want to answer that at the
10 beginning --

11 DR. HISER: Sure.

12 CHAIRMAN MCDADE: -- of tomorrow rather
13 than -- I mean, to me this is something that's
14 important and I don't want an answer off the top of
15 your head that I think this is the way it should be.
16 So, why don't we leave that and take that up first
17 thing in the morning?

18 DR. HISER: Okay. That's acceptable.

19 CHAIRMAN MCDADE: Okay. Do you have
20 anything further for --

21 ADMIN. JUDGE WARDWELL: I do not.

22 CHAIRMAN MCDADE: Okay. I would propose
23 that we would start tomorrow at 8:30. Before we
24 break, NRC is there any administrative matters or
25 other matters that you want to take up before we break

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1 for this evening?

2 MR. HARRIS: No, your honor.

3 CHAIRMAN MCDADE: Entergy?

4 MR. KUYLER: Yes, your honor. A few
5 minutes ago, we were discussing the Westinghouse
6 proprietary reports regarding the baffle former bolts
7 and the minimum bolting pattern analysis. And I
8 believe one of the things that Dr. Lahey said was that
9 he had not reviewed those reports. And we just wanted
10 to note that those have been in the record for several
11 months and they've been disclosed several years ago.
12 And, so, for us to look at that for the first time
13 afresh tomorrow would be challenging, your honor.

14 CHAIRMAN MCDADE: Well, I mean, these are
15 exhibits, are they not?

16 MR. KUYLER: Yes, they are.

17 CHAIRMAN MCDADE: So, I mean, if there's
18 something that's already admitted as an exhibit that
19 will help clarify Dr. Lahey's testimony, we will allow
20 him to refer to that and will of course give Entergy
21 the opportunity, if their experts need some additional
22 time to respond. Quite frankly, so far I've been
23 amazed at the capacity of all of our witnesses to know
24 a rather voluminous record and to be able to testify
25 with regard to the contents of the literally tens of

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1 thousands of pages of documents that we have. So I
2 think you may have underestimated your experts, but in
3 any event, we would certainly give them time and the
4 opportunity to refresh themselves with the documents,
5 with the reports in order to comment on Dr. Lahey's
6 testimony.

7 MR. KUYLER: Yes, your honor. But I would
8 just note that we have not seen any specific
9 criticisms of those documents from Dr. Lahey in the
10 past. So for him to introduce those on the very last
11 day of the hearing for the first time, we would object
12 to that, your honor.

13 CHAIRMAN MCDADE: We don't know whether
14 he's going to criticize them. He may look at them and
15 say, this is great. This allays my fears, if I had
16 read this before, if I had studied it harder, I
17 wouldn't be here. We don't know, we'll find out
18 tomorrow. Mr. Sipos, anything before we break for
19 tomorrow?

20 MR. SIPOS: Nothing further from New York
21 at this time.

22 CHAIRMAN MCDADE: Ms. Brancato?

23 MS. BRANCATO: No, your honor.

24 CHAIRMAN MCDADE: Okay. Does 8:30 tomorrow
25 pose a problem for anybody?

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MS. SUTTON: No, your honor.

CHAIRMAN MCDADE: Okay, apparently not.
We'll see you all at 8:30 in the morning. Thank you.

(Whereupon, the above-entitled matter went
off the record at 5:36 p.m.)