

1 can turn it over, but --

2 MR. WALLIS: It has been extruded from a
3 hole.

4 MR. ALLEY: Yeah, and we've seen that at
5 several different locations or different utilities
6 that had experienced this spaghetti string looking
7 deposit that's coming from the annulus area.

8 Again, we wanted to communicate that to
9 the industry. The first time somebody saw it and
10 referred to it, everybody was wanting to know what's
11 spaghetti strings. So we put these in a visual
12 guidance again and showed pictures of that.

13 MR. ROSEN: That's the first picture of
14 that I've ever seen. Is it rare?

15 MR. ALLEY: I won't say it's rare. It's
16 not as common as the popcorn type deposits, but there
17 have been, you know, more than one occurrence of this.

18 MR. WALLIS: You're probably got macaroni
19 and all kinds of things.

20 MR. ALLEY: Yeah, we've got all kinds of
21 names for things.

22 So we do have a document that we -- and a
23 CD and a videotape -- that has gone out to the
24 industry. People review that before their inspectors
25 go in to do visual inspections of the head.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. WALLIS: Well, you're saying that this
2 is the sign of a leak. Now, you're implying that
3 anything that comes out of the leak and solidifies
4 will be stay there and won't get blown away. Suppose
5 you have a leak that's tossing out particles or boric
6 acid but they're not sticking. You wouldn't see that,
7 would you?

8 MR. ALLEY: Well, you'll see other signs
9 of boron deposits on the head.

10 MR. WALLIS: You would? I don't know. I
11 don't know. I can imagine a hole which is simply
12 spewing out bullets instead of spaghetti.

13 MR. ALLEY: We certainly haven't seen any
14 of that, nor have we seen that in the NDE results that
15 indicate that we have nozzles that are acting like
16 that, that we don't have visual evidence of.

17 MR. WALLIS: Well, I know, but you see the
18 point. I mean, we don't really know all of the
19 possibilities when you get a leak in the form of the
20 solidified or otherwise boric acid is coming out.

21 MR. ALLEY: And we recognize that. That's
22 why this document has been revised twice now, because
23 we continue to learn. As we do inspections, we
24 continue to learn and want to communicate that to the
25 industry.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. SHACK: but you've got a lot more
2 volume now. Did you find anything in your volumetric
3 inspections this spring that would indicate a through
4 wall crack that you didn't see visually?

5 MR. ALLEY: I don't understand your
6 question.

7 MR. SHACK: You did a lot of volumetric
8 inspections in the spring inspections. Did you find
9 any through wall cracks that did not produce a visual
10 indication?

11 MR. ALLEY: No. We have some that are
12 being debated, but again, NDE is not exact science.
13 So it's debatable as to whether or not the crack went
14 right up to the edge or actually went through wall and
15 we're still having some of those debates.

16 I can only think of one case where that's
17 really being debated. Can you think of another?

18 MR. MATHEWS: Well, the other situation is
19 the one that just doesn't leak, like North Anna, the
20 Stealth crack.

21 MR. ALLEY: Right.

22 MR. MATHEWS: And you know, you can find
23 it with NDE/UT, but if it doesn't penetrate the
24 annulus, you won't have a leak.

25 MR. ROSEN: Right. It hasn't gone through

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D C 20005-3701

1 the surface.

2 MR. MATHEWS: Right.

3 MR. ROSEN: So there's no leak path to the
4 surface.

5 MR. MATHEWS: Yeah, exactly. So it takes
6 some other technique besides visual to find it, and
7 that's why we're saying that we've got to go back and
8 look at the basis for 75.

9 MR. ALLEY: And to skip from the visual
10 document, the approach that MRT has taken to
11 demonstrations, we work very close with the reactor
12 vessel head working group. That group defines to the
13 NDE committee relevant flaw mechanisms, the SEC or
14 BWSCC, fatigue, whatever those mechanisms might be.
15 They communicate that to the inspections committee.
16 They define the inspection locations in volumes, are
17 interested in weld metal tubes, define the range of
18 flaws that they wish to address in the mock-ups.

19 The inspection working group works on the
20 approach that we will take to demonstration and we'll
21 go into some details on that. Mock-up design and
22 procurement, we'll go into some additional details on
23 that.

24 Specification for the flaws in the mock-
25 ups, the realism of the flaws in the mock-ups --

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. WALLIS: Are you going to be trying to
2 duplicate spaghetti and popcorn in these experiments?

3 MR. ALLEY: We have skipped here to the
4 volumetric stuff. So now we're talking about the
5 flaws as they appear in the nozzles and the tube and
6 the weld. This is for ultrasonic purpose and eddy
7 current purposes now for a visual.

8 MR. WALLIS: Okay. So you're still on
9 cracks then.

10 MR. ALLEY: We're on cracks.

11 And then we developed a demonstration
12 protocol of the schedules to work with the various
13 vendors. There was a Tiger team that was put together
14 of key individuals from both the working head group
15 and the inspection group.

16 MR. WALLIS: Do these give false
17 indications sometimes?

18 MR. ALLEY: Certainly.

19 MR. WALLIS: How do you sort that out?

20 MR. ALLEY: It's a very difficult task.

21 MR. WALLIS: It could be that many of
22 these flaws which were reported earlier this morning
23 are simply false indication.

24 MR. ALLEY: Well, typically in an NDE you
25 would like to have more than one piece of information

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D C 20005-3701

1 that you rely on when you're going to make conclusions
2 with your NDE for that reason. We don't always have
3 that luxury, but we certainly look for that.

4 You like to see the visual signs of
5 leakage on the head supported by volumetric
6 examination that finds flaws. You feel very confident
7 about those results.

8 If you only have one NDE discipline, then
9 your confidence in a result can tend to be --

10 MR. WALLIS: So you really want to detect
11 them before they leak, don't you?

12 MR. ALLEY: That would be the preference,
13 yes. Again, you like to have eddy current results and
14 ultrasonic results. You like to have overlaying
15 results because there is the potential for false
16 calls, and it's not necessarily a small potential.

17 So the Tiger team got together, which was
18 key individuals from the head working group and the
19 inspection working group to design the next generation
20 of mock-ups, and again, we'll get into some more
21 details on that.

22 If we look at the demonstration process,
23 there's several characteristics of these
24 demonstrations that have been consistent ever since
25 the 9701 response. One of those is that these are

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 blind mock-ups. The inspection vendors are asked to
2 examine these mock-ups without knowing the location,
3 size, and orientation of the flaws. We demonstrate
4 the procedure so that it's application of the
5 procedure. We make sure that the procedure is
6 followed and it contains the essential variables.

7 We try to demonstrate the best available
8 techniques. As we mentioned earlier, this is an
9 evolving inspection, and it is changing with every
10 outage season actually.

11 The ASME codes should drive out the
12 technique and personnel qualifications. This is not
13 a qualification process. We are not out there trying
14 to qualify vendors, and as I'll mention later, nor do
15 we have an acceptance criteria. Those are left up to
16 code committees.

17 We're trying to demonstrate the state of
18 the art with regards to inspections. We're trying to
19 define the limits of the inspections, but we're not
20 trying to qualify the person at all.

21 MR. WALLIS: Do you have some
22 specifications for the sensitivity of these detection
23 techniques?

24 MR. ALLEY: We don't specify sensitivity
25 levels. The vendors work with their test pieces and

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 mock-ups to understand the sensitivities. What we do
2 is report back to the utilities and the end users of
3 this technology what these techniques are capable of
4 delivering.

5 We tried not to design the test. We leave
6 that to the vendors. What we're trying to do is
7 define the boundaries of the test.

8 MR. WALLIS: So you report to them that
9 they failed to detect ten percent of the flaws. They
10 don't really know whether this is the fault of the way
11 the personnel did the test or the sensitivity of their
12 device or something else.

13 MR. ALLEY: Well, again, what we do is we
14 look at their procedure and make sure they followed
15 the procedure. The calls that are made on whether a
16 flaw is real or false or the size or the depth or the
17 length is spelled out in the procedures. We do
18 monitor that process to make sure that the procedures
19 and the calls are done in accordance with the process
20 that they've outlined, and again, we've defined the
21 boundaries of that process and the results.

22 MR. WALLIS: So you're talking about --
23 I'm a little bit puzzled. This procedure
24 demonstration, there are no acceptance criteria.

25 MR. ALLEY: That's correct.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. WALLIS: And you don't qualify the
2 people or the technique

3 MR. ALLEY: That's correct.

4 MR. WALLIS: At what point does the
5 industry take responsibility?

6 MR. ALLEY: Well, the ASME code committees
7 need to drive that out. What we're, again, trying to
8 do, and these procedures are evolving. They're quite
9 a bit different today than they were two years ago.

10 We're trying to define the boundaries of
11 the procedure, and these demonstrations are set up to
12 do that. The acceptance of that procedure for use on
13 these heads is utility specific, and we'll get into a
14 little more details with regards to that as far as the
15 information utilities are provided here.

16 CO-CHAIRMAN FORD: So when the order goes
17 out to inspect, for instance, as it just has or for
18 the fall outages, who sets the criteria for the people
19 and the technique?

20 MR. ALLEY: It's normally worded that the
21 techniques will be demonstrated through the MRP
22 protocol.

23 CO-CHAIRMAN FORD: So you do set the
24 acceptance criteria.

25 MR. ALLEY: Well, the acceptance criteria

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 is that the boundaries have been defined, but not what
2 those boundaries are. We don't say that you've got to
3 have a minimum detection limit of ten percent through
4 the wall. We don't get to that.

5 What we're saying is that you have to
6 define what your boundaries are as part of this
7 process. You need to understand we've got maybe four
8 players in this ball game. So there's not a lot of
9 vendors that are out there going through this
10 protocol.

11 CO-CHAIRMAN FORD: So there's no
12 acceptance criteria of the crack depth, seven inches
13 plus or minus, that has been done by a qualified
14 person.

15 MR. ALLEY: No, sir.

16 CO-CHAIRMAN FORD: And there's no
17 information on the probability of detection.

18 MR. ALLEY: No, sir. Again, we were
19 trying to set the boundaries of this exam. We did
20 have a discussion, which we'll talk about perhaps in
21 a minute, with the Tiger team about probability of
22 detection. That actually requires a different set of
23 mock-ups with different flaw orientations and
24 different numbers of flaws and sizes of flaws.

25 Again, we're pushing the boundaries of

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 these inspections right now just trying to define the
2 limits.

3 CO-CHAIRMAN FORD: So when are you going
4 through your decision path that you showed on the
5 evaluating cracking and then applying eventually Reg.
6 Guide 1.174?

7 There's no uncertainties at all then.

8 MR. ALLEY: Normally what's looked at is
9 the minimum detection limit, and we detected that 100
10 percent of the time, but what we didn't do is go back
11 and repeat that exam ten, 15, 20 times to make sure
12 that it's detected every single time. Again, that's
13 where you start shifting protocols when you start
14 addressing the POD.

15 We're trying to set the boundaries of the
16 examination now. It may be later that we do address
17 POD, but to try to do all of that at one time and
18 develop the techniques did not seem to be a very good
19 goal.

20 So when we report, we would report minimum
21 detectability. Then normally the inspection committee
22 and these people looking at assessment would assume
23 that false highs or however they want to do that, and
24 the statisticians can draw some POD from the flaws
25 that we've got here, although it may have a fairly

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 wide variance.

2 MR. SHACK: In MRP 75 you assumed a
3 failure to not detect at like .08. Does that
4 number --

5 MR. MATHEWS: I thought it was much higher
6 than --

7 MR. SHACK: Much higher than that?

8 MR. MATHEWS: Yeah. I thought the
9 volumetric failure to detect was much higher than
10 that. I'd have to pull the document and look.

11 The visual was -- I know on the visual it
12 was like only a 60 percent probability of detection,
13 and then if you missed it the next time, it was like
14 20 percent of that. So you only had like a 12 percent
15 probability of picking it up a second outage.

16 On the volumetric, he had put in some kind
17 of POD curve based on vessel stuff, but I thought it
18 was more than an eight percent. It might have been
19 eight percent. I'm not sure. I'd have to pull that
20 out for the peak. I mean, that was just an
21 assumption.

22 CO-CHAIRMAN FORD: Alan, when you get up
23 later tomorrow, I guess, will you be addressing these
24 issues?

25 MR. HISER: These issues, can you

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 enumerate what "these issues" --

2 CO-CHAIRMAN FORD: Well, the issues that
3 I just brought up, the question of what acceptance
4 criteria is that the NRC is expecting.

5 MR. HISER: Well, we have reviewed the
6 demonstrations that the various vendors have been able
7 to perform. We have reviewed the MRP documents that
8 specify what the performance was, and we have found
9 those to be acceptable to providing, you know, the
10 reasonable assurance kind of level of inspection.

11 CO-CHAIRMAN FORD: Okay.

12 MR. HISER: So bottom line, we found the
13 inspections and the way they've been able to
14 demonstrate those to be to be acceptable.

15 MR. ALLEY: We know the ASME is working on
16 this, and that's usually an organization that drives
17 out in the industry the personnel qualifications and
18 accepted standards for things. So we're looking to
19 the ASME to drive that out if it's going to happen.

20 Again, what we're trying to do is define
21 the boundaries of the exams.

22 MR. HISER: And at this point the NRC has
23 found those boundaries to be acceptable. The problem
24 is the ASME code is not able to turn as quickly as the
25 industry is and we're able to do.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 CO-CHAIRMAN FORD: So do we keep pointing
2 in the other direction as to it's the NRC, no, it's
3 the MRP, no, it's the industry, no, it's ASME?

4 MR. HISER: Well, I think the MRP provides
5 a report card on what the vendors are able to do, and
6 we find that the grades so far have provided
7 acceptable inspections.

8 CO-CHAIRMAN FORD: Okay.

9 MR. HISER: Ultimately the ASME codes
10 should be the ones that should become a more
11 automated process within the ASME code, but we're not
12 there yet.

13 CO-CHAIRMAN FORD: Okay. Thank you.

14 MR. ALLEY: Okay. To carry on, the
15 demonstration process, the protocol that was
16 developed, the vendors collected data on the mock-ups
17 and reported the findings. We evaluate the measure
18 versus the true values of the flaws.

19 The detection of the number of flaws
20 versus total flaws; the location with respect to
21 pressure boundaries. Sizing results are documented.
22 False call performance is documented.

23 The NDE center documents the essential
24 variables. Again, we talked about this in the
25 procedure. There's things in the procedure, the way

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 you set your sensitivities, the transducers that are
2 being used, angles, frequencies, those are essential
3 variables as defined by ASME and some other areas.
4 Those essential variables are documented as part of
5 the procedure review.

6 We verify that the vendors are actually
7 using the procedures and the essential variables that
8 were reported in the procedures.

9 MR. WALLIS: I have no idea about this
10 process. Is this a process where the technician
11 manipulates a lot of things, and he flips on a screen
12 and has to interpret them, or is there a computer that
13 analyzes all kind of stuff and gives him an image of
14 what the flaws look like in some way?

15 MR. ALLEY: Probably more the first point,
16 as in they see, as you see, blips on the screen.
17 That's all computer enhanced and all of that, but they
18 have to -- in their procedure, they have to spell out
19 their decision making process, and it has to be
20 consistent. It has to be applicable to A inspector or
21 B inspector or C inspector. They have to follow the
22 procedure.

23 So the procedure will say: if you see a
24 blip in this location and it has this orientation and
25 this definition to it, you call it a crack or you call

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE, N.W.
WASHINGTON, D.C. 20005-3701

1 it a false call.

2 Those are the essential variables in the
3 analysis part of the procedure.

4 MR. WALLIS: -- ultimate judgment of the
5 person.

6 MR. ALLEY: Well, in the application of
7 the procedure it's not as much personal judgment as it
8 is the application of the procedure. The procedure
9 spells out the decision making. We try to keep it
10 immune from this black box, and we don't look in it
11 and pull an answer out.

12 The procedure has to spell out the logic
13 that you follow to get to that answer, and that has to
14 be consistent form one person to the next.
15 Theoretically that procedure should be able to be
16 followed by any inspector and they would get the same
17 answer consistently.

18 It's the same basic protocol that's
19 followed with the ASME Section 11, Appendix 8 PDI
20 process. You demonstrate the procedures. You
21 demonstrate the adequacy of the procedures to do it.
22 You take out as much of the human error or human
23 judgment part of this as you possibly can.

24 And then to summarize, the results are
25 given to the utilities.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. POWERS: Well, I guess I'm -- why the
2 emphasis on getting the human judgment out? There are
3 only four vendors that are doing this. One guy is
4 just really good. He looks at and is communicative
5 about what he sees.

6 MR. ALLEY: Well, you'll certainly find
7 utilities expressing an interest to have one inspector
8 or one person on their site versus another. So it
9 gets to be a word of mouth idea, but what we're trying
10 to demonstrate here is the capabilities of the
11 equipment and the capabilities of the procedures, not
12 the capabilities of the individual.

13 If the procedures and the equipment are
14 capable of detecting and locating sizing and detecting
15 these flaws, then we have demonstrated that we have
16 adequate techniques to do that.

17 The next part of that may go into the
18 personnel qualification piece of this, how someone
19 applies the procedure, but right now we're trying to
20 demonstrate the capabilities of the procedures and the
21 techniques.

22 MR. HISER: Dr. Ford, just one other
23 point. Where the NRC gets involved in this, for in-
24 plant implementation of inspections we have a
25 temporary instruction that's used by either the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D C 20005-3701

1 residents or regional staff to oversee and evaluate
2 the implementation of the inspections. They go back
3 and verify that the essential variables that are used
4 at the plant are consistent with what the vendor
5 demonstrated.

6 So there is that level of review and
7 evaluation as well that the NRC does on these
8 inspections.

9 CO-CHAIRMAN FORD: I was hoping to see a
10 plot of actual crack depth and location versus
11 measured crack depth and location.

12 MR. ALLEY: I have some results to share
13 with you, but we don't have that plot. That's the
14 POD data you're actually looking for.

15 CO-CHAIRMAN FORD: But such plots do
16 exist.

17 MR. ALLEY: They exist with some
18 techniques and some processes. That's true. That was
19 not the goal of this process, to define a bounds of
20 probability of detection as indicated in a least
21 squares fit and all of that. That was not the goal of
22 this demonstration process.

23 CO-CHAIRMAN FORD: Well, reassure me that,
24 for instance, if someone goes in and looks at North
25 Anna or any reactor and they size a crack, what makes

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 me think that I should believe that?

2 MR. ALLEY: They have demonstrated on
3 these mock-ups that their sizing has a certain error
4 associated with it. We have enough different size
5 flaws in there to say that they found this flaw and
6 that they size it X. We have data to support the fact
7 that they had the capabilities to do that.

8 What we don't have is the error defined
9 associated with that.

10 CO-CHAIRMAN FORD: Okay. So one of the
11 four teams goes in and does such a measurement.

12 MR. ALLEY: Un-huh.

13 CO-CHAIRMAN FORD: And it agrees to within
14 a certain tolerance of the actual --

15 MR. ALLEY: Well, that's some --

16 CO-CHAIRMAN FORD: -- and then they're
17 okay.

18 MR. ALLEY: That's some of what we're
19 hoping to drive out when we cut up these North Anna
20 pieces. I mean, ideally you'd like to have the
21 destructive analysis to go along with the NDE
22 findings. This environment is very tough to do that,
23 and so we don't have that analysis, and that's what
24 we're hoping to get out of the North Anna heads.

25 We are asking all of the vendors to go

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 through and reexamine the North Anna nozzles prior to
2 sectioning so that we will now be able to get a better
3 feel for what we're actually seeing versus what we're
4 actually detecting, and it may be that we evolve to
5 this point you're talking about now.

6 Right now we're pushing the boundaries of
7 the capabilities of the vendors to even get sound
8 energy in these things and get data out. So we're
9 trying to define those boundaries.

10 CO-CHAIRMAN FORD: Okay.

11 MR. ALLEY: I mean, you're talking
12 probably a more mature program here versus one that's
13 still evolving.

14 MR. WALLIS: Doesn't it really depend on
15 how you're acoustically coupled to the thing you're
16 looking at?

17 MR. ALLEY: Certainly, and that's one of
18 the things that the demonstration has done, and this
19 has been a very valuable experience for everyone
20 involved in this. And I've got some pictures later on
21 that will show you we simulated the nozzles through
22 the heads with the J groove welds that cause
23 distortion on these nozzles. They're not perfectly
24 round on the ID, and what we saw many of the vendors
25 do as part of this process, they were at one time

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE, N.W.
WASHINGTON, D.C. 20005-3701

1 scanning in the circumferential direction in what's
2 called a raster scan. They would scan the increment
3 and scan the increment, and what we saw was the way
4 they were losing coupling when they would go over some
5 distortion in the weld.

6 Now most of the vendors are scanning in
7 the up and down direction. Okay? So those are the
8 things that were driving through as a result of this
9 demonstration process. This is not only to
10 demonstrate the techniques. It's to improve the
11 techniques, and we've got some things I'll talk about
12 later on that we're doing to even further that some
13 more.

14 As we mentioned before, it's a very
15 complicated weld examination volume. It's very, very
16 difficult to inspect the weld metal itself. It's
17 very, very difficult to inspect through the tube into
18 the weld metal.

19 They're asymmetrical welds, which adds the
20 whole geometry factor to it. So it's just not a very
21 easy environment to inspect.

22 There's a whole host of different probes
23 and carriages and schemes of which you can go about
24 inspecting. There's open tube probes. This is when
25 the internals are pulled from the drives and you have

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 an open diameter tube that you can now inspect. When
2 you have that luxury, you can now deploy a big scanner
3 that's got multiple probes and multiple transducers
4 and eddy current probes and all of that stuff on one
5 scanner and actually go in and interrogate the volume.

6 In service we typically use blade probes,
7 and a blade probe is like a probe on a Venetian blind.
8 We have to get in between the other components in
9 there, and some of these areas I think Al will talk
10 about tomorrow. I think some of these relief requests
11 have to do with restricted areas. Things are not
12 perfectly concentric. So there's the thermal sleeves
13 and the lead screws and the stuff will push to one
14 side or the other and you jam blade probes and these
15 types of issues we're having to deal with in actually
16 implementing these things in the field.

17 MR. ROSEN: Isn't it another confusion
18 factor that each nozzle is different in terms of where
19 it is on the circumference? The degree of ovality is
20 changing --

21 MR. ALLEY: That is certainly an issue.

22 MR. ROSEN: -- as you go from the center
23 to the outside periphery.

24 MR. ALLEY: Yes, and then one of the
25 things that we also wanted to demonstrate here is the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 ability to map the weld because you've got to know
2 where you are on that weld itself. And, again,
3 they're asymmetrical.

4 There are some that are on the higher
5 slope, lower sides, and of course, the one on number
6 one nozzle is pretty concentric. So all of those
7 variables make this somewhat difficult.

8 And probes are designed to accomplish
9 specific objectives. The specific volumes, flaw
10 orientations, detection techniques. There's quarter
11 traps, tip diffractions. There's just a number of
12 different schemes that we can use to interrogate this
13 volume.

14 MR. WALLIS: All of these are qualitative
15 arguments. I'd like to go back a bit before. I used
16 to have some sort of a quantitative demonstration of
17 what's actually being measured versus what's there.
18 What are the sources of error, and so on?

19 That could probably be put into one or two
20 slides.

21 MR. ALLEY: I've got some summary slides
22 to show you some typical results. We can certainly
23 compare the true versus the indicated size on a given
24 flaw, but again, what we don't have, in a statistical
25 word, you'd like to run that a number of times to be

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 able to see what that error band is.

2 We know that the vendors have oversized or
3 under sized flaws. We have information and data to
4 support that, but in reality the way you apply this,
5 too, is typically this is a detection. If you detect
6 these flaws in these nozzles, most utilities are going
7 to invoke a repair immediately. So it's almost a
8 detection game.

9 Whether you size or under size or oversize
10 a flaw to a relative degree doesn't really matter in
11 reality. We repair them.

12 MR. MATHEWS: There have been a few that
13 have been left in service for one cycle, but believe
14 me, the UT data get scrutinized to the hilt to come up
15 with is it okay to leave this flaw in service for a
16 cycle. Is it going to grow through wall or grow 75
17 percent through wall?

18 And the NRC is buying off on that.

19 CO-CHAIRMAN FORD: So the ASME 11 book are
20 relying under the flaw -- it doesn't exist.

21 MR. ALLEY: The only place we have a --

22 CO-CHAIRMAN FORD: If you find a flaw, you
23 replace.

24 MR. ALLEY: The only place we have a --

25 MR. MATHEWS: I said some have been left

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 in service. Very shallow ID flaws may be left in
2 service for a period of time.

3 MR. WALLIS: Okay.

4 MR. SHACK: The next, shallow axials?

5 MR. MATHEWS: Yeah, I don't believe
6 there's any that have been left in service.

7 MR. ALLEY: Yeah, shallow axial flaws
8 which were typical of what we saw back in the 9701.
9 There is some analysis to allow you reasonable times
10 to reinspect those flaws, but once you get on the OD
11 of the tube and then the weld metal of the tube,
12 detection really is what you're trying to accomplish.

13 Okay. More than one probe, as mentioned
14 before, can be used to examine a volume, particularly
15 when we're dealing with blade probes. It's a decision
16 to make with regard to which blade probe you want to
17 deploy in trading off the sensitivity of one blade
18 probe versus another.

19 CO-CHAIRMAN FORD: Just to go back to
20 Graham's point, if you have such a presentation at the
21 full committee meeting in a couple of weeks' time
22 rather than all of these word slides, a graph of real
23 versus observed or observed versus actual --

24 MR. ALLEY: Okay.

25 CO-CHAIRMAN FORD: -- it would be very

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE, N.W.
WASHINGTON, D.C. 20005-3701

1 helpful.

2 MR. ALLEY: Okay. Let's regress just
3 slightly and talk a little bit more about the 2001
4 demo process. Again, we were looking for the safety
5 significant flaws in the two base metals.

6 The mock-ups consisted of two different
7 mock-up blocks or samples. One was the stub-in pieces
8 off the Ocone penetration tubes, and I've got a
9 picture to show you there.

10 The concept behind that was to demonstrate
11 that the ultrasonic techniques were capable of
12 detecting a cracked HIP, and this was a real PWSCC.
13 So you actually did -- the vendors did hand scanning
14 on this block to show that they could detect the
15 cracked HIPs, which is the primary mode that we're
16 using for detection.

17 We had a good range of flaw sizes in the
18 Ocone pieces which you'll observe in just a minute.
19 Then we had a full scale mock-up, and that full scale
20 mock-up contained EDM notches, which are not
21 particularly challenging in the NDE world.

22 At the same time, this is where we started
23 taking into account distortion issues, access to the
24 nozzle, scanning rates, patterns, those sorts of
25 mechanical devices probably as much as ultrasonic

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 devices were demoed as part of that.

2 MR. SHACK: Now, these EDM notches, did
3 you try to squeeze them down, tighten them up at all?

4 MR. ALLEY: This was the first round. So
5 these were EDM notches, and we did use squeeze notches
6 on the second round, which I'll discuss that in just
7 a few moments.

8 We had flaws located relative to the weld.
9 We had some cluster tight flaws, notches. In this
10 case we call them flaws, but notches. We had triple
11 point indications or notches in the triple point area.
12 Again, I've already mentioned we used EDM notches, and
13 the initial demo here was blind, but immediately after
14 the vendor turned over the results, we unfolded the
15 scales on the keys to the blocks. We were able to now
16 negotiate with the vendor with regards to what they
17 detected and what they found, a very helpful exercise
18 in developing the techniques.

19 MR. POWERS: I don't understand what you
20 mean, "negotiate." I mean you either found something
21 or you didn't.

22 MR. ALLEY: Well, you can try smaller
23 probe size. You can try a different frequency. Why
24 don't you do this? Why don't you do that? Trying to
25 work with the vendors at this point in time, showing

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 them what they missed and trying to explain to them
2 why they missed it.

3 This first round of demos we started in
4 the fall of 2001, actually went on for about six
5 months. We envisioned first that we would have these
6 blocks and we'd run these in a week, and I think the
7 NRC actually was invited on many of these demos and
8 came down and witnessed, and you stood around a lot
9 because the vendor would go in and do some of the
10 inspection work and then have to go back and tweak a
11 probe.

12 So this process went on and on and on.
13 This block was shipped all over the country; these
14 blocks were, trying to get the techniques developed.

15 So when I said "negotiate," that's what we
16 were trying to do, is basically push the technology
17 and the development of the technology. It was a
18 learning experience.

19 Okay. The next slide will show you the
20 Oconee in-stub pieces. This was the ends of the tubes
21 that were removed at Oconee as part of the repair
22 process. You can see the flaws that were contained on
23 these tubes, ID and OD flaws.

24 MR. WALLIS: Now, I can see a whole lot of
25 sort of vein like things. Those are all flaws?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. ALLEY: That's PT results from --

2 MR. WALLIS: Anything there which doesn't
3 look like a homogeneous substance is a flaw?

4 MR. ALLEY: All the bleed-out there that
5 we see in the dye penetrant. This was a dye penetrant
6 picture of the stub-in pieces only, Ocone unit.
7 Those are all --

8 MR. WALLIS: It's riddled with flaws.

9 MR. ALLEY: Yes, it is.

10 MR. WALLIS: And you're looking for one
11 flaw?

12 MR. ALLEY: Well, we picked out flaws that
13 were oriented at 45 degrees, the ID flaws and the OD
14 flaws, and we asked the vendors to take their probes
15 and manually manipulate their probes on the surface to
16 see that they could detect the tips of these flaws.
17 That was part of --

18 MR. WALLIS: --looking for rivers from a
19 satellite. I mean, you can see them, but if they're
20 small enough you won't see them.

21 MR. ALLEY: True.

22 MR. WALLIS: So there must be something
23 that you can specify about the resolution or the
24 sensitivity or something. Isn't that a requirement?

25 MR. ALLEY: It's looking at --

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 MR. WALLIS: You don't have any
2 specifications; is that right?

3 MR. ALLEY: It's looking for the tips. I
4 mean, they needed to demonstrate that their techniques
5 were capable of finding the tips, and it wasn't always
6 done.

7 Excuse me?

8 MR. WALLIS: Atomic size tip?

9 MR. ALLEY: No, we picked out a flaw in
10 here, the 45 degree off-axis flaws to demonstrate that
11 they're capable of doing that. Again, this wasn't to
12 define minimum detectabilities. This was to show that
13 they're getting sound energy to the cracked tip and
14 they're able to see resident energy off of that tip.

15 MR. WALLIS: It just sounds so
16 qualitative.

17 MR. ALLEY: This was the first cut through
18 these demos. So if they can't find crack tips,
19 they're not going to perform on any demonstration. So
20 the idea here was you find the crack tips first. Then
21 we'll go to the next round. So this was kind of a
22 screening process. It actually worked very well for
23 that.

24 MR. MATHEWS: And most of those -- is this
25 the same? Well, these are two different -- most of

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE, N.W.
WASHINGTON, D.C. 20005-3701

1 those that all those flaws on the OD, most of them
2 were not through wall by any stretch.

3 MR. ALLEY: No.

4 MR. MATHEWS: Marked through wall flaws of
5 various depths, and they picked out one or some.

6 MR. ALLEY: The off-axis flaws is one we
7 were very interested in.

8 MR. MATHEWS: Yeah.

9 MR. SHACK: You should have been around in
10 the days before they looked for the crack tip
11 reflection if you really wanted to see a qualitative
12 argument.

13 (Laughter.)

14 MR. ALLEY: The only thing in NDE worse
15 than finding something is finding nothing.

16 MR. SHACK: Amplitude drop and all of
17 those exciting parameters.

18 MR. ALLEY: Yeah. Then the next slide
19 just shows the full scale mock-up that was
20 constructed. Again, this had EDM notches in it, but
21 you can see here that we tried to emulate some of what
22 we had seen in the field. Here are some cross-hatches
23 with a circumferential flaw on the 45 degree slope,
24 and the inspection vendor has some difficulty not in
25 detecting that, but in trying to resolve the axial

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 flaws from circumferential flaw.

2 We had another circumferential flaw over
3 flaw number three there. It's a bit challenging.
4 It's got little cross-hatches on it as well. Again,
5 for the speed of trying to get this done for the fall
6 inspections, these were just all of the EDM notches
7 that we put in place.

8 You can see a picture of that block over
9 on the side there, and you see that that's full scale.

10 MR. WALLIS: So these flaws, these are not
11 -- it can't be like the real flaw.

12 MR. ALLEY: These are notches.

13 MR. WALLIS: And they're much more
14 microscopic than the real flaws, aren't they?

15 MR. MATHEWS: Yes.

16 MR. ALLEY: Yeah.

17 MR. MATHEWS: The goal was to demonstrate
18 the ability to detect the tip of a PWSCC flaw on a
19 real PWSCC flaw. That was the goal with the two stub
20 pieces from Oconee that had PWSCC flaws in them.

21 Then using that technique in a mock-up
22 with notches, the purpose of the notch -- mock-up with
23 notches was to demonstrate the ability to deliver
24 sound to the location, with the presumption, if you
25 will, that if you get the sound there and you can see

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 the tip, then it will work.

2 MR. ALLEY: Yeah, the notices were not
3 challenging, but again, it was somewhat challenging to
4 pick out the axials versus circumferentials when you
5 have all of these axials lined up with a
6 circumferential flaw cutting through it. That was a
7 bit challenging.

8 And we had WesDyne, Framatome, and
9 Technatome actually participated in these mock-ups.
10 We also had eddy current mock-up which I didn't show
11 here. it was an eddy current mock-up with a J groove
12 weld that just had three flaws located in it. So we
13 had some ability to do the eddy current.

14 The results were distributed by the MRP.
15 Vendors were capable of detecting the crack tips on
16 the Ocone tube ends after enhancing their
17 procedures. So to me that was the successful part of
18 this demo. The vendors came in at first and tried to
19 find crack tips on those tube pieces and couldn't find
20 them. So we changed the procedures and the techniques
21 associated with that until they were able to find
22 them.

23 Then you go to the full-scale mock-ups.
24 that was a very valuable experience.

25 Vendors were able to detect the flaws in

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W
WASHINGTON, D.C. 20005-3701

1 the full scale mock-ups. As I said, those notches are
2 not very challenging.

3 Again, I had already mentioned that we did
4 multiple demos. This process went on for a very long
5 time. We changed inspection requirements.

6 CO-CHAIRMAN FORD: Just to go back, you
7 said you changed the criteria and then they found it.

8 MR. ALLEY: We changed probes, changed --
9 I don't recall specifically what we changed now, but
10 the probes and the depth of focus of the probes and
11 the frequencies and the technique that was used, those
12 were changed as part of this demo process.

13 When the vendors first came in and scanned
14 the blocks manually, they couldn't see the crack tips.

15 CO-CHAIRMAN FORD: Right.

16 MR. ALLEY: So they throw that technique
17 away and got another technique and came out and
18 started doing that.

19 CO-CHAIRMAN FORD: You didn't make it
20 easier for them to find it. They had to go away and
21 sort it out for themselves?

22 MR. ALLEY: Yeah, we were able -- "we,"
23 EPRI was pretty instrumental, I think, in giving them
24 some guidance in what they needed to do to do that.

25 CO-CHAIRMAN FORD: Okay.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D C. 20005-3701

1 MR. ALLEY: So the EPRI NDE center is kind
2 of managing this system for us.

3 CO-CHAIRMAN FORD: So you educated them of
4 it and --

5 MR. ALLEY: Used the 45 degree shear wave
6 (phonetic), you know, that kind of thing.

7 The results were demonstrated periodically
8 as we had a chance to update this or something new
9 happened in the demonstration process. We updated the
10 industry on where we were.

11 The next slide is just a table that shows
12 typical results. The vendors still treat this as
13 fairly much proprietary as far as what angles and what
14 probes and what frequencies they're doing. There's
15 certainly a commercial aspect to them having developed
16 most of these techniques.

17 Again, the goal of MRP was not to develop
18 these techniques. The vendors needed to develop that.

19 Just to give you a feel for the types of
20 results that we were able to get, you can see a number
21 of different techniques or flaw sizes that were used
22 across the top. The A, B, C, D, E, F, which is scaled
23 on the right-hand side, shows you the orientation of
24 those flaws, the techniques and whether they were
25 detected and whether they were sized successfully.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 These are the kind of tables that went out
2 along with additional information to the industry for
3 all of the vendors that went through the examination.

4 So that was the first round of demos done
5 very hurriedly and done with notches and what we could
6 get our hands on very quickly.

7 MR. SHACK: Were the Framatome people
8 using the same techniques that they used on the French
9 reactors? I mean, were they --

10 MR. ALLEY: Well --

11 MR. SHACK: They run with cracks.

12 MR. ALLEY: The initial approach that
13 Framatome used at Oconee, for instance, when we found
14 Oconee 1 with some issues, they deployed the
15 techniques that were developed as part of 9701: eddy
16 current ID, rotating probe, and went in and did that.
17 And the performance of that was not anywhere near what
18 it is today. So those techniques have changed.

19 Now, the eddy current techniques are still
20 the same, but the ultrasonic techniques have changed
21 quite a bit in the last two years.

22 Again, what the French were looking at was
23 eddy current detection and then a very shallow focused
24 ID flaw for sizing, and it was backed into sizing. If
25 you didn't see it, you would assume it was the minimum

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 detection limits of the probe. So that kind of broad
2 brushed approach to the 9701 was very successful in
3 that program, but in this program since the flaws are
4 oriented from the OD and coming in, that approach was
5 not as successful. So we had to change.

6 Now, for the 2002 demos, we replaced the
7 EDM notices with CIP flaws, which is cold isostatic
8 pressure. We actually EDM the flaws in place and then
9 put it in autoclave and slam the flaws shut and make
10 a very tight flaw.

11 We were able to have depth sizing, length
12 sizing, and location with respect to the weld. We had
13 an increase population of flaws, many more flaws in
14 the blocks. We had blocks manufactured to have flaws
15 in the attachment welds. We had wanted to identify
16 flaws that reached the triple point, and the triple
17 point is the point where you have the two materials,
18 the weld metal and the buttering, all meeting at that
19 one point up there, which is the spot at which you
20 have to get across the triple point in order to leak
21 into the annulus.

22 So, again, there's several different
23 schemes about how you might go about addressing this
24 problem. One is if I don't see any indications to the
25 triple point, then I don't have leakage. If I don't

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 have leakage, I can't have circumferential flaws.

2 So there's a logic approach for a while.

3 We wanted to get some information on that.

4 The effects of cluster flaws we know is
5 part of the 9701, that many of these nozzles contain
6 crazed type IDs, shallow clusters. So what would
7 happen if we had a flaw line beneath that? So we
8 wanted to include that in the next round of demos.

9 So the Tiger team, to go back to that real
10 quickly, the Tiger team did design the next round of
11 mock-ups. These were the goals of the mock-ups.

12 We wanted to maintain a blind. We wanted
13 to demonstrate the sizing capabilities. We wanted to
14 maintain a full scale mock-up. We wanted to establish
15 inspection thresholds. What's the minimum
16 detectability?

17 Again, we talked about the POD. That was
18 not part of the goal of this process. We wanted to
19 provide practice blocks, and we wanted to include the
20 craze cracking.

21 So those were the high level goals that we
22 approached going into the next round of demos.

23 The mock-up flaws must be representative
24 and appropriate for the NDE methods to be
25 demonstrated. For UT we needed specular reflection

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE, N.W.
WASHINGTON, D.C. 20005-3701

1 off the flaws. We needed tipped fraction responses
2 and corner trap responses. So we needed to make sure
3 those were included in there.

4 For eddy current, we needed a realistic
5 electromagnetic properties and crack widths.

6 The goals as realistic reproduction of key
7 detection and sizing variables. So any differences
8 were monitored and considered during the demonstration
9 process. Again, numerous NDE methods were being
10 applied, a number of different probe frequencies and
11 schemes were being applied.

12 The CIP flaws we considered. The Tiger
13 team considered all different flaw making techniques.

14 MR. ROSEN: What's sift?

15 MR. ALLEY: CIP, cold isostatic pressure.
16 We basically put it in an autoclave and just put so
17 much pressure in there that we're able to slam these
18 notches shut and get a very tight flaw.

19 We reviewed all of the different flaw
20 making techniques, fatigue cracks, thermal fatigue
21 cracks, mica disks, EDM notches, CIP flaws, HIP flaws,
22 which is hot isostatic pressure, and we settled in on
23 the CIP as being a good approximate for the eddy
24 current. They are very tight and no unrealistic
25 electromagnetic features. They didn't give us false

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 calls, in other words. They were appropriate for UT.
2 They gave good tip responses, which again tip response
3 is the primary detection mode now.

4 The reason that we use CIP rather than a
5 true SCC flaw is because we can control the dimensions
6 of that. We machine the notch in it. We know how
7 deep it is, how long it is, and the orientation of it
8 before we put it in an autoclave to slam it shut, and
9 that way we've got good sizing ability to know what it
10 is.

11 If it's a true SCC flaw, we really,
12 because of the sonic uncertainties, you don't
13 understand what the true bounds are. So that was one
14 of the primary goals.

15 MR. POWERS: But the trouble is now you
16 don't know anything about the detection of true flaws.

17 MR. ALLEY: Well, the true flaws, as I
18 mentioned before, they meander, and they sort of break
19 up and scatter and work their way through the
20 material. So there's some ultrasonic uncertainties
21 associated with that.

22 In defining the boundaries of the exam, we
23 wanted to make sure that we eliminate those
24 uncertainties.

25 MR. POWERS: I understand that, but the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 result is that the skeptic says, "Great. This is an
2 inapplicable."

3 MR. ALLEY: It's inapplicable?

4 MR. POWERS: Doesn't have anything to do
5 with reality.

6 MR. ALLEY: Because the true flaw may not
7 be truly represented?

8 MR. POWERS: Doesn't look like that at
9 all. It meanders and goes around, gets diffused, and
10 there are a lot of things that fool the detector.

11 MR. ALLEY: That's why we're very
12 interested in the North Anna results. The only way to
13 truly understand detection versus true in real life is
14 to cut flaws up, and that's what we're going to
15 accomplish with the North Anna. We should be able to
16 answer that question better for you once we have
17 sectioned the North Anna components and can compare
18 the true ultrasonic responses to the true --

19 MR. POWERS: And the scenario --

20 MR. MATHEWS: We simulate some of that
21 though. We did try to simulate some of the branching,
22 et cetera, by intersecting multiple flaws in the EDM
23 before they were squeezed, et cetera.

24 MR. ALLEY: That's correct.

25 MR. MATHEWS: Some of that was captured in

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 the way some of these flaws were manufactured, and
2 plus what do you call it? The irregularity of the
3 flaw face, I think, was tried to be captured in some
4 of the flaws or maybe all of them.

5 So they do the best they can to create a
6 flaw that will represent what's in the field.

7 MR. POWERS: And then the question is
8 whether that best you can is good enough. Now, the
9 problem we have with the North Anna is here's one
10 that's unusual, unique, and whatnot. So you get done
11 with that, what do you have?

12 MR. ALLEY: You've got several different
13 orders of uncertainty, and one is uncertainty in the
14 technique itself, which is where we need to have
15 clearly defined rules for how we can define that,
16 which is what the CIP flaws accomplish.

17 The other is the physical boundaries of
18 the technique itself, and that's what you're asking.
19 What are the physical boundaries when physics starts
20 to distort the answer?

21 And, again, the only way I know to
22 accomplish that is to cut samples up. This protocol
23 here is not designed to answer the physical
24 boundaries. When we start pushing the physics beyond
25 its abilities, we can't define that in this protocol

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 here.

2 Does that answer your question? You still
3 look confused.

4 Do I continue?

5 CO-CHAIRMAN FORD: Please.

6 MR. ALLEY: Again, what Larry mentioned
7 was we actually went in and machined the notches so
8 they would have some faceting to them, again, to try
9 to emulate a flaw that would tend to meander through
10 a material.

11 We did have branching in several of the
12 flaws. We also found out from studies that when the
13 notched tip collapses, it actually forms a little Y
14 where the material collapses, and it gives us two real
15 good branches there to get tip refractions off of. So
16 those flaws worked very well for that.

17 We did use accelerated corrosion cracks.
18 We had some mock-ups that we used, weld metal to
19 accelerate the cracks. We used this mostly with the
20 eddy current, which I'll get into in a minute when we
21 show you the eddy current blocks.

22 We were able to use the SCC flaws for eddy
23 current because eddy current, you have almost no depth
24 information on eddy currents. So the actual depth of
25 flaw is not as important in that.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE, N.W.
WASHINGTON, D.C. 20005-3701

1 Again, just to kind of go through what the
2 Tiger team had --

3 MR. POWERS: How did you make your
4 accelerated flaws?

5 MR. ALLEY: Weld metal in the tube that's
6 then put in an autoclave. So the weld metal has a lot
7 of residual stress, and you put it in the autoclave
8 and then put it in the environment. It got slow to
9 start, and then it went pretty well. So we got a
10 little behind on that process.

11 I'll show you a picture of one of those in
12 a minute.

13 CO-CHAIRMAN FORD: I'd like to finish by
14 about five to one, 11 minutes to one.

15 MR. ALLEY: Okay.

16 MR. WALLIS: Mr. Chairman, are we doing
17 now what we would normally do after lunch on the
18 program or do we have something after lunch as well?
19 Are we doing Part 5 now or four or what?

20 CO-CHAIRMAN FORD: We did Part 5.

21 MR. WALLIS: We did Part 5. So we're
22 doing this afternoon's session now.

23 CO-CHAIRMAN FORD: Yes.

24 MR. ROSEN: Why are we doing the afternoon
25 session now? I thought we would go to lunch. I

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 thought we were going to go to noon when you took the
2 poll at 11:30.

3 CO-CHAIRMAN FORD: Well, I know that.
4 that's why I asked the question. Do you want to have
5 lunch at half past 11 or --

6 PARTICIPANTS: Or not at all.

7 (Laughter.)

8 MR. MATHEWS: He didn't phrase it that
9 way.

10 PARTICIPANT: This is the way it's working
11 out.

12 CO-CHAIRMAN FORD: Could I suggest Jack
13 reminds me that you might have problem getting lunch
14 in the cafeteria?

15 PARTICIPANT: Yeah, if you wait long
16 enough they all go home.

17 CO-CHAIRMAN FORD: Sine you're just
18 starting the 2002 topic, maybe this is a good time to
19 break if that's okay with you.

20 MR. ALLEY: Very good, yeah.

21 CO-CHAIRMAN FORD: And then let's go into
22 recess now until half past one, and then we'll start
23 up again at half past one.

24 (Whereupon, at 12:28 p.m., the meeting was recessed
25 for lunch, to reconvene at 1:30 p.m., the same day.)

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:33 p.m.)

CO-CHAIRMAN FORD: Okay. We're back in session.

You're all well fed. Mike says I'd better keep you awake now.

Okay. Tom.

MR. ALLEY: Okay. Where I am is 2002 mock-ups. The next slide, I think. Let me get the video here and where I am on the same page.

Okay. Yeah, what the Tiger team has decided to do in the 2002 mock-ups is have axial circumferential and off-axis tube flaws. Now, I use "flaws" to describe notches before, but these are actually the CIP flaws.

We had approximately 20 flaws, up to 100 percent in depth, ranging in length from 1/100,000 to three inches. We had cluster flaws in the tube, 25 flaws up to 20 percent deep, 1/100,000 to 1/250,000; axial circumferential flaws in the attachment welds. We located them at the well head and weld to tube interface, and flaws approaching and through the triple point. So, again, it was one of the inspection philosophies here was being able to look at that triple point. So we wanted to be able to define the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 capability to do that.

2 The next slide is just a graphical
3 presentation, and this is typical because, again,
4 these blocks are steel blond (phonetic). So we did
5 hand this out to the inspection vendors and had time
6 to show a representation of the flaws and the
7 locations and what we're trying to accomplish.

8 This isn't the actual drawing of the
9 block, and it shows the orientation across the weld.
10 You can see the little clustered flaws, 14 and 15 up
11 on the right-hand side. That was to look at the
12 detectability through the craze crack along the ID
13 that we saw on the left-hand side. You could see some
14 cross-sectional views of flaws that would be in a
15 circumferential direction and in the axial direction.

16 I'll have a few more details on this as we
17 go along.

18 The J groove welds, this is a similar view
19 for what was proposed to build and construct in the J
20 groove itself. You could see flaws along the lower
21 part of the weld, through the weld, axial --

22 MR. ROSEN: It would help me if you could
23 point out as you're going along what you're talking
24 about.

25 MR. ALLEY: Okay. We've got defects that

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 would essentially be in the circumferential location
2 even though it's on an off axis. You just talk a lot
3 about the off axis, but it's following the weld root
4 area.

5 We've got the axial flaws that would go
6 down through the weld approaching the triple point.
7 We've got flaws up through the triple point. These
8 are in the weld metal.

9 MR. WALLIS: How do you make those flaws?

10 MR. ALLEY: Those flaws in the weld metal
11 were made by notches, and then collapsed.

12 MR. WALLIS: Notches and then you squeeze
13 it all together again?

14 MR. ALLEY: Yeah.

15 MR. ROSEN: Can you put the red dot on the
16 triple point?

17 MR. ALLEY: The triple point would be
18 right here.

19 MR. ROSEN: Right there.

20 MR. ALLEY: So, again, you're thinking
21 this is probably on the ID. This is on the OD of the
22 weld. So it's a --

23 PARTICIPANT: OD of the tube.

24 MR. ALLEY: I mean the OD of the tube,
25 even though it looks like the ID. Exactly, you've

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701

1 opened up what's called a C scan view. So we've got
2 a variety of flaws proposed in here.

3 The next slide is just a copy of what we
4 call the J block, which is, again, the tube weld -- I
5 mean the tube defects that we put in here and the
6 location. You can see the full scale mock-up here on
7 the side, and we actually suspend it off the floor.
8 So we have to manipulate the equipment underneath it
9 and then access up to the bottom of the tube and scan
10 the tube.

11 These defects are in the tube themselves.
12 So you'll see OD circumferential, ID circumferential.
13 We see the axial flaws here, both OD and ID. This
14 particular block was manufactured as a piece and then
15 welded in place. We were able to --

16 MR. WALLIS: Excuse me. These flaws are
17 straight, aren't they? They're relatively simple
18 geometry?

19 MR. ALLEY: Well, we talked about before
20 we've fastened them as much as we can. You have to
21 machine the notch in, and then we can collapse them.
22 So there aren't absolutely straight specular
23 reflectors. They've got some twisting and turning to
24 them. We've tried to emulate branching in some of
25 them. They're just graphically shown here as being

1 straight to show the orientation.

2 And then it's very important to us that we
3 did some work to show that the tip, as I mentioned
4 before, when it collapses it actually forms a little
5 Y. As all of that material collapses, it's very
6 important because the vendors rely on cracked tip
7 detection as a means for detection and sizing the
8 flaw. So now we have a couple of tips up here that we
9 can now detect with tip responses. If it was just a
10 specular reflector, we wouldn't get a very good tip
11 response off of that.

12 So that's the ones that are in the tube
13 material themselves. The next slide, again, shows the
14 K mock-up, we call it. This was the one with the weld
15 metal defects that are located here, and then we've
16 got these defects are shown growing this way You'
17 can't really see it in this slide, but they're shown
18 growing circumferentially around the nozzle and up
19 through the weld.

20 So there are actually two blocks there for
21 that, and those, again, were ship flaws.

22 We did UT tests on the inside of the tube
23 to try to detect these. Again, we're interested in
24 seeing how far in the weld metal we can see things,
25 and we did eddy current inspections from the wetted

1 surface to see the interface of these flaws to where
2 they interface to wetted surfaces.

3 MR. ROSEN: How do you put the pressure on
4 the outside of this thing to close the --

5 MR. ALLEY: It's done in autoclave.

6 MR. ROSEN: You make this whole part and
7 put it in the autoclave?

8 MR. ALLEY: Well, there's kind of a --
9 usually we end up having to crop it off here and crop
10 it off somewhere else and weld it together and
11 reassemble it. We make sure that the area that
12 contains the effects here is what goes through the
13 treatment, and then we'll manufacture that in place.
14 We can't put that whole block in.

15 So it can cause us some sonic concerns out
16 here and some sonic concerns down here, but that's not
17 the area of interest for us.

18 MR. ROSEN: So you put it in the autoclave
19 and you take the autoclave up to a couple thousand psi

20 MR. ALLEY: Yeah, I forgot.

21 MR. MATHEWS: Forty-five thousand.

22 MR. ALLEY: I've forgotten what the
23 pressure is, but it's --

24 MR. POWERS: Are you doing your own or are
25 you having somebody do it for you?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS
1323 RHODE ISLAND AVE., N.W.
WASHINGTON, D.C. 20005-3701