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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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ADVANCED BOILING WATER REACTOR SUBCOMMITTEE

+ + + + +

WEDNESDAY

APRIL 6, 2011

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear
Regulatory Commission, Two White Flint North, Room
T2B1, 11545 Rockville Pike, at 8:30 a.m., Dr. Said
Abdel-Khalik, Chairman, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

SAID ABDEL-KHALIK, Chair

J. SAM ARMIJO

DENNIS C. BLEY

CHARLES H. BROWN, JR.

MICHAEL T. RYAN

WILLIAM J. SHACK

1 SUBCOMMITTEE MEMBERS PRESENT (CONT'D) :

2 JOHN D. SIEBER

3 JOHN W. STETKAR

4

5 NRC STAFF PRESENT:

6 MAITRI BANERJEE, Designated Federal Official

7 GEORGE WUNDER

8 TIM STEINGASS

9 TOM TAI

10 DEVENDER REDDY

11 DINESH TANEJA

12 ANGELO STUBBS

13 GREGORY MAKAR

14 MARK TONACCI

15 STACY JOSEPH

16 DAVID JENG

17 ALSO PRESENT:

18 SCOTT HEAD

19 COLEY CHAPPELL

20 MICHAEL MURRAY

21 TOM DALEY

22 STEVE CASHELL

23 WARREN ODESS-GILLETT

24 EDGAR BROWN

25 CRAIG SWANNER

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

8:39 a.m.

CHAIR ABDEL-KHALIK: The meeting will now come to order.

This is a meeting of the ABWR Subcommittee of the Advisory Committee on Reactor Safeguards. I'm Said Abdel-Khalik, Chairman of the Subcommittee.

ACRS Members in attendance today are Charlie Brown, Sam Armijo, Dennis Bley, Michael Ryan, John Stetkar and Bill Shack. Ms. Maitri Banerjee is the Designated Federal Official for this meeting.

In today's meeting, we are scheduled to discuss Chapters 10 and 14 of the Safety Evaluation Report related to the COL Application submitted by NINA for two ABWR units at their STP site in Texas. These Chapters were presented to us last year when the SER had open items in it.

In today's meeting, the staff will discuss how they have resolved these open items. The staff and the Applicant will also discuss some follow-up action items from previous ABWR subcommittee meetings.

The rules for participation in today's meeting were announced in the *Federal Register* on March 23, 2011, for an open/closed meeting. Parts of

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1 this meeting may need to be closed to the public to
2 protect information proprietary to the Applicant or
3 other parties. I'm asking the NRC staff and the
4 Applicant to identify the need for closing the meeting
5 before we enter in such discussion and to verify that
6 only people with the required clearance and need-to-
7 know are present.

8 We have a telephone bridge line for the
9 public and stakeholders to hear the deliberations.
10 This line will not carry any signal from this end
11 during the closed portion of the meeting.

12 Also, to minimize disturbance, the line
13 will be kept in listen-in-only mode until the end of
14 the meeting when ten minutes are allocated for public
15 comments. At that time, any member of the public
16 attending this meeting in person or through the
17 bridgeline may request to make a statement or provide
18 comments.

19 As the meeting is being transcribed, I
20 request that participants in this meeting use the
21 microphones located throughout this room when
22 addressing the Subcommittee. Participants should
23 first identify themselves and speak with sufficient
24 clarity and volume so that they can be readily heard.

25 We will now proceed with the meeting. And

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1 I call on Mr. Mark Tonacci of NRO to begin the
2 presentation.

3 MR. WUNDER: Good morning, Mr. Chairman
4 and Members of the Committee.

5 I'd like to thank you for allowing us the
6 opportunity to come to and present the staff's work on
7 Chapters 10 and 14. I look forward to an engaging and
8 positive discussion today.

9 And that concludes my statement. Thank
10 you.

11 CHAIR ABDEL-KHALIK: We'll move on to the
12 Applicant. Mr. Head?

13 MR. HEAD: Good morning. We appreciate
14 the opportunity to brief the ACRS this morning. We're
15 going to start with Chapter 10 on the agenda for
16 today.

17 We have a couple of items of interest we
18 wanted to share with you and then also discuss some
19 ACRS action items on this Chapter.

20 With us today and myself are Mike Murray
21 and Tom Daley are also here with me today, and they've
22 briefed the Subcommittee before on other Chapters and
23 other topics. And Coley Chappell and Jim Agles are
24 here also today with us.

25 And with that, I'll turn it over to Coley.

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1 MR. CHAPPELL: Good morning. My name is
2 Coley Chappell. Good to see you, Mr. Chairman, and
3 Members again.

4 Just as was mentioned briefly previously,
5 Chapter 10 was discussed last year on June 23rd. We
6 went through a number of departures that resided in
7 Chapter 10 as well as other departures that have
8 consistency changes in Chapter 10, discussed COL
9 information items and site-specific information such
10 as the power cycle heat sink that was required to be
11 completed by Applicant.

12 Items of interest since that meeting, the
13 resolved RAIs that since that time have been addressed
14 include a couple that are shown here. One is related
15 to a departure -- Standard Departure 10.4-1 -- which
16 had a nonsafety-related clean steam supply, a gland
17 seal steam evaporator, which was not part of the
18 certified design. So we answered a number of detailed
19 questions on that in response to an RAI and resolved
20 that issue.

21 Now we also revised a previous response to
22 RAI 10.04.07-3. And we revised a Tier I figure --
23 2.10-2a -- which shows condensate booster bumps on
24 that Tier I figure for consistency.

25 Also since last year's meeting, we have

1 gone through a number of interactions with the staff
2 -- meetings and RAIs and revised RAIs. On this page
3 that we refer to RAIs 10.2-1 through 10.2-8, the
4 latest submittal was on February 21st.

5 Just to run through a couple of the
6 points, RAI 10.2-3 resolves some differences in
7 specific valve setpoints that were referred to the SRP
8 and the Toshiba design, for example, when the turbine
9 control valves are full closed and when intercept
10 valves are fully closed.

11 We also added some information into the
12 FSAR regarding the power load and balance anticipatory
13 trip function and how that supplements EHC speed
14 control.

15 A number of RAIs in which the balance of
16 those discussed the adequacy of the departure
17 referring to the overspeed protection system. So the
18 SDP departure replaced the mechanical overspeed with
19 a redundant electrical overspeed and also included
20 additional details in the FSAR in Subsection 10.2.2.

21 We also included site-specific ITAAC. And
22 that site-specific ITAAC is part of what addresses
23 Action Item #45. And we'll have a few slides on that.

24 With that, I'd like to turn it to over to
25 our I&C Manager, Mike Murray.

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1 MR. MURRAY: Good morning. Mike Murray
2 addressing the Committee.

3 The picture we've got here in front of us
4 will be will be added to the FSAR. It's a simplified
5 diagram of the two overspeed trip functions -- how
6 they're implemented.

7 We'll take a minute and go through the
8 lower of the primary trip function. And then we'll
9 talk about as we go to the top we'll talk about the
10 diversity between the two.

11 If you look through -- follow through on
12 the primary which will have a setpoint of nominally
13 110 percent, there's a speed wheel #2, and there's
14 three passive speed probes. That means they don't
15 have any excitation on them. So they are magnetic and
16 sensed by those circuitries.

17 In the detection circuitry, there's speed
18 monitors that convert that pulse signal into a
19 comparator signal and then produces a trip signal if
20 the overspeed setpoint is exceeded. And then it goes
21 into a two out of three which is relay logic
22 specifically in this particular circuit. And then
23 with a two out of three function being met, it goes to
24 the trip valves. And if you'll look, there are two
25 different trip valves -- trip pilot valves. It takes

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1 both of those in order to initiate a turbine trip. So
2 if you would de-energize one of the pilot valves, you
3 don't get a trip. If you energize -- pardon

4 MEMBER BROWN: I misunderstood you.
5 Sorry.

6 MR. MURRAY: -- turbine trip. That's
7 correct.

8 So it takes both of those as an and gate
9 basically hydrologically that both pilots have to be
10 de-energized to actually adopt the trip header and
11 trip the main turbine. So in it that makes it sink
12 failure criterion acceptable as well as has required
13 redundancy in it.

14 In the upper box, a lot of the type of
15 methodologies are similar and the same except all of
16 the equipment is diverse from what is used for the
17 primary. The emergency trips at 111 percent setpoint.
18 And this particular one uses a different speed sensor.
19 We use an active probe which means it has a wetting
20 voltage on it to produce the pulses that the speed
21 monitors pick up as well as there's a completely
22 separate speed wheel for those sensors to pick up.

23 And then it goes into a two out of three
24 logic which is a solid state or basically a PLC-type
25 logic that does the two out of three. It has speed

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1 sensors also, converts to signal to the trip signal,
2 and then the two out of three logic which is diverse
3 from what's used in the primary trip function. Then
4 we'll monitor that logic in a two-out-of-three.
5 Again, we'll de-energize a pilot solenoid valve.
6 Again, it takes both of them to be de-energized in
7 order to trip the main turbine.

8 Any questions on those? Yes, sir?

9 MEMBER BROWN: John, did you have one?

10 MEMBER STETKAR: Several. But go on.

11 MEMBER BROWN: Okay. I just want to make
12 sure after going through this and the clarifications
13 you all added to the RAI. There are three active
14 speed sensors that are also used for the normal speed
15 control?

16 MR. MURRAY: That is correct.

17 MEMBER BROWN: Okay. So those are shared
18 sensors. But the normal speed control electronics is
19 separate -- is a separate set of electronics. It's
20 not the same electronics. At least that's what I got
21 out of the RAI.

22 MR. MURRAY: And that is correct.

23 MEMBER BROWN: That's correct also.

24 MR. MURRAY: There's a separate set of
25 electronics and a separate set of power supplies for

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1 that set of electronics.

2 MEMBER BROWN: Okay. And that was a
3 question we had in one of the last meetings as to what
4 are you sharing the electronics and just going to a
5 set of trip functions. Okay. So that's been
6 clarified in there.

7 MR. MURRAY: Right.

8 MEMBER BROWN: The next thing, you said
9 those are going to be incorporated into a later
10 revision -- these clarifications -- to a later
11 revision of the COLA?

12 MR. MURRAY: That is -- those are for
13 information in the RAIs will be incorporated in the
14 next revisions.

15 MR. CHAPPELL: The next revision is
16 expected later this year.

17 MEMBER BROWN: Okay. It said future
18 revision and I just wondered what future was --
19 whether I'd still be alive or not yet when --

20 (LAUGHTER.)

21 MEMBER BROWN: Got to have a little humor
22 there.

23 All right. So that answers my question on
24 that. And I'll ask my other one later when we get to
25 it.

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1 MR. HEAD: Yes, we normally say future in
2 our correspondence because we want to make sure it's
3 acceptable to NRC before we put it in.

4 MEMBER BROWN: That's fine. Except I
5 think it said part 9? No, that's the ITAAC that goes
6 there.

7 MR. HEAD: That's the ITAAC. I think
8 we're targeting it for August right now.

9 MEMBER BROWN: Okay. What part does it go
10 in -- the text part? The description part? Is that
11 part --

12 MR. CHAPPELL: Section 10.2.

13 MEMBER BROWN: Okay. I got that. Thank
14 you.

15 CHAIR ABDEL-KHALIK: John?

16 MEMBER BROWN: That's all I had, John.

17 MEMBER STETKAR: Mike, the two trip
18 valves, are they the same?

19 MR. MURRAY: Are the two trip valves the
20 same? Yes. They're in one manifold device which is
21 called an emergency trip device. They are the same.

22 MEMBER STETKAR: Show me a drawing of
23 that, please.

24 MR. MURRAY: I don't have it with me.

25 MEMBER STETKAR: If you have one --

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1 because I've been trying to figure out how -- I mean,
2 I know how it works. But I'd like to see the Rube
3 Goldberg electromechanical device that actually ports
4 the hydraulic fluid. That could be a single device.

5 I'd originally thought it was a single
6 device. With these cartoons, you convinced me that it
7 was two different valves -- or two valves.

8 MR. MURRAY: Two valves within the device.
9 Right.

10 MEMBER STETKAR: If the two valves are
11 identical. So they are not diverse.

12 MR. MURRAY: That's correct.

13 MEMBER BROWN: There are two sets, aren't
14 there?

15 MEMBER STETKAR: Can he answer the
16 question?

17 MEMBER BROWN: Yes, I'm sorry. Trying to
18 make you understand that --

19 MEMBER STETKAR: I'm trying to understand
20 how it works too. So --

21 MR. MURRAY: Yes. There are not diverse.
22 In fact we pointed that out I think in our responses
23 that that was the only portion that was not diverse.

24 MEMBER STETKAR: So they could be subject
25 to common-cause failure?

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1 MR. MURRAY: Yes.

2 MEMBER STETKAR: Yes. Thank you. Yes.

3 You mentioned that the normal speed
4 channels, if two of the three speed signals fail, you
5 get a turbine trip.

6 MR. MURRAY: What I mentioned was if they
7 exceed setpoint. But also in the information we
8 provided, yes, if you have one failure, you do not get
9 a turbine trip. You go to a two out of -- or you
10 reduce the logic -- go two out of three. But a second
11 failure of a speed probe will provide a trip.

12 MEMBER STETKAR: I'm trying to understand
13 the definition of the term failure. A statement is
14 made, the failure of any two of these speed sensors
15 will result in a turbine trip. Does that mean if any
16 two of the three speed sensors fail with speed zero,
17 you will get a turbine trip?

18 MR. MURRAY: It senses the -- I want to
19 make sure that my understanding is that it senses the
20 failure mechanisms of the sensors as well as the speed
21 monitors. And if there's a failure detected in the
22 way it's monitored that it will provide a trip signal
23 of that channel. And if it takes two of them, that'll
24 be two -- if you have two failures, you get two.

25 MEMBER STETKAR: Let me try to -- I

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1 understand failure modes.

2 MR. MURRAY: Right.

3 MEMBER STETKAR: If any two of those speed
4 sensors detect speed at greater than -- this is the
5 emergency trip -- 111 percent, you will get a trip
6 signal. I understand that.

7 Now what I'm trying to understand because
8 a lot of emphasis is made about how safe this is and
9 if fail-safe, the statement is made that furthermore
10 if any two of those three sensors fail, you'll also
11 get a turbine trip. Now does that mean if the output
12 signal -- I'm going to walk you down an aisle here so
13 be careful.

14 MR. MURRAY: Yes.

15 MEMBER STETKAR: If any two of those speed
16 signals go to zero, will you get a turbine trip?

17 MR. MURRAY: I don't have that information
18 to answer.

19 MEMBER STETKAR: I'd like to know that.

20 MR. MURRAY: Okay.

21 MEMBER STETKAR: Now those are categorized
22 as passive speed probes which means what? Do those
23 speed-sensing circuits have any applied voltage to
24 them at all?

25 MR. MURRAY: They sense the magnetic

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1 change -- pulse of magnetic which makes energy. And
2 that particular one monitors it.

3 MEMBER STETKAR: Okay. So --

4 MR. MURRAY: On the active, there's a
5 wetting power supply.

6 MEMBER STETKAR: No, I just want to talk
7 about the passive ones.

8 MR. MURRAY: Yes. And that is that it's
9 basically a coil that monitors the change in
10 magnetism.

11 MEMBER STETKAR: Okay. So you just pick
12 up the change in the pulses on that. So they're not
13 powered. Then maybe I'm not so interested in that
14 failure mode.

15 The active ones for the normal primary
16 trip do have an applied voltage.

17 MR. MURRAY: That's correct.

18 MEMBER STETKAR: What speed signal occurs
19 if that voltage goes to zero?

20 MR. MURRAY: I can't confirm that. I know
21 what I would expect, but I would just be telling you
22 what I'd expect.

23 MEMBER STETKAR: Yes, right. I'd like to
24 know what it does because I'm trying to do a little
25 failure modes and effects analysis here, and I have

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1 some equations I'm going to ask about later.

2 I think that's all that I had for this.

3 If you do have some drawing that shows the
4 internals of the emergency trip device and how the
5 hydraulic ports are configured, those tend to be kind
6 of interesting things. I don't know how interesting
7 --

8 MR. CHAPPELL: We have a copy with us that
9 we can show.

10 MEMBER STETKAR: Great. And I think
11 that's all I have on this part. Thanks.

12 CHAIR ABDEL-KHALIK: So the follow-up item
13 here is you want to understand what the word fail
14 means?

15 MEMBER STETKAR: I want to understand what
16 the word fail means in the context of the emergency
17 trip sensors that are also the normal control, because
18 there's a lot -- in the SER at least -- there are
19 statements saying that this is diverse, it's
20 redundant, and furthermore, if any two of these three
21 sensors fail, you will get a turbine trip.

22 CHAIR ABDEL-KHALIK: Right.

23 MEMBER STETKAR: And that's apparently --

24 MR. HEAD: Yes, we understand. I got
25 three of them. Failure of the detector.

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1 MEMBER STETKAR: Failure of the detector,
2 the wetting --

3 MR. HEAD: And if the wetting fails, which
4 I think would almost be the same thing.

5 MEMBER STETKAR: I'm not going to guess in
6 the configuration of --

7 MR. HEAD: And the internals, can we show
8 that in a break?

9 CHAIR ABDEL-KHALIK: Yes.

10 MEMBER STETKAR: Sure. Certainly.
11 Absolutely.

12 MR. HEAD: All right. And the other two,
13 like I said, I believe we know the answer but we want
14 to confirm that. And we'll do that after a break.

15 CHAIR ABDEL-KHALIK: All right. Thank
16 you.

17 MR. HEAD: Okay.

18 MR. MURRAY: Any other questions on this
19 slide?

20 (No audible response.)

21 MR. MURRAY: Next slide, please.

22 So additionally we've added two ITAAC to
23 the site-specific area. And they both are related to
24 the circuitry we just discussed, one being the trip
25 signals -- the electrical overspeed protection

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1 functions. They're isolated and independent.

2 The acceptance criteria is there that we
3 do confirm that the two electrical overspeed
4 protection functions are diverse hardware as well as
5 software firmware. And they are isolated and
6 independent from each other. So there is ITAAC added
7 specifically for that.

8 Any questions on this slide?

9 (No audible response.)

10 MR. MURRAY: Next slide, please.

11 The second ITAAC we've added has to do
12 with the emergency overspeed protection functions and
13 the normal controls which is Mr. Brown asked questions
14 about just now.

15 The emergency overspeed acceptance
16 criteria here is that the emergency overspeed
17 protection functions are implemented with trip
18 controllers that are separate from the normal speed
19 controllers. And that's to confirm the separation
20 from normal speed trip.

21 Any questions on this slide?

22 (No audible response.)

23 MR. MURRAY: Okay. I'll turn it back over
24 to Mr. Chappell.

25 MR. CHAPPELL: All right. A number of

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1 action items remain to be closed related to Chapter
2 10. I have these listed up here.

3 The first one that we've been discussing
4 is on the previous slides regarding the overspeed
5 protection systems. We're also going to address the
6 action item that regards the main turbine missile
7 analysis maintenance program. Also the strike and
8 damage probability value of 10^{-2} , and the turbine
9 rotor departure that was a basis of an audit.

10 This is a summary of the previous slides.
11 I think we've captured the additional questions. And
12 if there is no further discussion on this, we'll
13 address those additional questions a little bit later.

14 Action Item #42 discusses the missile
15 analysis and maintenance program. So we briefly
16 touched on this in the Chapter 3 presentation back in
17 October. And this provides this commitment -- 3.5-1
18 -- that addresses an Applicant requirement out of the
19 DCD that a maintenance program will be submitted three
20 years after receipt of the combined license that
21 demonstrates the turbine missile generation and
22 maintenance meets the minimum requirements for the
23 missile probabilities.

24 As part of our responses to the Chapter
25 10, we provided reports that were not intended to

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1 satisfy this commitment but only to show some of the
2 information that Toshiba has from Japanese plants.
3 And these reports are referenced on this slide and
4 have been made available.

5 MEMBER STETKAR: Coley, when do you want
6 us to ask questions about these reports?

7 MR. CHAPPELL: My point would be on the
8 last bullet is that those reports were provided ahead
9 of time. We had had discussions about those with ACRS
10 about when would they be available. The commitment is
11 three years after receiving a license is when we would
12 provide reports that would be intended to satisfy that
13 commitment.

14 MEMBER STETKAR: Okay.

15 MR. CHAPPELL: So those reports --

16 MEMBER STETKAR: So you're basically
17 telling us you don't want to have us ask questions
18 about the analyses and those particular reports?

19 MR. CHAPPELL: I would suggest that if you
20 have comments and questions that we would take those
21 and ensure that they're fully addressed at a later
22 date. I mean, this is something that would be
23 provided with those reports to satisfy the commitment.

24 MEMBER SHACK: You may want to look at
25 Section -- I didn't read the whole report -- but if

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1 you look at Section 4.4.2 on crack growth rates,
2 equation 4.9 for the stress corrosion crack model has
3 no applied stress in it which is rather unusual
4 because one would think that would be the dominant
5 parameter.

6 It then tells you that the table of data
7 is fatigue crack growth data which is probably unusual
8 because again you're talking about stress corrosion
9 crack growth rates.

10 And there's a sign wrong in the
11 logarithmic deviations in the table.

12 MEMBER STETKAR: Yes, the way those
13 numbers are applied, they systematically --

14 MEMBER SHACK: But the one that concerns
15 me most is equation 4.9 which doesn't have any applied
16 stress in it which would be most unusual for a stress
17 corrosion crack growth curve.

18 MR. HEAD: Okay.

19 MEMBER STETKAR: I'll pick up on the
20 second report -- the turbine valve test frequency
21 report.

22 I don't know. In the interest of time and
23 the fact that you're actually not going to submit the
24 turbine missile analysis for another number of years,
25 I don't know how much worth it is to go into details

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1 about that particular for the Committee.

2 I'm going to give you a few highlights.

3 Number one, it does not quantify at all
4 the likelihood of failure of the overspeed protection
5 system itself -- period. So it only quantifies
6 failures of the main turbine stop valves -- high-
7 pressure turbine stop valves, high-pressure turbine
8 control valves, intercept stop valves and intercept
9 control valves. That's the only thing it looks at.

10 The equations for the basic failure of
11 those valves are correct.

12 The numbers that are used in the analysis
13 -- and I will emphasize the word numbers rather than
14 data although the word data is pervasive. The numbers
15 that are used in the analysis are quite misleading.
16 They're derived from the operating experience of ten
17 units in Japan of which ten units have had precisely
18 one failure of one valve controller. And there is a
19 lot of questionable statistics that are used to derive
20 failure rates out to five significant figures from
21 this evidence and -- is it six? I'm sorry. I only
22 printed out five.

23 MEMBER BLEY: Some think seven.

24 MEMBER STETKAR: I'm sorry. Dennis is
25 right. It's exceedingly large numbers of digits with

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1 things like mean failure rates of zero. And Dr. Power
2 noted yesterday that I made the statement that zero is
3 an exceedingly small number. I'll make the same
4 statement today. The mean failure rate is not zero.

5 There are methods -- Bayesian analysis
6 methods that can be used to look at evidence from
7 operating facilities and look at the plant-to-plant
8 variability in that evidence and treat it with
9 appropriate uncertainty. Those methods are not used.

10 The estimated frequency of loss of the
11 load is -- I don't want to use the word derived
12 because that would imply too much actual relevant work
13 -- is based on numbers from those same ten Japanese
14 units. So it's not at all clear to me what the
15 operating experience of ten units in Japan has to do
16 with loss of load for the South Texas Project. So I'd
17 be interested in making sure that your analysis looks
18 at a plant-specific evaluation for the frequency of
19 loss of load from all sources -- loss of off-site
20 power, control system failures, switchyard failures,
21 transformer failures -- anything that could cause a
22 loss of load and that you just don't derive a number
23 from those Japanese plants.

24 By the way, that number -- I don't know
25 how it was derived. There was one event at one plant.

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1 I can't figure out how the X number of significant
2 figures of frequency that's calculated was derived.
3 I think I know how it is. But I couldn't reproduce
4 it. And then that number is magically multiplied by
5 a factor of ten to be conservative.

6 So effectively, it uses a made-up number
7 after many, many gymnastics to say, give you the
8 impression it's derived from beta. It's not. It's a
9 made-up number. You should have a better number for
10 that for your plant.

11 And the other part of the equation is that
12 the analysis uses the so-called stand-by failure rate
13 model which is a linear model for incipient component
14 failures that is directly proportional to the time
15 between tests. That model is used without
16 justification. It's used without any sensitivity
17 analyses.

18 There are in fact two components -- two
19 contributors to a complement failure. That is an
20 incipient contributor that may indeed be proportional
21 to the time between tests and something that people
22 tend to call a shock failure -- something that is just
23 simply because of a demand.

24 The degree of optimism or conservatism in
25 this stand-by failure rate model depends on the actual

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1 proportions of those incipient failures to shock
2 failures. And the stand-by failure rate model can
3 give you conservative results, or it can give you
4 optimistic results depending on the fraction of those
5 two types of failure mechanisms and the test interval.
6 It's not always conservative. It's not always
7 optimistic.

8 But without some sort of reasonable
9 sensitivity analysis to look at the sensitivity of
10 that fraction of incipient failures versus shock
11 failures over the range of test intervals that you're
12 looking at, you really don't know whether the numbers
13 that you're calculating are numerically conservative,
14 or they could be numerically optimistic. There's no
15 sense of that in there.

16 And I think that's probably enough. There
17 are a lot more details.

18 So in summary, the major points are that
19 you need to quantify failures of the trip functions
20 themselves including everything that was on the
21 drawing that you showed before and accounting for
22 example for common-cause failures of the two trip
23 valves which are not diverse. They may be the weak
24 link in the whole system and they're not quantified at
25 all.

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1 If you're going to rely strictly on the
2 valve data from those ten Japanese units, you need to
3 correctly account for the variability in that data and
4 uncertainties in the estimates of the failure rates.
5 You need to provide some justification that the use of
6 that stand-by failure rate model with the assumption
7 that the failure rate is linearly proportional to the
8 time between tests, that that assumption -- the
9 results are not sensitive to that assumption or at
10 least over the range of the proposed test intervals if
11 you're looking at one to six months, for example. Or
12 you need to do a plant-specific analysis for the
13 frequency of load-rejection events.

14 Now, that's on the basic equation. What
15 is not quantified is it is assumed that there's a
16 precisely zero conditional probability of any rotor
17 failures at design over speed or intermediate
18 overspeed conditions. The analysis looks at three
19 overspeed conditions: design overspeed, intermediate
20 overspeed and destructive overspeed. It's assumed
21 based on the results -- I think -- of the report that
22 Bill looked at that the conditional probability of
23 rotor failure at design and intermediate overspeed is
24 effectively zero. It's not quantified.

25 The argument is made that the frequency of

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1 demands for those particular overspeed conditions
2 times the conditional probability of rotor failure
3 given that demand is negligibly small compared to the
4 frequency of destructive overspeed conditions for
5 which rotor failure is assumed.

6 I did a little calculation, and using the
7 numbers that are in that report, the conditional
8 probability of rotor failure at the design overspeed
9 condition would need to be less than 2×10^{-4} for
10 demand for that contribution to be less than ten
11 percent of the destructive overspeed.

12 Now it's not clear to me because I'm not
13 a fracture mechanics guy whether you can justify a 2
14 $\times 10^{-4}$ conditional failure probability at design
15 overspeed. At intermediate overspeed, I can buy that
16 argument. The conditional probability of failure in
17 intermediate overspeed would only have to be less than
18 about .25 to justify that negligibly small.

19 But the design overspeed condition, if you
20 just use the numbers that are in that report and run
21 them through, conditional failure probability would
22 have to be less than 2×10^{-4} per design overspeed
23 event which in this context is an overspeed somewhere
24 between 110 and 120 percent. Effectively the way your
25 trip systems work, somewhere around 110 percent since

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1 your trip setpoints are 110 or 111. But the way it's
2 cast in the study, it's between 110 and 120. So look
3 at that assumption of very low conditional probability
4 of failure at design overspeed in particular if the
5 rest of the numbers apply.

6 And now I'm done.

7 CHAIR ABDEL-KHALIK: Well, I'm trying to
8 understand the basic question of the purpose of these
9 two reports.

10 MEMBER STETKAR: Well, the reason I wanted
11 to ask is they said that they're going to re-do the
12 whole analysis. Now, if they're not going to use
13 those reports at all, it's sort of worthless to
14 discuss the reports. If they're going to use those
15 reports verbatim and apply them, there are a lot of
16 problems in those reports. And I think that's the
17 message.

18 MR. HEAD: Well, clearly we were
19 attempting to react to some of the questions that you
20 all had asked.

21 CHAIR ABDEL-KHALIK: Right.

22 MR. HEAD: And we're asking ourselves the
23 same question. In the context of the actual COLA
24 process and the action item, are these reports of any
25 value or appropriate at this point in time because

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1 they're not going to be used to close out -- as
2 written, they're not going to be used to close out
3 this commitment.

4 They do exist. We appreciate the comments
5 that we received. My thinking at this point -- if I
6 could just offer a -- is that we will capture in our
7 Corrective Action Program that we've received some
8 insightful comments on what's been created and that we
9 need to address that as part of the closing-out
10 process. And that would ensure that both our notes
11 and the transcript is reviewed and we would understand
12 our particular perspective on that because that's
13 something that I think we owe it to ourselves to
14 understand as we close this action.

15 What I suggest offering is --

16 MEMBER STETKAR: I think my concern is
17 that we as a Committee will not be involved in the
18 eventual close-out of this because it's a post-COLA
19 issue. And my concern is more to get on the record
20 cautions both for you in terms of doing the
21 calculation -- the final calculation of record and for
22 the staff that we really need to look at details of
23 those calculations and understand where the numbers
24 came from when they review that eventual calculation
25 of record or audit it, I guess, because it's an audit

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1 function. So it's mostly to get kind of these
2 concerns on the record.

3 It is surprising though that the two
4 reports that you cite were dated September of 2010.
5 Quite honestly, Scott, these are the kinds of analyses
6 I saw people doing in the early 1980s when they didn't
7 know how to do the liability analyses very well. They
8 aren't the kind of analyses that should have been done
9 in September of 2010.

10 That's a very strong statement, but
11 they're not.

12 MR. HEAD: Okay. I understand.

13 MEMBER STETKAR: They're not very good
14 quality analyses.

15 CHAIR ABDEL-KHALIK: Now the question I
16 need to follow-up on the earlier question about the
17 purpose of these two reports. How will that feedback
18 impact your response to Action Item 42?

19 MR. HEAD: We are suggesting it's closed.
20 We're suggesting that the actual report -- the work
21 has to happen post-COL per the DCD expectation.

22 Admittedly, creating these reports has
23 given us now a question at this point in time. But I
24 believe since we're not offering these as for closure
25 that where we really are is that having created them,

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1 having gotten the feedback -- and I understand the
2 strong feedback on them -- that we're obligated to
3 factor that into our thinking. And we have a process
4 -- a Corrective Action Program -- that would allow us
5 to ensure that that's captured.

6 We could even capture a reference in one
7 of these or something so that it's there to make sure
8 that this insight is considered as we actually create
9 the final reports.

10 CHAIR ABDEL-KHALIK: Well, we'll sort of
11 deliberate later on as to --

12 MEMBER STETKAR: We can deliberate on it.
13 It's my opinion that with this exchange we've pretty
14 much said all that we can say within the purview of
15 our review function because the analysis is not being
16 performed as part of the COL activity or submitted for
17 review. So anything that's post-COLA is pretty much
18 out of our hands.

19 CHAIR ABDEL-KHALIK: I need to sort of
20 just work through the thought process of the purpose
21 of these letters and the feedback that has been
22 provided. And your planned response through the
23 Corrective Action Program is that -- what is the
24 purpose of this whole process?

25 MR. HEAD: Like I say, at this point in

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1 time, it's not totally clear. But obviously it
2 exists. And that's our proposal for reacting to the
3 feedback we got because it would be inappropriate to
4 obviously not to react to it.

5 MR. CHAPPELL: The initial question was
6 this commitment that's three years --

7 CHAIR ABDEL-KHALIK: Right.

8 MR. CHAPPELL: -- from the COL --

9 CHAIR ABDEL-KHALIK: Right.

10 MR. CHAPPELL: -- won't be anything
11 available. That's the concern.

12 CHAIR ABDEL-KHALIK: Right.

13 MR. CHAPPELL: And we reacted by trying to
14 put something together in the time frame. At the
15 time, we had six weeks or so to put something together
16 for Chapter 10 and presentation to try to wrap things
17 in. And so it was provided to try to attempt to give
18 information to ACRS.

19 CHAIR ABDEL-KHALIK: Right. We are
20 appreciative of that. I'm just trying to sort of see
21 how these pieces fit together.

22 MR. STEINGASS: I have a comment on the
23 process.

24 CHAIR ABDEL-KHALIK: Yes, sir?

25 MR. STEINGASS: Can you hear me? I'm Tim

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1 Steingass with the staff.

2 Just to give you a little background, the
3 turbine missile probability analysis originally was
4 put in as a departure to submit one year prior to fuel
5 load. We asked STP to revise that to three years
6 after the COL license is granted. And that's
7 consistent with all the other design centers. Okay?

8 We received the turbine missile
9 probability analysis in a preliminary format. And we
10 are not scheduled and we are not inclined to deal with
11 a preliminary report. We informed South Texas
12 verbally that that's our position at this time and
13 that they have three years to submit the turbine
14 missile probability analysis. So what we expect will
15 happen is Mr. Head and his people will take your
16 comments under consideration and revise it
17 appropriately. And I'm here and heard your comments.
18 And I can assure you we will within three years of
19 these folks getting their license take all these
20 factors under consideration.

21 So this is not a done deal. Okay?

22 CHAIR ABDEL-KHALIK: Yes. But the
23 underlying reason for my concern is that these are
24 recognized as reports that for lack of a better word
25 are irrelevant to the question at hand. Maybe

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1 irrelevant is a strong word. And yet, the comments
2 that were provided may be in essence incomplete given
3 the nature of these reports.

4 So you will address these comments in your
5 final report that will be submitted at the time it's
6 scheduled to be submitted. But has it really received
7 the appropriate level of evaluation and review?

8 MR. HEAD: Well, there's a specific
9 comment that we have. But then there's the overall
10 impression that this is not a 2011-vintage report.
11 And I think that will color the entire creation of the
12 final reports and our review that these were created
13 as discussed rather quickly and they are not the final
14 report.

15 So I think if all we do is go through and
16 check off the individual comments and don't look at
17 the bigger picture, that's not what we would expect of
18 the staff at that point in time.

19 CHAIR ABDEL-KHALIK: Okay. All right.
20 Thank you.

21 Yes, sir?

22 MEMBER BROWN: I wanted to backtrack to
23 something a little bit less expansive on a comment you
24 made. And I hadn't quite realized it when asked the
25 question before.

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1 You made a comment and it's in your RAI in
2 the context, it says -- it's talking about the normal
3 speed control units. And these are the active
4 sensors. And John addressed what's a failure. But it
5 says if you lose any two of the speed sensors -- the
6 active sensors -- then you will initiate a turbine
7 trip.

8 Whatever the mode of failure, we haven't
9 got that defined as to what defines a failure, et
10 cetera. And in my previous reading, I kind of felt
11 that applied to the primary diverse system also. But
12 then I went back and looked through and I could not
13 find that in the RAI response, anything that addresses
14 the passive sensors such that if two of them fail --
15 whatever the mode either -- there's no output or the
16 output goes bananas or whatever the thing is that
17 stays in one place -- couldn't find any reference to
18 if you lost sensing on the primary system that you
19 would get a turbine trip. So am I wrong?

20 MR. MURRAY: It does. It has the same
21 function -- loss of sensor. And again, I can't answer
22 the failure --

23 MEMBER BROWN: I'm not trying to deal --

24 MR. MURRAY: And I too looked for that
25 yesterday and saw that we didn't specifically state

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1 that for the primary that it has the same sensing of
2 failures and it's still two failures of the speed-
3 sensing circuits would cause the turbine trip.

4 MEMBER BROWN: Okay. I guess I would like
5 to ensure that that at least gets documented because
6 it's conspicuously absent right now.

7 The other thing you mentioned in the
8 context of the answer to John a minute ago was the way
9 I interpret this, if you're operating it 100 percent
10 rated speed and your just fine and all of a sudden
11 your signals go away on two on them, it'll trip. It
12 has nothing to do with whether you get a signal that
13 goes above a trip function. If you appended one
14 short, little stubby sentence that says when you
15 exceed the trip. And I just wanted to make sure I
16 understood it. It has nothing to do with the trip.
17 If you lose the sensor and whatever that failure mode
18 is, you get a trip.

19 MR. MURRAY: When a sensor is lost, it
20 provides a trip signal. So if you lose two sensors,
21 you get two trip signals.

22 MEMBER BROWN: Regardless of whatever the
23 speed it's operated?

24 MR. MURRAY: That's right.

25 MEMBER BROWN: Okay. So I guess I'd be

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1 satisfied somehow if we could get the write-up -- the
2 description part specifically address the primary as
3 well as the normal active speed sensors.

4 MR. MURRAY: And the loss of speed
5 sensors.

6 MEMBER BROWN: Yes. And the loss of speed
7 sensor discussion. And I think that's in 10.2.2.4,
8 the turbine overspeed protection system. It's a
9 description.

10 If it's somewhere else, I did not find it.
11 I read through the rest of them while the other
12 discussion was going on.

13 Have you got that Maitri?

14 MS. BANERJEE: Yes.

15 MEMBER BROWN: It's not a technical issue.
16 It's just a matter of documenting the configuration.

17 MS. BANERJEE: Address both primary and
18 normal speed sensors.

19 MEMBER BROWN: Well, the normal's
20 addressed. We've got to throw in the primary
21 overspeed trip sensor failure.

22 MR. CHAPPELL: And we need to explain in
23 greater detail what the effect of the failure of those
24 --

25 MEMBER BROWN: What that means.

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1 MR. CHAPPELL: -- on the primary overspeed
2 system.

3 MEMBER BROWN: Well, yes. That's what did
4 you mean by failure. That's the question.

5 MR. CHAPPELL: The loss of the speed
6 signals, what would be the result.

7 MEMBER BROWN: Yes. For the primary. And
8 it's covered.

9 MR. CHAPPELL: Right.

10 MEMBER BROWN: There's a bunch of
11 different subjects addressed in about five sentences
12 -- switches from normal speed control to the loss of
13 the sensors to the trip on the timer. It just kind of
14 rolls right through them.

15 CHAIR ABDEL-KHALIK: Okay. It's captured
16 then?

17 MR. CHAPPELL: Yes, sir. I believe so.

18 CHAIR ABDEL-KHALIK: Thank you. All
19 right.

20 MR. CHAPPELL: All right. Moving on to
21 the next action item. This talks about the strike and
22 damage probabilities.

23 So we have discussed where this number
24 came from -- 10^{-2} . It comes from SRP. And we quoted
25 that in our FSAR in addressing the COL item. It talks

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1 about an unfavorable orientation for turbine
2 generators so we choose a value of 10^{-2} for P2 x P3.

3 I wanted to point out a couple of items
4 from SRP Section 3513 which was followed for this COL
5 item that the calculations or orders of magnitude and
6 that those calculations require a large number of
7 dysfunctions and are fairly difficult. And so the
8 staff accepts the value of 10^{-2} per the SRP for an
9 unfavorably oriented turbine. That is the value we've
10 selected.

11 In the SRP, they describe a range based on
12 a number of factors as 10^{-3} to 10^{-2} for those
13 probabilities. And then they say they accept the 10^0
14 value.

15 So going on to the next slide, the basis
16 for this unfavorable orientation is from our dual-unit
17 departure where we have since we have a single unit
18 based on the orientation of the turbine as a favorable
19 orientation to itself but an unfavorable orientation
20 to the adjoining unit. So we say we use the
21 unfavorable criteria of 10^{-2} for that.

22 In our previous discussions, we came away
23 with the understanding that we should do a simple look
24 at the geometry of it -- of the arrangement between
25 the adjoining units and determine if that is a

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1 reasonable number. So we looked at the low-trajectory
2 path of the single turbine acting on the adjacent
3 turbine as well as the distances between the safety-
4 related structures and the height of the buildings and
5 did a simple horizontal plane/vertical plane cross
6 section. And we came up with using a number of broad
7 assumptions, no trajectories, straight path, taking
8 into account no obstructions and using the entire
9 building as the target rather than specific
10 components. We came up with the value for the strike
11 probability of approximately .007. And that is --

12 CHAIR ABDEL-KHALIK: This is just a solid-
13 angle fraction?

14 MR. CHAPPELL: Just a straight angle
15 looking at a square building and assuming no
16 obstructions. So just any area -- surface area above
17 grade.

18 And so that number we think is consistent
19 with the 10^{-2} value of $P_2 \times P_3$ and shows that that's
20 reasonable for the orientation of the dual units and
21 the gross geometry of the turbine generators for those
22 structures.

23 Any other questions on this action item?

24 MEMBER STETKAR: I would assume that you
25 will fold that into your eventual turbine missile

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1 analysis. But I don't want to assume anything. I
2 would hope that you would fold it into it just to make
3 it a plant-specific analysis.

4 MR. CHAPPELL: Right. Certainly the value
5 of 10^{-2} --

6 MEMBER STETKAR: This is a confidence-
7 builder.

8 MR. CHAPPELL: Okay.

9 MEMBER STETKAR: This is a confidence-
10 builder.

11 MR. CHAPPELL: Okay. And the last item
12 for discussion is addressing a departure -- STP
13 Departure 10.2-2 dealing with the main turbine. This
14 is the FATT and Charpy V-notch values.

15 This Departure was the subject of one of
16 the departures that was a subject of an audit that was
17 conducted in 2009. And the conclusion that the STP 3
18 and 4 COLA in a Departures report was is that this is
19 a no-prior approval. We did the analysis according
20 Section VIII.B.5 of Appendix A, Part 52. And this
21 process was the subject of the audit.

22 Now on the next slide I have a summary of
23 an engineering document that was reviewed in this
24 audit specific to this Departure. And we have brought
25 that documentation with us.

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1 But just to summarize these items, the
2 low-pressure rotor design is a forged monobloc design.
3 And this is a not so recent industry development to
4 improve those components.

5 And the lower stresses are associated with
6 an alloy steel ASTM code that's used in the
7 fabrication. It has greater corrosion resistance.
8 And again, it's an approach consistent with industry
9 practices.

10 And then there are reports that show that
11 the rotor design and material properties -- and this
12 is somewhat tied back to the previous discussion -- is
13 that the overspeed conditions based on this design are
14 improved resistance to overspeed conditions or
15 overspeed conditions that would cause a missile
16 generation.

17 And that's an outline of that report. So
18 as I said, we do have that available that you can look
19 through.

20 MEMBER ARMIJO: I'd certainly like to do
21 that because the thing that got to me was the fracture
22 toughness of this forged monobloc is quite a bit lower
23 than that of the conventional -- the old rotors. And
24 I didn't know whether it was because of the materials
25 that you chose or because of the size and the

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1 complexity and the fabrication procedures to do the
2 integral large forging.

3 And fundamentally, I just think if you can
4 you should achieve the highest fracture toughness in
5 this materials because ultimately if there's anything
6 deficient in an analysis or an environment, that
7 fracture toughness is your protection against serious
8 accident.

9 So the question I had was why can't you
10 achieve the fracture toughness properties that were
11 achievable in the past.

12 MR. DALEY: This is Tom Daley. I'm
13 mechanical engineering supervisor for STP 3 and 4.

14 You alluded to it in your question in that
15 these forgings are huge.

16 MEMBER ARMIJO: I know that. Yes.

17 MR. DALEY: Ingots are 500 tons. I'm only
18 aware that the only place where they can fabricate
19 this is in Japan Steelworks.

20 So because the size of these ingots,
21 you'll get differing material properties throughout
22 the size. And you can see from our application that
23 the wheel area -- the outside areas -- we do meet the
24 fracture toughness and FAT temperatures that are
25 indicated in the SRP. But when you get to the inner

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1 portion of the rotor is where we've got the lower
2 fracture toughness and the --

3 MEMBER ARMIJO: Is it because you can't
4 prove that the properties deep inside this forging are
5 as good? Or is it because are the fracture toughness
6 properties --

7 MR. DALEY: Well, you can prove it because
8 they used the counter-bore for these forgings because
9 at the center --

10 MEMBER ARMIJO: You could take out a
11 sample.

12 MR. DALEY: Yes. They have the sample.
13 But because of the process that was previously used,
14 you had to get rid of that material because you didn't
15 know where it was at. But for example, our rotors are
16 not going to be center-bored because the processes
17 have improved so that you have a better appreciation
18 for what those materials are.

19 So again, you do know what the materials
20 are. And material differences are because of the size
21 of the rotor that you're dealing with.

22 MEMBER ARMIJO: Okay. So you may have
23 much better fracture toughness properties than you're
24 advertising here. You just can't prove it.

25 MR. DALEY: Yes. We're actually saying

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1 that -- I think in our application we said that the
2 FAT would be a -40 --

3 MEMBER ARMIJO: +40.

4 MR. DALEY: -- 40 degrees. We can meet
5 the ASTM standard which is 30 degrees. We're
6 confident we can do that.

7 MEMBER BLEY: Isn't the advantage you
8 don't have the same crack initiation.

9 MEMBER ARMIJO: Yes.

10 MEMBER BLEY: It's a big deal.

11 MEMBER ARMIJO: It's a superior design.

12 MEMBER BLEY: So far I'm not aware of any
13 of these having --

14 MEMBER ARMIJO: No. Believe me, I think
15 the monobloc technology is the right way to go. I'm
16 just wondering why you couldn't have both the design
17 advantage as well as -- and maintain the fracture
18 toughness that we used to have. And my --

19 MR. DALEY: As I mentioned, in the wheel
20 area, we are achieving that level of fracture
21 toughness. It's just that the inner portion of the
22 ingot -- the inner rotor area -- we don't get the
23 same.

24 MEMBER ARMIJO: So the time temperature,
25 cooling --

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1 MR. DALEY: That's correct.

2 MEMBER ARMIJO: -- all of that stuff is --

3 MR. DALEY: That's correct. And really I
4 think with the monobloc design, no key way, no shrunk-
5 on disks, it is an improvement. And with the material
6 we're using, it does offer better corrosion
7 resistance. And that's where we've seen the problems
8 is on the stress prototype and so on.

9 MEMBER ARMIJO: Okay. If you have your
10 documentation, I'd just like to take a look at it.

11 MR. HEAD: Well, Mr. Chairman, it is
12 proprietary. But we're more than willing just to have
13 a break-out briefing if --

14 CHAIR ABDEL-KHALIK: I think that would be
15 worthwhile.

16 MEMBER ARMIJO: Yes, it's educational for
17 me. Because I think I understand what's going on.
18 But --

19 MR. DALEY: I can show you pictorially
20 what we're talking about.

21 MEMBER ARMIJO: Okay.

22 CHAIR ABDEL-KHALIK: So tell me if you
23 would, what would the 40 degree F and 45 foot-pounds
24 values pertain to versus the 0 degree F and 60 foot-
25 pounds specified in the SRD criteria?

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1 MR. DALEY: Well, if you get your ingot
2 and you're going to machine the wheel portions out, if
3 you looked at the material furthest out in the
4 wheel area, the 0 and 60 foot-pounds would be that
5 material. The material at the center of the rotor
6 would have the lower --

7 CHAIR ABDEL-KHALIK: But nowhere in your
8 application would you say that anywhere in this rotor
9 would you meet the 0 degree and 60 foot-pound
10 criteria.

11 MR. DALEY: I think we do say it.

12 CHAIR ABDEL-KHALIK: You do?

13 MR. DALEY: Yes. I think in the latest
14 revision of the FSAR, we actually say the wheel. And
15 it's a little confusing because you say there's no
16 really wheel any more.

17 CHAIR ABDEL-KHALIK: Right.

18 MR. DALEY: It's the wheel area. And we
19 say that that does exhibit the 60 foot-pounds and the
20 0 degree. We say the rotor, which again it's all one
21 integral part --

22 CHAIR ABDEL-KHALIK: Right.

23 MEMBER SHACK: The rotor area.

24 MR. DALEY: -- area has the lower material
25 properties.

1 CHAIR ABDEL-KHALIK: Okay. So --

2 MR. DALEY: And I do have a picture that
3 shows that a little bit more clearly.

4 CHAIR ABDEL-KHALIK: Yes.

5 MEMBER ARMIJO: Maybe in a break-out,
6 we'll take a look at that.

7 MR. DALEY: All right. Thanks.

8 MR. HEAD: Then the acceptable way of --

9 MEMBER ARMIJO: What?

10 MR. HEAD: -- we'll do that in a break-
11 out?

12 CHAIR ABDEL-KHALIK: Sure.

13 MEMBER ARMIJO: Sure. I'll be available.

14 MR. HEAD: Okay. Coley?

15 MR. CHAPPELL: In summary, COL items, we
16 have address those. Certainly we've had some
17 discussion on at least a couple of those.

18 We have responded to all of the items, and
19 we included in our interests the discussion here just
20 some of the ones that are wrapped up are reviews.

21 Open items, results of that are that the
22 items were closed or confirmatory. We have a number
23 of changes as were alluded that will be included in
24 the FSAR and in other parts of the COLA in the
25 upcoming revision later this year.

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1 The action items, we've gone through all
2 these actions items. I think we have a number of
3 follow-ups to several of those. So we'll capture
4 those and address those a little bit later.

5 CHAIR ABDEL-KHALIK: Okay. Are there any
6 additional questions to the Applicant on Chapter 10?

7 (No audible response.)

8 CHAIR ABDEL-KHALIK: Okay. All right.
9 Thank you.

10 MR. HEAD: Thank you.

11 CHAIR ABDEL-KHALIK: We'll move on to the
12 staff's presentation on Chapter 10.

13 MR. TAI: Good morning. My name is Tom
14 Tai. I'm the PM for Chapter 10.

15 When I came before you in June for Chapter
16 10 Phase 2, we had a couple of open items. One of
17 them is on the overspeed system and the other one is
18 on the con safety water system -- Departure to cause
19 effect, Tier I.

20 And I have with me Angelo who will talk
21 about the condensate water system, and Devender next
22 to Angelo and Dinesh to talk overspeed. And we also
23 have a couple of actions that we want to close out
24 with the ACRS today.

25 This is the team that we have. And Tim

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1 Steingass is our component lead reviewer reviewer.
2 And he'll be joining us when the subject comes up on
3 the temperature issues.

4 These are open items and actions. And
5 I'll pass onto Devender and Dinesh to talk about
6 these.

7 MR. REDDY: Good morning, Chairman Dr.
8 Said and Members of the Committee.

9 My name is Devender Reddy. I'm from the
10 Balance of Plant Branch, in that Office. And I'm the
11 lead reviewer for the turbine system, not the turbine
12 rotor. And here we are going to present how to close
13 this open item that we had from our previous ACRS
14 meeting last year in the month of June.

15 As you know, South Texas had a plant-
16 specific departure from standard design of ABWR. And
17 we had an open item during the meeting last time -- a
18 staff meeting we had in June. Also we had additional
19 comments from this submitting last year. Particularly
20 regarding the operational insights from NUREG-1275
21 Volume 12.

22 So basically the staff focused on the
23 redundancy and the diversity factors of the control
24 system, overspeed control systems. And also, we
25 focused on the subsystem which is from the turbine

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1 trip lock to the fluid laser wire. And the second
2 part actually came from your Committee through the
3 comments.

4 Do you want to go to the next slide?

5 As you all know that South Texas in the
6 primary mechanical, they substituted with other
7 electrical overspeed system. And the staff's concern
8 was with the redundancy and the diversity of this
9 primary electrical system.

10 And also the concern was actually how the
11 nominal speed, primary speed and the emergency
12 electrical overspeed, all three of them are
13 electricals and how they satisfied the design GDC
14 criteria to achieve the redundancy of the diversity
15 factors.

16 Next slide, please.

17 So as a result of the concern, the staff
18 issued a series of RAIs. We received the RAI
19 responses along with the FSAR mark-up which STP
20 submitted. And based on the RAI responses as well as
21 the FSAR mark-up, we performed the evaluation and
22 then the findings that we saw in the responses were --
23 next slide, please -- as you already discussed with
24 Applicant, speed sensors, hardware software, firmware,
25 tripallogic signals -- next -- cabinets, these are

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1 overspeed systems predicated on the primary and the
2 emergency are located in the same cabinet because that
3 question came from your Committee last time.

4 Also the power sources, do they have the
5 redundant power sources? And also when you compare
6 the nominal overspeed and the individual speed,
7 control systems from the nominal emergency, are they
8 isolated and independent a feature tha this is the SRP
9 criteria.

10 And in conclusion, we evaluated all these
11 factors and determined that they satisfied NRC
12 regulations -- particularly GDC-4 and the SRP guidance
13 in Section 10.2. And we determined that we resolved
14 the issue and we concluded that this open item is
15 closed unless you have further comments.

16 And if you have any questions, address to
17 Dinesh, you know, he's from I&C.

18 MR. TANEJA: Good morning. John, your
19 question earlier about the failure mode. The way, you
20 know, we understood the design. It's a classic TMR
21 architecture, the triple modular architecture. And we
22 had a meeting with the Applicant in February. And
23 this was a presentation of their meeting to us back
24 then when we were trying to understand the design.

25 In the classic TMR architecture, they have

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1 everything triplicated in that one. So the typical
2 architecture really relies on using three inputs and
3 then having three processing modules. And they use a
4 median select of a concept where a median select
5 signal is used by all three of the controllers to make
6 a determination of what the median speed is. And then
7 they compare it to the setpoints.

8 MEMBER STETKAR: That's for the normal
9 control, for example.

10 MR. TANEJA: Then and a similar concept is
11 used for the overspeed protection.

12 MEMBER STETKAR: That's not the way I read
13 it. The way I read it is the median select is used
14 for the normal speed control. It's a pretty standard
15 turbine control logic.

16 MR. TANEJA: Right.

17 MEMBER STETKAR: It was not my
18 understanding that there was any voting regarding
19 quality of the speed signal for the protection, that
20 it was strictly a two out of three.

21 MR. TANEJA: Let me show this figure.
22 Maybe this might show --

23 CHAIR ABDEL-KHALIK: I'm not sure this is
24 an appropriate way to conduct our business. If you
25 have a slide to show, leave a copy of it and show it

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1 on the screen.

2 MR. TANEJA: Okay. All right.

3 MEMBER STETKAR: I think, Dinesh, my
4 questions to the Applicant kind of get to the point of
5 what happens if a speed signal -- two out of three
6 speed signals go to zero speed is basically what I was
7 looking for.

8 MR. TANEJA: Okay. Well, like I said, our
9 understanding was that this was a TMR architecture.
10 So they can clarify that one.

11 MEMBER STETKAR: It certainly is for the
12 control part of it.

13 MR. TANEJA: Yes. And the overspeed
14 part..

15 MEMBER BROWN: I agree with John.

16 MEMBER STETKAR: Not clear to me on that.

17 MEMBER BROWN: The way I read the RAI and
18 the other information, it is a sensor, a sensor and a
19 sensor and a controller, a controller and a
20 controller. It's two out of three trips, and bang --

21 MEMBER STETKAR: Because three speed
22 signals often treat them differently over the control
23 part --

24 MEMBER BROWN: As opposed to a tree
25 control mode. Obviously for the control mode, you

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1 have to do something with three signals and determine
2 what you're going to do with them.

3 MR. REDDY: All three speed sensors --
4 Charlie? All three speed sensors go into all three of
5 the controllers. Okay. They have three controllers.

6 MEMBER BROWN: On the overspeed as well as
7 the normal --

8 MR. REDDY: All of them.

9 MEMBER STETKAR: Primary.

10 MR. REDDY: Okay. Let's talk about
11 primary overspeed. Right?

12 In the primary overspeed, there are three
13 passive pickups. So all three sensor signals go to
14 three separate controllers. Okay? All three inputs
15 go to each -- it's not like one and the one
16 controller. Each controller receives three inputs
17 from each. Okay? That input is used as a median
18 select to determine what your operating speed is and
19 compare to the setpoints and generates a trip signal,
20 right?

21 Then there is a two out of three --

22 MEMBER STETKAR: Dinesh, can I stop you
23 there?

24 Mike, is that true -- by the primary
25 overspeed trip?

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1 MR. MURRAY: This is Mike Murray. I need
2 to look at the diagram again that Dinesh is looking at
3 before I answer that.

4 MEMBER BROWN: He used the term control
5 again also. And that's why I say just look at the
6 primary overspeed trip system, not the control --

7 MR. TANEJA: I am talking about the
8 primary overspeed.

9 This is what -- when we investigated it,
10 this was my understanding. And I'm just explaining
11 how I understood their design to be. Maybe I'm not --

12 MR. MURRAY: I would like for us to take
13 a look at the diagram again and then --

14 CHAIR ABDEL-KHALIK: So why don't we just
15 let the Applicant clarify --

16 MEMBER STETKAR: Because I'm certainly
17 getting a much different impression from the
18 statements that are being made this morning compared
19 to what I read in the RAI responses. I thought I
20 understood the way it worked. And apparently I don't.

21 CHAIR ABDEL-KHALIK: We have a follow-up
22 action item for the Applicant to clarify this point.
23 And rather than sort of trying to add further
24 confusion to the issue, maybe we ought to wait until
25 they respond.

1 MEMBER STETKAR: One just simple thing,
2 and this is nontechnical and it's part of the theme of
3 one should be technically accurate in one's reports.
4 There is a sentence that I will read verbatim, but I
5 will give you the reference first. It's in Section
6 10.2.4 of the SER which is a long section. It's under
7 STP Departure 10.2-3. That sentence in the SER says,
8 "The normal speed control unit utilizes three speed
9 signals, and the loss of any one signal initiates a
10 turbine trip via the emergency trip system."

11 I think we're all agreed that that's not
12 true. So in the sense of technical accuracy in the
13 SER, you ought to at least get the logic right.

14 MR. REDDY: What page?

15 MEMBER STETKAR: It's actually page number
16 from my copy of the -- I gave you the reference. It's
17 10-10, I believe -- 10-10. It's Section 10.2.4 under
18 the STP Departure 10.2-3. It was in the previous
19 version of the SER, but I don't make editorial
20 comments. I figured you'd catch that in the final
21 one. But apparently not.

22 MR. TANEJA: We picked that up, I believe.
23 I remember catching that error.

24 MEMBER STETKAR: Not in the version of
25 what was construed as final that we had since

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1 received.

2 MR. TANEJA: Right. Thank you. We'll
3 make sure that --

4 CHAIR ABDEL-KHALIK: Okay. Please
5 continue.

6 MR. REDDY: Well, unless you have any
7 questions, I think about the turbine system
8 presentation --

9 CHAIR ABDEL-KHALIK: We may come back to
10 you after we hear from the Applicant.

11 MR. REDDY: Sure.

12 CHAIR ABDEL-KHALIK: Thank you.

13 MR. REDDY: And actually I consider this
14 printing of the clarification from Applicant and
15 follow-up on this issue what was discussed. I
16 consider this open item as closed.

17 CHAIR ABDEL-KHALIK: Let's just wait to
18 hear. Thank you.

19 MR. TAI: Let's move onto the next open
20 item on the condensate feedwater system.

21 MR. STUBBS: Okay. Good morning. My name
22 is Angelo Stubbs. I'm with the Balance of Plant
23 Branch, and I performed review for the condensate
24 feedwater system.

25 When the Chapter 10 SER with open items

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1 was issued last year, we identified one open item in
2 Section 10.4.7. That open item was associated with a
3 Tier 2 Departure that was taken in the COL application
4 that altered the condensate feedwater system.

5 Basically what it did was it departed from
6 what was in the DCD and changed the system arrangement
7 as the number of some components when they added a
8 traditional feedwater pump so that they could have one
9 on standby. I think there's some feedwater drainpump
10 changes. But they also changed it by fitting the
11 system with a condensate booster pump so that they
12 could operate portions of the system at lower
13 pressure.

14 In reviewing that change, we looked at the
15 Tier 1 information, and there appeared to be an
16 inconsistency between the Tier 2 information and the
17 Tier 1 information which they had incorporated from
18 the DCD by reference.

19 The first slide here pretty much
20 summarizes what the issue was when we came and talked
21 to you last time at the ACRS meeting. And basically
22 like I just said, we had a Tier 2 change that changed
23 system configuration, and the Tier 1 information still
24 reflected the DCD information which didn't incorporate
25 condensate feedwater system that utilizes a booster

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1 pump. So the open item was for them to resolve that
2 discrepancy between Tier 1 and Tier 2.

3 In resolution, they provided us with a
4 revision to one of our earlier RAIs. And in that
5 revision what they did was they revised the figure
6 that the design description pointed to -- or the ITAAC
7 pointed to design description figure to confirm that
8 the system in the ITAAC was the system that we were
9 approving in the design. And they updated that
10 figure, and now the figure shows the condensate pump
11 -- the relative location of the condensate pump. And
12 it includes the condensate, moves the pump into Tier
13 1 figure.

14 So based on that, we reviewed that. We
15 looked at the Tier 2 information and with the revised
16 RAI response, we now feel like this issue is resolved
17 and the open item can be closed.

18 CHAIR ABDEL-KHALIK: Okay.

19 MR. STUBBS: So any questions?

20 (No audible response.)

21 CHAIR ABDEL-KHALIK: Please proceed.

22 MR. TAI: We are on the action item 43 and
23 ACRS asked the material. And Tim Steingass of CIB
24 will address this.

25 MR. STEINGASS: Good morning, Mr.

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1 Chairman, ACRS Committee.

2 My name is Tim Steingass. I'm the
3 technical reviewer for this departure.

4 Under STP Departure 10.2-2, the Applicant
5 selected a monobloc turbine rotor design from the
6 original design, of course, which is shrunk-on discs.
7 And the Departure lists values of 40 and 45 -- 40
8 degrees up and 45 foot-pounds for a fractured
9 appearance transition temperature and Charpy V-notch
10 energy at the minimum operating temperature
11 respectively which are different from the SRP
12 acceptance criteria.

13 Next slide, please.

14 MEMBER ARMIJO: Tim, maybe this could
15 clarify the thing for me. Are the SRP criteria the
16 minimum properties of the forging? Or are they the
17 average properties, or what?

18 MR. STEINGASS: Okay. The values are
19 established at the outer periphery -- period --
20 minimum out of periphery, whereas these folks
21 submitted their values from the center of the forging.

22 Next slide.

23 Because this is a Tier 2 departure, we
24 went to South Texas to take a look at how these folks
25 determined that they did not need to submit this

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1 departure for our approval. I was a member of the
2 audit team. And we performed an audit there. And
3 I've got to say Texas is probably the flattest place
4 on earth.

5 But other than that, we reviewed their
6 validation package and determined that the Tier 2
7 change proposed by the Applicant does not meet any of
8 the criteria identified in Part 52, Appendix A,
9 Section VIII.B.5 that would result in them notifying
10 us of this change and asking for our approval. So the
11 safety evaluation was written not to evaluate the
12 departure but to evaluate our actions and our
13 compliance and their compliance with the regulations.

14 However, just because they don't have to
15 submit it to us for assessment, we assessed it anyway.
16 And the reason for that is we really don't care what
17 the regulations say when it has to do with a safety-
18 significant issue. If it has to do with a safety-
19 significant issue, we will make an issue out of it.

20 So in looking at this issue, the pure
21 matter of fact is that this is low level. It's not a
22 safety-related issue. This is an inherently good
23 choice. It's a conservative choice. It's a good
24 design.

25 And also if Mr. Armijo, I invite you to

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1 look at -- in break-out session, I have a really slick
2 report here from EPRI that was generated back in 1988
3 that shows that the fractured toughness values -- the
4 FAT values -- from the center of these large monobloc
5 forgings correlate quite well and favorably with the
6 outer periphery fracture appearance transition
7 temperature and Charpy V-notch temperatures.

8 MEMBER ARMIJO: Well, my question is do
9 you have the best properties where you need them --
10 say at the surface -- and that you measure them in a
11 place where you don't need them -- let's say in the
12 center of a forging where time, temperature, cooling
13 rates, all that sort of stuff -- can affect the
14 properties. And I hate to see us lose fracture
15 toughness when we've just gained by the use of a
16 superior design -- the monobloc design. So it's like
17 you're spinning your wheels.

18 But my feeling was that you actually were
19 under-reporting or not claiming fracture toughness
20 that you probably do have at the surface where you
21 need it. But I didn't understand that. So I wanted
22 to make sure that I did.

23 MR. STEINGASS: All right. I understand
24 your concern. But way back then, the concern by the
25 people that manufactured shrunk-on rotors say whoa --

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1 MEMBER ARMIJO: I used to work for one of
2 those guys. So I understand.

3 (LAUGHTER.)

4 MR. STEINGASS: Well, at Susquehanna, we
5 had a shrunk-down rotor too. And we had one go.

6 The concern was that the center was the
7 area that displayed the least favorable properties.
8 So from South Texas' perspective, if they're reporting
9 where the least favorable properties are and the
10 values are still significantly below room temperature
11 so that when you start up the turbine there's not any
12 brittle fracture, it's a good thing. So from our
13 perspective, that was an issue that made this a low-
14 threshold item.

15 Finally, it's not a safety-related
16 component. And the Applicant still has to --
17 regardless of what their fracture appearance
18 transition temperature and Charpy V-notch values are,
19 they still have to meet the turbine missile
20 probability calculations because the two are
21 technically intertwined.

22 Next slide.

23 So in conclusion, we consider it a
24 monobloc design and apparently superior. The
25 Applicant complies with the regulations. It's not a

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1 safety-related component. It's not a safety-
2 significant issue. And our safety evaluation reflects
3 exactly what we did and what they did with respect to
4 this issue.

5 CHAIR ABDEL-KHALIK: Earlier you said that
6 the 0 degree F and 60 foot-pounds criteria pertain to
7 the outer periphery. Is that explicitly specified in
8 the SRP?

9 MR. STEINGASS: Greg?

10 MR. MAKAR: This is Greg Makar also from
11 Component Integrity.

12 I don't have the direct answer to your
13 question in my head. The SRP when it was written was
14 written when there were only the shrunk-on wheels, and
15 there were no values from the center line. So that
16 was the place to get the samples.

17 So whether or not it says that directly in
18 the SRP, I'm sorry I don't know at this moment. But
19 that's where those values come from. Those were the
20 only available ones on the outside.

21 CHAIR ABDEL-KHALIK: Okay. Do you think
22 the SRP should be modified to explicitly state where
23 these values are obtained?

24 MR. STEINGASS: It would make things
25 simpler, and we are in a process of looking at a lot

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1 of our SRPs. So this was definitely one of the
2 candidates for that. Yes, sir.

3 MEMBER ARMIJO: Yes. As technology
4 changes, the SRP should adjust.

5 MR. STEINGASS: Absolutely.

6 CHAIR ABDEL-KHALIK: All right. Thank
7 you.

8 MR. STEINGASS: Thank you.

9 MR. TONACCI: Mr. Chairman?

10 CHAIR ABDEL-KHALIK: Yes, sir?

11 MR. TONACCI: If I could engage on one
12 comment that was made earlier, I just can't leave it
13 lie.

14 I think the statement was said we don't
15 care what the regulation says. If there's a safety
16 concern --

17 CHAIR ABDEL-KHALIK: Well, we took it in
18 jest. I do know that we do care.

19 MR. TONACCI: I -- the regulation, but in
20 fact Tim is doing his job to ensure himself of safety
21 and the rest of the regulations required.

22 CHAIR ABDEL-KHALIK: Yes, sir. Thank you.

23 MR. STEINGASS: It's still on the record.

24 (LAUGHTER.)

25 MR. TAI: The last Action Item is 45 and

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1 I think all our reviewers left. But this is the one
2 that Denish referred to back in February and we met on
3 the overspeed sensors that NINA proposed to add an
4 ITAAC. And we'll leave that as a confirmed item in
5 the RAI.

6 And that concludes our presentation.

7 CHAIR ABDEL-KHALIK: Thank you. Are there
8 any additional questions for the staff on Chapter 10?

9 (No audible response.)

10 CHAIR ABDEL-KHALIK: Okay. Thank you.

11 Are you ready to make any additional
12 presentation or should you wait until later?

13 MR. HEAD: They're still deliberating.

14 CHAIR ABDEL-KHALIK: All right. Okay.

15 Well, at this time, we'll take a 15-minute
16 break. We will reconvene at 10:15.

17 (Whereupon, at 9:58 a.m., off the record
18 until 10:16 a.m.)

19 CHAIR ABDEL-KHALIK: We're back in
20 session.

21 At this time we'll go to Chapter 14. And
22 the Applicant will present.

23 MR. HEAD: Thank you. We are here today
24 to present Chapter 14.

25 Our agenda is a standard agenda. And we

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1 have presented this chapter in some detail before and
2 are with us today.

3 Don Bailey who was with us before and
4 Steve Cashell and Coley Chappell. All of us have
5 briefed the ACRS before.

6 So Steve, I'm going to go ahead and turn
7 it over to you.

8 MR. CASHELL: There's an overview for
9 Chapter 14 as we went through the last time. Chapter
10 14 consists of a lot of standard and all the site-
11 specific test descriptions. ITAAC is part of Chapter
12 14, but it's actually addressed in each of the
13 individual FSAR chapters. All the COL information
14 items have been addressed, and they included testing
15 requirements and when we would provide certain
16 information -- test procedures and the like -- and
17 then also the creation of the start-up administrative
18 manual. And the start-up administrative manual
19 actually contained the bulk of the COL license
20 information items.

21 And finally we discussed this substantial
22 ABWR start-up experience that Toshiba has and the
23 start-up experience we have and the relationship
24 between the two -- what we've done with Units 1 and 2
25 and how we'll integrate all this experience.

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1 Here's just a quick chart of what Toshiba
2 has done for three recent plants. Toshiba was the
3 lead on two of the plants and then participated in the
4 others.

5 Some items of interest that we have, we
6 had a revision to the site-specific reactor service
7 water and ultimate heat sink ITAAC. We received RAIs
8 from Chapter 14 and from Chapter 9. We responded
9 differently to these RAIs. And the long and short of
10 it is we inappropriately referenced two figures that
11 we shouldn't have done. We should have stayed with
12 Tier 1. And the ITAAC were a little ambiguous.

13 And the ITAAC implied that there were
14 alarms for ultimate heat sink temperature and level on
15 the remote shutdown panel. And there are no such
16 alarms. So what we did, we submitted a response to
17 both RAIs that cleared up on both Chapters 14 and 9.
18 And we clarified the tables in Part 9 ITAAC to
19 describe what we did have there and what we were going
20 to test.

21 And finally the other item of interest is
22 the flow-induced vibration. When we met the last
23 time, that was considered an open item and it was
24 going to remain open in this chapter until it was
25 closed. It's all going to be addressed now in Chapter

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1 3. So it doesn't hold this chapter up anymore.

2 And that's all I had for Chapter 14.

3 CHAIR ABDEL-KHALIK: Any comments on
4 Chapter 14?

5 MEMBER STETKAR: Yes, I had one question.
6 I'll ask you and perhaps the staff also.

7 The staff asked a question about how the
8 start-up administrative manual captures structures,
9 systems and components that are not safety-related but
10 important to safety because the initial test program
11 should cover those items also. And the response
12 points to examples of systems and equipment that are
13 typically included in the reliability assurance
14 program. But the examples emphasize only fire
15 protection system, environmental qualification of
16 electrical equipment, alternate rod injection system
17 for ATWS and nonsafe purelated station black-out
18 sources. And those are explicit criteria that the
19 regulations make you look at. It does not make any
20 mention of structured systems and components that
21 might be on the reliability assurance program list
22 solely because of results from the PRA or the expert
23 panels that evaluate those items.

24 And I guess my question was how do we have
25 assurance that those items that are important to

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1 safety identified solely because of the PRA or the
2 expert panel evaluations are also folded into the
3 initial test program because I didn't see any mention
4 or any implication from the response to the RAI or the
5 staff's conclusion on that response that would give me
6 that assurance.

7 MR. CASHELL: I don't have any off-hand
8 response.

9 MEMBER STETKAR: The response was -- I'm
10 not sure I read the complete response because I read
11 the staff's summary of the response. And it does say
12 examples, but the examples are clearly within the
13 constraints of those issues that fire protection
14 black-out and ATWS basically that are delineated as
15 things you absolutely have to look at.

16 MR. CASHELL: And I'm sure this is going
17 to be driven by the PRA into the program.

18 MEMBER STETKAR: I'd just like to see some
19 assurance that that loop is going to be closed because
20 the population of those non-safety systems important
21 to safety could be influenced pretty strongly. We've
22 had discussions about the reliability assurance
23 program. And I'm not going to re-open that whole
24 discussion. I just was looking for assurance that
25 indeed the feedback from those PRA or expert panel

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1 evaluations generated issues with feedback into that
2 program and it wouldn't be lost.

3 MR. HEAD: Yes, we understand your
4 question. And I don't see the answer in front of us
5 right now. So we'll take this as a follow-up item
6 that we'll get back either today or maybe we have to
7 actually add the clarification.

8 MEMBER STETKAR: Yes. I don't whether
9 it's just words or whether there's other issues let's
10 say going on.

11 CHAIR ABDEL-KHALIK: Now will the staff
12 discuss open item 14.03.02.09 related to the diesel
13 generator fuel oil storage vaults?

14 MS. JOSEPH: We don't have a specific
15 slide on that. The staff is here who formed that
16 review if you have any specific questions on that. We
17 briefly discussed it I believe at the whole committee
18 meeting. But they are here if there are specific
19 questions.

20 CHAIR ABDEL-KHALIK: Okay. We'll see.
21 Thank you.

22 All right. Any additional questions to
23 the Applicant on Chapter 14?

24 (No audible response.)

25 CHAIR ABDEL-KHALIK: Thank you. Are you

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1 going to go to the follow-up items or do you want to
2 wait until the staff presents their Chapter 14?

3 MR. HEAD: I think we have a follow-up
4 item and then discuss some of the stuff from earlier
5 this morning. We would do that during the next
6 session.

7 CHAIR ABDEL-KHALIK: That's fine. So
8 we'll move on to the staff's presentation of Chapter
9 14.

10 MEMBER STETKAR: By the way, Said, while
11 the staff is getting set up here, I did want to -- but
12 in my ranting, I forgot. I did want to compliment the
13 staff on their RAI follow-ups on the turbine systems.
14 I thought the RAIs were really good. They looked for
15 common failures that we'd asked. And I thought they
16 did a really good job on that. And I didn't have the
17 opportunity to do it because I was too busy ranting
18 about other things. But I wanted to make sure that's
19 on the record.

20 CHAIR ABDEL-KHALIK: Yes. Thank you.

21 MS. JOSEPH: We're ready. Good morning.
22 My name is Stacy Joseph, and I am the project manager
23 for Chapter 14 Verification Plans. And I'll be giving
24 the presentation today, but I'm joined by several of
25 the technical reviewers who contributed to this

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1 chapter who are here to answer questions if you have
2 them.

3 Today I'm going to discuss the closure of
4 three open items in Section 14.2 that remain since our
5 last meeting that we discussed the Phase 2 SER with
6 Open Items. I'm also going to describe a couple of
7 departures that were new to Chapter 14 in Revision 4
8 of the FSAR. And finally, we'll be discussing the
9 late-breaking revision of the ITAAC for ultimate heat
10 sink and reactor service water.

11 The first two open items as discussed by
12 the Applicant had to do with the flow-induced
13 vibration program. The staff requested that test
14 abstracts be updated to reflect the FIV program. The
15 Applicant revised Section 14.2 to basically point to
16 the review being done in Chapter 3 and the Chapter 3
17 reference items. Unit 3 is going to be the prototype
18 plant, and we'll be tested in accordance with the DCD
19 and the Chapter 3 reference documents and the unit
20 thoroughly tested in accordance with the Reg Guide
21 1.20 and the Chapter 3 reference documents.

22 The FIV program is still under review in
23 Chapter 3 and will be evaluated in the Chapter 3 SER
24 and presented at that time with the rest of the
25 chapter.

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1 CHAIR ABDEL-KHALIK: Okay.

2 MS. JOSEPH: For the final open item in
3 Chapter 14.2, the staff proposed four license
4 conditions for Section 14.2 initial test programs.

5 The first license condition requires that
6 the licensee provide the pre-op and start-up test
7 specification six months prior to the start of initial
8 test programs and also approved procedures are also to
9 be made available to the NRC 60 days before their
10 intended use.

11 The next license condition requires that
12 the licensee review and evaluate test results at the
13 completion of pre-critical and criticality testing,
14 low-power testing and at-power testing. The licensee
15 is also required to notify NRO completion of each
16 phase of testing.

17 Next the licensee is required to submit a
18 schedule to NRO 12 months after COL issuance that
19 supports NRO planning for inspections of the test
20 program. The schedule is to be updated every six
21 months until one year before fuel loading where
22 they're to update the schedule every month.

23 The final condition is that any change
24 made to the initial test program described in Chapter
25 14 in accordance with 50.59 or Part 52, Appendix A,

1 Section VIII, that those need to be reported in
2 accordance with the requirements.

3 These four license conditions are
4 consistent with the generic license conditions being
5 developed by the staff to be applied to all design
6 centers.

7 There were two new departures in 14.22 and
8 Revision 4 of the FSAR. The first had to do with Tier
9 I 2.4-4, removing the criterion to have the temporary
10 strainer for the RHR and high-pressure core flooders 50
11 percent blocked. We discussed that general departure
12 in Chapter 6 last time. This is consistent with the
13 upgrade for the suction strainers to the guidance of
14 Reg Guide 1.8.2, Revision 3.

15 And the next departure has to do with the
16 turbine design 10.2-1. And the test abstracts for the
17 main turbine control system and main turbine auxiliary
18 pre-op tests were revised to reflect the correct
19 description of the intercept valves and intercept stop
20 valves.

21 Section 14.3 and 14.3S of the staff's SER
22 is largely a plainer document to where the ITAAC and
23 also Tier 1 changes were reviewed just keeping track
24 to make sure that all the important Tier 1 changes are
25 reviewed.

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1 There were two new departures -- Tier 1
2 departures that were talked about in 14.3. The first
3 one is Tier 1 1.1-1 which modified the definition of
4 as-built to clarify that the determination of the
5 physical properties of an as-built SSC may be based on
6 measurements and section tests that take place before
7 installation in cases where it's technically
8 justifiable, provided that subsequent fabrication
9 handling, installation, testing don't alter any of the
10 properties that were previously tested. This
11 definition is in accordance with the most recent
12 revision of the NEI document that's endorsed by the
13 staff.

14 The second new Tier 1 departure as
15 discussed earlier is the ITAAC for the RHR high-
16 pressure core flooders, and RCIC were revised to
17 remove the 50 percent strainer -- 50 percent flooding
18 as discussed in Chapter 6.

19 Any new ITAAC that's ongoing review in
20 Chapter 3, as this is a pointer document, Tier 1 will
21 be updated to point to any new Tier 1 changes if
22 there's -- Chapter 14 will be updated to point to
23 where the review of any Tier 1 changes occur in later
24 revisions of the SER. So there won't be any more
25 technical discussion added to this chapter, but more

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1 to make sure that the other chapters contain lists.

2 And finally as discussed by the Applicant,
3 during their presentation, NINA submitted a revised
4 RAI response last week that revised the ITAAC for the
5 ultimate heat sink and reactor service water to
6 clarify their requirements for displays, alarms and
7 controls for the main control room and remove shutdown
8 system. The staff looked at those proposed changes
9 and determined that the intent of the interface
10 requirements of Tier 1 for these two systems are still
11 met and that the new ITAAC are inspectable.

12 The staff will need to revise the SER to
13 reflect the change as the current discussion in the
14 SER for 14.3.5-2 reflects deletion of item 5 of the
15 reactor service water ITAAC. This item probably has
16 been added back in and clarified. So we will have to
17 update our SER. But the overall conclusion about the
18 ITAAC is unchanged.

19 And with that, any specific questions?

20 CHAIR ABDEL-KHALIK: Would you just remind
21 us how open item 14.03.02-09 was closed?

22 MS. JOSEPH: I think David or -- there is
23 a new ITAAC added for that.

24 MR. JENG: This is David Jeng on the
25 staff. I'm the reviewer of the 14.3.2.

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1 The RAI 14.3.2-9 relates to the ITAAC on
2 the diesel generator fuel oil storage vault.
3 Originally, the Applicant indicated they are going to
4 do an ITAAC to ensure they comply with the design
5 basis loads. The description was very brief and
6 inadequate. So the staff requested them to provide a
7 more cost-defined description including the loads
8 items that were to be verified, the process, the
9 procedure and acceptance criteria which pertained to
10 problems on this item. And the Applicant provided all
11 the detailed information requested by the staff.

12 So the ITAAC that is presented right now
13 is adequate in detail and complete. And based on that
14 revised submittal and the response to the RAI, the
15 staff finds it's adequate including the dispute
16 reconsideration reconciliation requirements. So the
17 discussion in the staff SER addresses all this
18 additional information provided and the staff accepted
19 that issue and closed that RAI.

20 CHAIR ABDEL-KHALIK: Thank you. Are there
21 any questions for the staff on Chapter 14?

22 MEMBER SHACK: Just on the flow-induced
23 vibrations in Chapter 3, does that include the whole
24 secondary system also? As I read Chapter 3, it looks
25 focused on primary system.

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1 MS. JOSEPH: Tom, I'm not familiar exactly
2 with what's going on in Chapter 3. But our PM for
3 Chapter 3 is here.

4 MR. TAI: I'm Tom Tai. I'm the PM for
5 Chapter 3.

6 Right now, the flow-induced vibrations
7 talk about basically the reactor internals -- the
8 dryers --

9 MEMBER SHACK: Right.

10 MR. TAI: -- and all the internal
11 components.

12 MEMBER SHACK: But how about the secondary
13 system?

14 MR. TAI: No. Right now, the program does
15 not talk about that.

16 MEMBER SHACK: The ASME code covers that.
17 That's covered under a different place. I mean, I
18 assume you still look at that before start-up.

19 MR. TAI: I have to doublecheck. I'm not
20 too sure if it is in 3.9.6 or what. But I'll take an
21 action to verify that. Because right now a lot of our
22 effort -- a big part of our effort is to complete
23 Chapter 3 is on the seismic design and flow-induced
24 vibrations for reactor internals. But we'll verify it
25 whether it's -- where is it being addressed.

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1 MEMBER SHACK: Okay. Thank you.

2 CHAIR ABDEL-KHALIK: Any additional
3 questions on Chapter 14?

4 (No audible response.)

5 CHAIR ABDEL-KHALIK: Okay. Thank you.

6 MS. JOSEPH: Thank you.

7 CHAIR ABDEL-KHALIK: I guess just to make
8 sure we don't lose it, a follow-up action item that
9 they will confirm that the flow-induced vibration
10 discussion regarding the secondary system will also be
11 included in Chapter 3.

12 MS. BANERJEE: Got it. Thank you.

13 CHAIR ABDEL-KHALIK: Okay.

14 MR. HEAD: I guess we'd like to have a
15 presentation on Action Item 68 which the question was
16 raised recently in the Subcommittee.

17 We'd also like to use the opportunity
18 while we're up here to provide some feedback on some
19 of the follow-up items that were identified earlier in
20 the day.

21 CHAIR ABDEL-KHALIK: Yes.

22 MR. HEAD: And then I'd like to go ahead
23 and just make sure after that that we'll go through
24 the list and make sure that we've captured everything
25 for the day at that point.

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1 So I'm going to go and ask Mike to brief
2 us on -- let's go ahead and go through the follow-up
3 items that we had earlier today. Is that all right,
4 Mike?

5 MR. MURRAY: No, let's wait on Dinesh. I
6 think we ought to just go get Dinesh.

7 MR. HEAD: Okay. Well, let's dive into
8 this one. Okay?

9 MR. MURRAY: Okay. So I'll lead the
10 discussion -- Mike Murray again -- and with me is --
11 I'll let Warren and Ed introduce themselves. They'll
12 be supporting them if there are any questions from
13 Westinghouse.

14 MR. ODESS-GILLETT: This is Warren Odess-
15 Gillett. I'm with Westinghouse Nuclear Automation
16 Licensing.

17 MR. BROWN: Ed Brown. I'm with
18 Westinghouse Electric. I'm a technical advisor to the
19 Safety Systems and Monitoring Department.

20 MR. MURRAY: So let's go on to slide 4 if
21 you would, Coley.

22 On slide 4, the question we had -- the
23 open item out of Chapter 7 -- was provide
24 documentation on the qualification testing for Common
25 Q platform at 70 percent loading. And when we talked

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1 through this, we'll use the term AC160 because that is
2 the original platform the Common Q is built upon and
3 a lot of the qualification testing is done there.

4 So from a generic response, we'll go
5 through in more detail some of the supporting
6 information for these responses. There is information
7 that demonstrates that there has been testing at loads
8 greater than 70 percent. And we'll talk about those
9 results a little bit farther in it.

10 Then the generic qualification testing, we
11 demonstrated or it demonstrates that on a time
12 response test done with normal loading as well as
13 greater than 70 percent loading, minimal impact on the
14 performance of the system.

15 Also we want to point out that in this
16 one, we'll talk about when looking at the design of
17 the system -- the software -- there are a couple of
18 important factors that play into this. And one is the
19 constraints and the design requirements and how that's
20 managed. And it's managed within Westinghouse who is
21 the sole provider of the platform, and is Westinghouse
22 in this case. But there's a software program manual
23 that describes the processes of software development.

24 And then there's application restrictions.
25 And what the application restrictions importance of

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1 them is that they're very specific requirements for
2 software as well as hardware that must be exercised to
3 maintain the qualification. And that's a process
4 that's done by the design engineers as well as through
5 the verification and validation process that's
6 independently verified that all those requirements are
7 met.

8 MEMBER BLEY: Could I maybe ask you to do
9 it? If not, I'll mention it to the rest of the
10 Committee.

11 I had a chance yesterday to look through
12 the applications -- the restrictions document with
13 these folks. And it took me a while to understand
14 what they were doing. But let me say what I heard and
15 see if you guys agree with it.

16 Westinghouse has this document that tells
17 them how to develop their systems. And part of what
18 it does it says -- well, this package comes from the
19 vendor with subroutines that do all kinds of things.
20 And part of what they do here is they restrict their
21 application software not to cause the subroutines that
22 especially would challenge the determinism and other
23 things they care about. And although those things are
24 sitting there through this administrative control,
25 they try to make sure that their software never cause

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1 those things. So I didn't know they did that.

2 MEMBER BROWN: Let me clarify one point on
3 that.

4 This is a commercially-used platform. So
5 it's got a lot of functionality that's incorporated in
6 terms of different routines that other people may use.
7 But their application restrictions literally go
8 through and say don't do this, don't use, you can't
9 use these functions because that's the way our thing
10 is qualified without this.

11 So I just wanted to make it clear that it
12 was a commercial, wide-band platform that is now being
13 constrained into a somewhat narrow niche and
14 restricted in what functionality and algorithms and
15 things they can use. So I just wanted to --

16 MEMBER BLEY: And I guess the other thing
17 for the subcommittee that made sense to me when I
18 heard them talking about this was that because of
19 that, they do get trouble reports from that broader
20 industry that does include some of these things. But
21 it also includes things that their system is using.
22 So they get a much broader base of operating
23 experience than they'd have if it was just from their
24 own systems.

25 MEMBER BROWN: According to Ed Brown, the

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1 Westinghouse rep, I guess I think you told me you all
2 monitor these things on a quarterly basis?

3 MR. BROWN: Yes. We collect them and
4 immediately do a screening to make sure there's no
5 immediate Part 21-type evaluation.

6 MEMBER BROWN: And that's part of their
7 responsibility.

8 MR. BROWN: Right. And on a quarterly
9 basis, we do a detailed review to decide which things
10 to be included into the next software revision.

11 MR. MURRAY: Okay. Next slide, please.

12 So this is a little bit more specific
13 about the testing of the baseload software releases.
14 Each time there's a new release, it goes under a set
15 of testing. The test that is performed, it'd have to
16 be agreed to by the Appendix B holder as well as the
17 vendor that does the software.

18 Processor loads monitored, the results are
19 recorded. In this particular type test, it indicated
20 that the software performed properly at greater than
21 70 percent load and one example at least of one
22 monitor that was running that had 80 percent loading
23 and still didn't have any performance issues.

24 MEMBER BROWN: I want to make one
25 observation that they made to me when I was going

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1 through this yesterday also. This part of the -- say
2 they demonstrate -- this fundamentally demonstrated
3 the process of what handled these loads doesn't crash.
4 It has nothing to do with time response or whatever it
5 is. It just says hey, it processes, continues to
6 operate, does not crash, you don't get the Blue Screen
7 of Death -- just to use an analogy to current
8 commercial computer systems, at least Windows anyway.
9 So that's this one. That's separable from the other
10 concept of how does it respond in a deterministic time
11 response manner which they'll demonstrate later.

12 MR. MURRAY: Next slide. And this is what
13 Mr. Brown was just discussing is the time response
14 version of it.

15 For the qualification of the Common Q with
16 a Swedish reactor, there was test data that Warren was
17 able to show us that there were two configurations set
18 up normal load which would be a configuration of less
19 than 70 percent which is what you would expect to
20 always design the system at.

21 And then a secondary test which was at 75
22 percent loading. In other words, put enough
23 applications in it to make it run at 75 percent
24 loading and looked at the difference of the time
25 response.

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1 We'll flash up the two tables, let you
2 have enough time to do a quick analysis of it. The
3 bottom line on this is we studied it for a few minutes
4 and were able to extract some information out of it.
5 And there's 100 tests there. And what it shows is
6 this is the normal -- this would be the less than 75
7 percent -- is that you get expected ranges of
8 differences of what you would expect to see with where
9 it starts the sampling at within it. And I think the
10 min-max on this was like 24 milliseconds from min to
11 max is what we had seen when we looked at this.

12 And when you're ready, I'll move onto the
13 next slide.

14 PARTICIPANT: They already did.

15 MR. MURRAY: Okay. So the next slide
16 shows a very similar set of data for 100 tests at 75
17 percent loading of the processor. What it indicates
18 also is from the min-max was relatively the same. I
19 think 28 milliseconds if you take the low and the high
20 out of it. It's very consistent results. So it
21 indicates that you're getting a consistent expected
22 results out of it with the increased load of 75
23 percent.

24 CHAIR ABDEL-KHALIK: How are you reading
25 this to give you a min-max difference of 28

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1 milliseconds?

2 MR. MURRAY: I was looking at the -- maybe
3 I picked the wrong ones.

4 MR. ODESS-GILLET: The lowest number of
5 the 100 and the highest number of the 100 samples.

6 MEMBER BLEY: Each of the 100 tests is
7 testing the same function.

8 MR. MURRAY: That's right.

9 CHAIR ABDEL-KHALIK: I understand. But I
10 don't see --

11 MR. MURRAY: I picked 45 as the low.
12 Maybe I'm -- no, there's a 44. I'm sorry. But it's
13 relatively close.

14 MEMBER BLEY: Tell them which tests.

15 MR. MURRAY: Okay. The test number would
16 be -- oh, I found that -- 46, for example, is a 45.
17 Test 25 is 73.

18 CHAIR ABDEL-KHALIK: And 25 is --

19 MR. MURRAY: And 25 is 73. And I just
20 took that from it.

21 But if you look, there's also the average
22 of each set of data. And there's the average overall.

23 CHAIR ABDEL-KHALIK: Okay.

24 MR. MURRAY: It asked the same thing I did
25 on the table before.

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1 CHAIR ABDEL-KHALIK: Thanks.

2 MR. MURRAY: Okay. Next slide.

3 So in summary, the test records
4 demonstrate that it continued to perform at greater
5 than 70 percent loads, and the response time it's
6 minimally impacted on and is greater than 70 percent.

7 Software as we discussed, the V&V programs
8 verify that the restrictions or application
9 restrictions were properly applied. And that's shows
10 independence of that. It requires independency for
11 that verification.

12 MEMBER ARMIJO: What is a response time
13 that would be unsatisfactory?

14 MR. MURRAY: It's all in accordance with
15 the design of the system and the applications that
16 it's to required. And then that's back to the safety
17 analysis. So for saying that on here, I don't believe
18 I could come up with one there.

19 MEMBER ARMIJO: Is it something that can
20 be --

21 MEMBER BROWN: No. You take this
22 information in terms of the performance of the
23 platform. And then you say okay, how many of these do
24 I have in a row? And you take your inputs, your
25 signal conditioning -- these items -- and then your

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1 response of the drivers, and you get a composite time
2 response. This is just a part of it. Then that time
3 response has to obviously meet the overall transient
4 accident analysis for the various casualties that we
5 consider.

6 So this sets the baseline. So you look at
7 the -- no, it's consistent with what I did in my other
8 programs. You'd get a performance basis for this
9 part. And then you look at the tails and say okay,
10 you have boundary conditions on the tails. And that's
11 what you test for. And then you come in an overall
12 number based on a combination of all the parts -- all
13 the components in the series.

14 So this could be 200 milliseconds. And if
15 it met the action in it, that's fine.

16 MR. MURRAY: Yes. And as we discussed in
17 the Appendix that we added to the FSAR in the last
18 briefing of Chapter 7, in there it describes an
19 analysis of just that, that says what we expect the
20 results would be and the time response of that. And
21 that is a deliverable out of the detailed design.

22 CHAIR ABDEL-KHALIK: Okay. From what I
23 heard from Dennis and Charlie, we should consider this
24 Action Item closed?

25 MEMBER BROWN: I'm happy with it. I'm

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1 satisfied with it. I think John is also. I'll let
2 John speak for himself.

3 CHAIR ABDEL-KHALIK: Okay. Thank you.

4 MR. HEAD: Okay. Then Mark, we want to go
5 into the morning follow-up.

6 MR. MURRAY: Yes, we want to clear up one
7 thing. And I think there's some pictures --

8 MS. BANERJEE: Let me distribute it.

9 MR. MURRAY: Yes, please. And Dinesh, do
10 you want to sit with me?

11 And there was some confusion about -- we
12 discussed a lot about the emergency trip and how it
13 was done triple with triplicate redundant-type
14 processes. And Dinesh pointed back out to me what I
15 had -- didn't bring that slide show with me nor
16 remembered at the time.

17 But the primary as the picture will show
18 is done in a very similar fashion. Again, it's still
19 diverse in the particular modules that do it. But
20 each module senses the speed sensor -- all three
21 speed sensors.

22 Now, Mr. Stetkar, I'm going to try to
23 answer your question in general terms and see if
24 you're less acceptable.

25 But in a triple-redundant type

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1 configuration with each module looking at each
2 sensors' input, it has the ability to do cross-
3 checking quality checks on the signals because it's
4 looking at all three sensors. And if one is out of
5 range, then it will detect that out of range either
6 loss of electrical or loss of signal out of the range
7 of the other two. And it would then flag it within
8 itself.

9 Now if any one of the modules see two
10 sensors bad in this, which then it would see it and
11 then it would do a trip.

12 Yes, sir?

13 MEMBER BLEY: And by that from what you
14 just said before, these are two out of three high.
15 These are two out of three out of range.

16 MR. MURRAY: It could be out of range. It
17 could be loss of electrical signal --

18 MEMBER BLEY: Which would essentially out
19 of range.

20 MR. MURRAY: -- out of range. That's
21 correct.

22 MEMBER BLEY: The base of your mechanisms
23 sounds like it's out of range.

24 MR. MURRAY: Out of range. If I were to
25 cut the wires to one of the sensors coming up, either

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1 inactive or passive or active or passive -- either or.
2 And if I cut the wires, then that particular sensor
3 would show --

4 MEMBER BLEY: What's the middle one out of
5 range?

6 MR. MURRAY: Pardon? See I don't know the
7 ranges -- those specifics. What was your question
8 again to make sure I understand it?

9 MEMBER BLEY: We know what the high end
10 overspeed is. When is it out of range low?

11 MR. MURRAY: I don't know where the window
12 will be set between the three overspeed sensors.

13 MEMBER BLEY: That may not be set.

14 MR. MURRAY: But that would be in the
15 detailed design. You'd set a window of what's your
16 expected quality ranges of the sensors.

17 MEMBER BLEY: So to John's question,
18 failure is the signal is either too high or too low?

19 MR. MURRAY: Too low. Too high, too low,
20 loss power.

21 MEMBER STETKAR: Too high would have to be
22 interpreted as --

23 MR. MURRAY: As out of range.

24 MEMBER STETKAR: -- it's a legitimate --

25 MEMBER BROWN: Why would one? I mean, it

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1 depends on what you select is too high. I mean, if
2 one of them is reading -- if your maximum range is say
3 150 percent -- just to pick a number -- and one of
4 them is reading 120 and the other two are reading 105,
5 does that mean it's out of range and I would have
6 selected that to say that's one of the trips in each
7 of the three channels? It's not out of range. I
8 mean, this is --

9 MR. MURRAY: It would -- wait for the trip
10 set system. It's a fuzzy way for the trip set
11 systems.

12 MEMBER STETKAR: It would sensed as a bad
13 sensor.

14 MEMBER BROWN: Well, how do you know it's
15 not right?

16 MR. CHAPPELL: These are typically
17 selected as you go through and develop how these
18 signals are processed. And so if you have three
19 signals and you can compare those signals, you may
20 look at two of them, you may look at a third and come
21 up with an averaging signal or come up with a median
22 signal. And you'll do a signal comparison, and you'll
23 have a setpoint that'll kick it out.

24 The speed it senses varies over a wide
25 range. It's not just 1800 rpm all the time.

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1 MR. MURRAY: The exact algorithm that's
2 being used in these modules I can't tell you what that
3 is.

4 MEMBER BROWN: Okay.

5 MR. MURRAY: But a lot of the
6 clarification is that it's triple vented as well which
7 was not very clear in the discussion earlier until
8 Dinesh had pointed that out.

9 MEMBER BROWN: Well, you've made it clear
10 that all three go to all --

11 MR. MURRAY: Right.

12 MEMBER BROWN: -- as Dinesh mentioned in
13 your earlier conversation. It's just that and for a
14 normal control function, I couldn't pony up to the
15 fact that you use a median or a summed of all those
16 you lose one. But I don't know what your median is
17 because now you've got a high one and a low one.
18 There's no median anymore. So again, it's algorithm-
19 dependent.

20 But for an overspeed trip function, unless
21 the thing slams to 200 percent or 150 or it goes to
22 zero, after that it's difficult to envision. I mean,
23 120 percent where the other ones are at 105 would not
24 indicate necessarily a bad sensor. I don't know how
25 narrow you make that.

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1 MR. SWANNER: This is Craig Swanner.

2 If it went to 120 percent, that's over the
3 trip value. That can --

4 MEMBER BROWN: Yes, that's a good point.
5 I would have put a -- well, that's not what he said,
6 I don't think.

7 MR. MURRAY: If it sensed above -- we said
8 that earlier -- if it sensed above setpoint, it will
9 provide the trip. So the failure high on it would be
10 -- it's a good point that Craig made -- it would be
11 sensed as above it.

12 Now, one sensor above setpoint does not
13 trip the turbine. But it does put that particular --

14 MEMBER BROWN: Relative to your picture.

15 MR. MURRAY: That's right.

16 MEMBER STETKAR: If it was only one out of
17 the three and the normal control system, the normal
18 control system would just basically ignore that.

19 MR. MURRAY: If one was greater than
20 setpoint, it would be seen by all three monitors as a
21 trip, then it wouldn't make the two out of three logic
22 to actually trip the turbine.

23 MEMBER BROWN: Or the normal.

24 MR. MURRAY: Or the normal.

25 MEMBER STETKAR: Normal control function

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1 on the control function because I think --

2 MR. MURRAY: Okay. We're normal -- okay.
3 It would ignore that. It would ignore that as well.

4 MEMBER STETKAR: It really would ignore
5 it. It wouldn't adapt to it.

6 MEMBER BROWN: If one -- I'm slow. Please
7 forgive me. But if I had one sensor that went -- I've
8 got three sensors going to each one. So if one sensor
9 goes to say 115 percent, that's over the trip value.

10 MR. MURRAY: That's correct.

11 MEMBER BROWN: I would have one trip
12 signal on each of the three control.

13 MR. MURRAY: Correct.

14 MEMBER BROWN: Now does that make the
15 controller trip?

16 MR. MURRAY: No.

17 MEMBER BROWN: You'd have to take two of
18 them in each controller and then you do two out of
19 three.

20 MR. MURRAY: Two out of three on two
21 controllers.

22 MEMBER BROWN: Of the three controllers?

23 MR. MURRAY: That's correct.

24 MR. TANEJA: My experience -- I did a
25 similar implementation in engineering when I designed

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1 this thing. In a classical TMR application, actually
2 the three inputs are validated and interpreted as one
3 value of say, 1800 rpm, right?

4 MEMBER BROWN: For control or trip
5 functions?

6 MR. TANEJA: For control and trip
7 functions.

8 Because the way the TMR works typically --
9 the architecture -- the algorithm is used.

10 I'm talking from my experience. I don't
11 know how this is being done.

12 But a typical TMR architecture, you get
13 three inputs coming into one controller. Okay? That
14 three inputs are derived into one value based on an
15 algorithm. It's comparing the three inputs relative
16 to each other. And if one is obviously out of range
17 as compared with the other two, then that is assumed
18 to be a bad signal nor an alarm.

19 MEMBER BROWN: It deviates from the other
20 two.

21 MR. TANEJA: It deviates from the other
22 two. All right?

23 Then those two become the drivers. And
24 then you take the average of the two as the input
25 speed signal. Okay? And then it's compared to the

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1 setpoint and generate a trip based on that.

2 So two out of three logic is again done
3 after it receives three inputs from each controller
4 separately. Right? This is my experience how that
5 was done in a TMR application -- a classic way of
6 doing it.

7 So the algorithm that does validation of
8 those input signals -- see, you have a common speed
9 wheel, right? And so it's got the tooth on it. They
10 should all be reading exactly the same thing. And
11 your magnetic pickup, passive -- all it's looking at
12 is a bunch of teeth spinning out in front of it.

13 Ideally speaking, I mean, these are
14 installed and whatever 120 degrees apart or whatever
15 on that wheel. We should be seeing exactly the same
16 thing, right? So one of them is obviously out. The
17 algorithm looks at that relativeness and also looks at
18 like low or under-range conditions. You could set it
19 to whatever value. You want to set it to 122 percent.
20 And you put that algorithm into logic or into the
21 circuit when the speed is above say 400 rpm or 200
22 rpm.

23 I don't know what the turning gear --
24 usually the rotors are set on a turning gear, right?
25 They're always rotating. So they're always running at

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1 some low rpm all the time. So you say that if it's
2 below, I would consider that to be a failure.

3 So you can set these things to whatever
4 your machine is designed to do. So it's all relative
5 to how your machine is designed.

6 MEMBER BROWN: You could do that with a
7 turning gear because it's a fixed motor drive that's
8 just rotating it. So it's always going to run it --
9 I mean, it's an ac motor.

10 MR. TANEJA: Right.

11 MEMBER BROWN: It's going to run it
12 whatever the --

13 MR. TANEJA: Whatever the rpm -- gearing
14 is on that one.

15 MEMBER BROWN: I'm not arguing with that.

16 MR. TANEJA: So if the speed was below
17 that, then you could say that if I'm not detecting
18 minimum of that speed and if it's below that on that
19 input, then it says that's a bad input.

20 MR. MURRAY: I guess what we would like to
21 say also from an Applicant perspective is we don't
22 know what that algorithm is just now, John. And as we
23 continue with the detailed design there and apply it
24 to the monitors, we would set those algorithms to
25 sense those sensor failures.

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1 In general terms -- I'm trying to answer
2 your question as best I can.

3 MEMBER STETKAR: This certainly helps me.

4 MEMBER BROWN: The text in the RAIs was
5 not particularly crisp, as well as RAI-8, whatever
6 that --

7 MEMBER STETKAR: You can read RAI-8 -- the
8 words -- and get a different impression about how the
9 trip logic treats the signals compared to the normal
10 control.

11 MR. MURRAY: The normal control and the
12 normal emergency.

13 CHAIR ABDEL-KHALIK: So John, as far as
14 knowing what the meaning of the word fail is, has that
15 clarified it?

16 MEMBER STETKAR: I know functionally more
17 that it's out of whatever that not yet defined
18 tolerance range is is failed.

19 MEMBER BLEY: Fail is not going to be
20 defined before --

21 MEMBER STETKAR: The pure definition of
22 fail in a crisp, analytical form is not defined yet
23 and hasn't been.

24 MEMBER BROWN: And won't be.

25 MEMBER STETKAR: And won't be. And I'm

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1 okay with that.

2 CHAIR ABDEL-KHALIK: Okay. So we will
3 close this question.

4 MR. HEAD: Okay. I basically had two on
5 the failure of the detector. And then if the active
6 fails, I think -- did we cover --

7 MEMBER BROWN: No, it is the primary
8 sensors. There's another in RAI- whatever that 10.2-
9 8. Item 15 says loss of two of the active and normal
10 and emergency sensors. The primary sensors are left
11 out totally --

12 MR. HEAD: Right.

13 MEMBER BROWN: -- in all the discussion.
14 I couldn't find anything.

15 MR. HEAD: And I was going to suggest that
16 one is --

17 MEMBER BROWN: That's open.

18 MR. HEAD: -- is open because I think
19 we've agreed that we want to enhance the -- on that
20 RAI. So I'll leave one open that we'll go back and
21 look at the RAI and consider enhancements to that
22 description.

23 MEMBER STETKAR: But in the context of the
24 system design, failure of those things would mean the
25 same thing as if the signal is out of the preset

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1 tolerances.

2 MR. MURRAY: Either way. It will be using
3 algorithms. They won't be the same because they're
4 diverse and they're software designs. But you'll have
5 to set a basis for them. Philosophically you'll use
6 the same technologies and type of algorithms similar
7 to the tech failures on it.

8 So the action is to enhance the RAI
9 response and the information to provide clarification
10 that failure of a sensor -- how it's treated in the
11 primary. I looked for that as well and couldn't find
12 it.

13 MR. HEAD: And then from that discussion
14 th is morning, we had a follow-up item on the
15 internals of the trip device that I believe you and
16 Tom discussed.

17 MEMBER STETKAR: Yes.

18 MR. HEAD: Has that been --

19 MEMBER STETKAR: I think so. I think it's
20 worth mentioning. I think I know how it works. But
21 it's worthwhile for the remainder of the Subcommittee
22 to perhaps hear that.

23 MR. HEAD: Tom, could you describe the --

24 MR. DALEY: This is Tom Daley.

25 A mercy trip system consists of two

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1 solenoid trip valves. And those two solenoid trip
2 valves are fairly simple solenoids. They're not
3 complex with diverse flow paths in them.

4 They're both located in the front standard
5 of the turbine. So they're located there to keep it
6 away from any missile hazards, pipe whip, high-energy
7 sort of lines that might affect them.

8 MEMBER STETKAR: To kind of answer my
9 question, where I got confused was you made the
10 statement this morning that they're both installed in
11 the emergency trip device manifold or something like
12 that which led me to question the electromechanical
13 hydraulic configuration, because I've seen some pretty
14 innovative designs. Let's call them that.

15 And I think you told me that these are --
16 what you just said and just make sure that I
17 understand -- these are just two basic solenoid
18 operated valves each of which has two coils and a
19 single spool. We must de-energize both coils for the
20 spool to move so that you drain the fluid. Is that
21 right?

22 MR. DALEY: That's correct. And they're
23 both the same. And they are therefore subject to a
24 common-mode failure. And in fact, in our failure
25 modes and effect analysis, they represent the one,

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1 two, three, four and five levels of potential that we
2 have to deal with.

3 I also pointed out that that's for the
4 emergency and the primary trip systems. There's also
5 the normal PLU function that uses the fast-acting
6 solenoid valve to dump the fluid directly from the
7 valves themselves. And that's located in the EHC
8 system itself which is in a different location.

9 MEMBER STETKAR: And that would be
10 enacted. I think if the power-load imbalance is
11 greater than 40 percent, that --

12 MR. DALEY: Forty percent. That's
13 correct. And that's sets up staff if we have a trip
14 anywhere, it'll keep it less than 120 percent -- the
15 design overspeed.

16 MR. HEAD: So I believe -- I'm sorry.

17 MEMBER BROWN: One other question. During
18 the break after our discussion, I was reading back
19 through 10.02-8. And on page 9 down towards the
20 bottom, the speed sensors and the valves I thought
21 were the only two shared components on the normal
22 control and emergency trip system.

23 MR. MURRAY: That speed monitor is a part
24 of the speed sensors. That's what you're discussing?

25 MEMBER BROWN: Yes, it says here the speed

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1 sensors and speed monitors are the only shared
2 components. And I had no clue what a monitor was. I
3 thought it was the controller.

4 MR. MURRAY: It converts again the pulse
5 to --

6 MEMBER BROWN: Okay. It's the signal
7 conditioning for the sensor. Okay. You can stop if
8 that's what that is.

9 MR. MURRAY: -- sends it to the control
10 and it also sends the trip signal into --

11 MEMBER BROWN: Thank you. Got it.

12 MR. HEAD: So I believe from that morning
13 condition we have the one follow-up item to enhance
14 the RAI response. And we'll look at the whole thing
15 to make sure it addresses some of what we talked about
16 today.

17 I had proposed that the follow-up item
18 regarding the trip system or the turbine probability
19 that I had proposed that it was closed. You obviously
20 want to discuss that some more. But our action will
21 be to go place in our corrective action program an
22 attachment to that follow-up item to the COL item the
23 insights that we received today. So that will happen
24 so that we're ensured that we go back and give that
25 the scrub that it needs when those reports are

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1 finished.

2 CHAIR ABDEL-KHALIK: Is there a timeline
3 for your corrective action program to respond to
4 things of this type?

5 MR. HEAD: Well, it'll be there attached
6 so that when it's built, that's available for people
7 to look at. And then when STP or NINA is ready to
8 sign off on that that they'll have that to look at to
9 make sure that these topics have been addressed. So
10 right now, it would stay open and it would have a two-
11 or three-year time frame to address -- be closed.
12 Like I say, that's the proposal on that one.

13 Then we had a follow-up item to provide
14 the report in our validation package. And we're going
15 to support that with a review this afternoon -- Sam
16 and --

17 MEMBER ARMIJO: If we close up before
18 noon, we can do it --

19 MR. HEAD: Absolutely.

20 And then we have a follow-up item with
21 respect to how is the insights from DRAP applied to
22 the start-up program and any expectations that come
23 with that.

24 MEMBER STETKAR: And my particular concern
25 was that the way I read the information, I want to

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1 just make sure that the stuff that's on DRAP that's
2 populated directly out of the PRA without regard to
3 the other sort of if I could call it deterministic
4 fire protection aspects.

5 MR. HEAD: Yes. Those are given.

6 MEMBER STETKAR: It's the other complement
7 of equipment.

8 MR. HEAD: We understand it has that.

9 MEMBER STETKAR: Yes.

10 MR. HEAD: And that was my summary of the
11 follow-up items from the report.

12 MR. TONACCI: I think -- excuse me. This
13 is Mark Tonacci.

14 I think we had one additional one that
15 came up just a moment ago about the FIV and does that
16 expand into the balance of plant.

17 CHAIR ABDEL-KHALIK: Correct.

18 MR. TONACCI: Tom perhaps could answer
19 that.

20 MR. TAI: Yes. This is Tom Tai, Chapter
21 3 again.

22 I just want to follow up on Dr. Shack's
23 questions on the flow-induced vibration. I checked
24 and it is in 3.9.6. 3.9.2. is all about reactor
25 internals. 3.9.6, we put it under the operation

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1 program because I wanted to make sure that they do
2 have a program for start-up tests and the pre-op
3 tests.

4 CHAIR ABDEL-KHALIK: Thank you.

5 MS. BANERJEE: I have one more. Dr.
6 Stetkar pointed out an inaccurate statement in the
7 Safety Evaluation Report, Section 10.2.4. Is staff
8 going to revise that?

9 CHAIR ABDEL-KHALIK: One out of three
10 versus two out of three?

11 MR. TONACCI: The answer is yes. We'll
12 look at that and make the necessary changes.

13 MR. REDDY: This is Devender Reddy. Dr.
14 Stetkar, that was a typo. Actually with regard to
15 that, we wanted a final SER.

16 CHAIR ABDEL-KHALIK: Well, that means we
17 didn't get that.

18 MEMBER STETKAR: That apparently means the
19 document that I was reading that I was told was the
20 final SER was not.

21 MR. REDDY: Apparently.

22 MEMBER STETKAR: Which is a different
23 issue but perhaps more troubling than then one versus
24 two.

25 MR. REDDY: We did correct that.

1 MR. TONACCI: We did.

2 PARTICIPANT: So we may have corrected it
3 on a draft version. But the version we sent to you
4 was the official version. If we made changes after
5 that, we'll have to come back around and either
6 represent it if it's significant or in some other way
7 get it authorized. We don't just willy-nilly make
8 changes to the SE.

9 MR. CHAPPELL: There are at least two
10 locations in the SER that make reference to a loss of
11 speed signal in one location. It makes a reference to
12 the number in each of those locations. So it's
13 possible it was corrected in one location and not the
14 other. So I can work with Steve Cashell and point
15 those sections out and make sure it's clarified.

16 CHAIR ABDEL-KHALIK: Okay.

17 MS. BANERJEE: Is it worth following?

18 CHAIR ABDEL-KHALIK: The staff will make
19 sure it's done.

20 Let's just ask the question about Action
21 Item 42 and the proposed response of essentially
22 closing this item by inputting the comments that were
23 provided today into their corrective actions program.
24 This pertains to the turbine missile analysis -- the
25 two reports that were provided.

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1 Are there any concerns about that given
2 the timing of when the final reports would actually be
3 available?

4 MEMBER STETKAR: Said, I think in our
5 advisory capacity and what we're limited to do in this
6 -- our role in this process that stops at issuance of
7 the COL, I think we've done everything that we can do.
8 We will not see the final turbine missile analyses
9 whenever they are completed. And I think we've made
10 our concerns at this point pretty clear. And it's now
11 up to the Applicant and the staff to follow up when
12 the final analysis is completed and make sure that at
13 least some of the concerns that we've raised were
14 addressed. Whether there are any other concerns at
15 that time, I mean, it's out of our hands at that
16 point.

17 CHAIR ABDEL-KHALIK: Right. Any other
18 comments regarding this specific issue?

19 (No audible response.)

20 CHAIR ABDEL-KHALIK: Okay.

21 Before we close, let's just see if there
22 are any comments from members of the public.

23 Is the phone line open?

24 MS. BANERJEE: I'll go check.

25 CHAIR ABDEL-KHALIK: Okay.

1 MR. BROWN: The phone line is open.

2 CHAIR ABDEL-KHALIK: The phone line is
3 open? Okay.

4 Are there any members of the public on the
5 bridgeline who wish to make a statement?

6 (No audible response.)

7 CHAIR ABDEL-KHALIK: If there is someone
8 on the line, if you would just sort of make some sound
9 so that we know that the line is indeed open.

10 PARTICIPANT: Yes, the line is open.

11 CHAIR ABDEL-KHALIK: All right. Thank
12 you. Okay.

13 Are there any members of the public here
14 who wish to make a statement?

15 (No audible response.)

16 CHAIR ABDEL-KHALIK: Okay.

17 MS. BANERJEE: Mr. Chairman, can I just
18 say that these two pages are going to be added to the
19 transcript. If anybody has any problem with it, let
20 me know.

21 CHAIR ABDEL-KHALIK: The copy that was
22 provided?

23 MEMBER STETKAR: We were in open session
24 here, right? Is there anything that's considered
25 proprietary on that?

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1 MR. HEAD: That was a public meeting is
2 what happened.

3 CHAIR ABDEL-KHALIK: Okay. Let me just go
4 around and see if there are any additional comments
5 that Members would like to make with regard to these
6 two chapters or the responses to the follow-up items.

7 MEMBER SHACK: No.

8 MEMBER BLEY: None for me.

9 MEMBER ARMIJO: None.

10 MEMBER RYAN: None for me.

11 CHAIR ABDEL-KHALIK: Okay.

12 MEMBER BROWN: None on that. I just want
13 to say I thought they did a good job of bringing in
14 the information on the Common Q platform. That was a
15 very thorough presentation of information yesterday.
16 At least that's my opinion.

17 PARTICIPANT: I'd second that.

18 MEMBER BROWN: So I thought that was a
19 good set-up.

20 CHAIR ABDEL-KHALIK: John?

21 MEMBER STETKAR: No. Other than to again
22 say that I really appreciate the effort that the staff
23 put into the follow-up RAIs on the turbine overspeed
24 and turbine control systems. And as critical as I was
25 of those two reports, I really do appreciate you

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1 submitting those and giving us the opportunity to kind
2 of give you feedback on them. Thanks a lot.

3 CHAIR ABDEL-KHALIK: Well again, let me
4 express our thanks to both the staff and the Applicant
5 for a through presentation. Thank you very much.

6 This meeting is adjourned.

7 (Whereupon, at 11:17 a.m., the hearing was
8 adjourned.)

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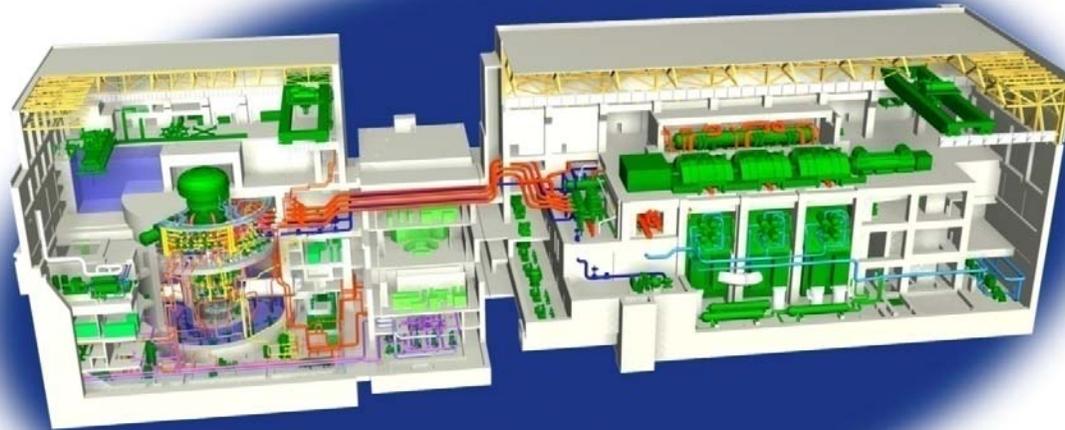
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South Texas Project Units 3 & 4 Presentation to ACRS ABWR Subcommittee Chapter 10 “Steam and Power Conversion System”



Agenda

- Introduction/Attendees
- Chapter 10 Items of Interest
- ACRS Action Items
- Chapter 10 Summary
- Conclusion

Attendees

| | |
|----------------|--|
| Scott Head | NINA Manager, Regulatory Affairs, STP 3 & 4 |
| Mike Murray | NINA I&C Manager, STP 3 & 4 |
| Tom Daley | NINA Mechanical Engineering Supervisor, STP 3 & 4 |
| Coley Chappell | NINA Licensing, STP 3 & 4 |
| Jim Agles | NINA Licensing, STP 3 & 4 |

Chapter 10

Chapter 10 was discussed at the ACRS ABWR Subcommittee meeting on June 23, 2010, summarized as follows:

- Tier 2 departures, standard and site-specific
- COL License Information Items
- Site-specific supplemental information, *e.g.*, related to the main cooling reservoir and the circulating water system, not included with the standard plant design.

Items of Interest

- Resolved RAIs not closed at the time of the previous ACRS presentation:
 - RAI related to turbine gland seal steam departure (STD DEP 10.4-1), which added a non-safety related gland steam evaporator as a clean steam supply to main turbine shaft seal glands and various turbine valve stems.
 - Revised the response to RAI 10.04.07-3 by proposing a new Tier 1 departure (STD DEP T1 2.10-1) to show the addition of a condensate booster pump on Figure 2.10.2a.

Items of Interest (cont'd)

- Since the previous ACRS meeting, RAI 10.02-1 through 10.02-8 revised responses were submitted (2/21/11) related to the turbine generator.
 - RAI 10.2-3 response describes the basis for valve closure setpoints in the Toshiba design and compares to setpoints noted in Standard Review Plan.
 - RAI 10.2-5 response describes how the power load unbalance (PLU) anticipatory trip function supplements the normal EHC system.
 - RAIs 10.02-4, -5 and -6 responses describe the adequacy of two electrical overspeed trip systems and provide additional details on redundancy and diversity in FSAR Section 10.2.2
 - Include site-specific ITAAC.
 - Addresses ACRS Action Item #45

Items of Interest (cont'd)

RAI 10.02-4 revised response added a figure to FSAR Section 10.2:

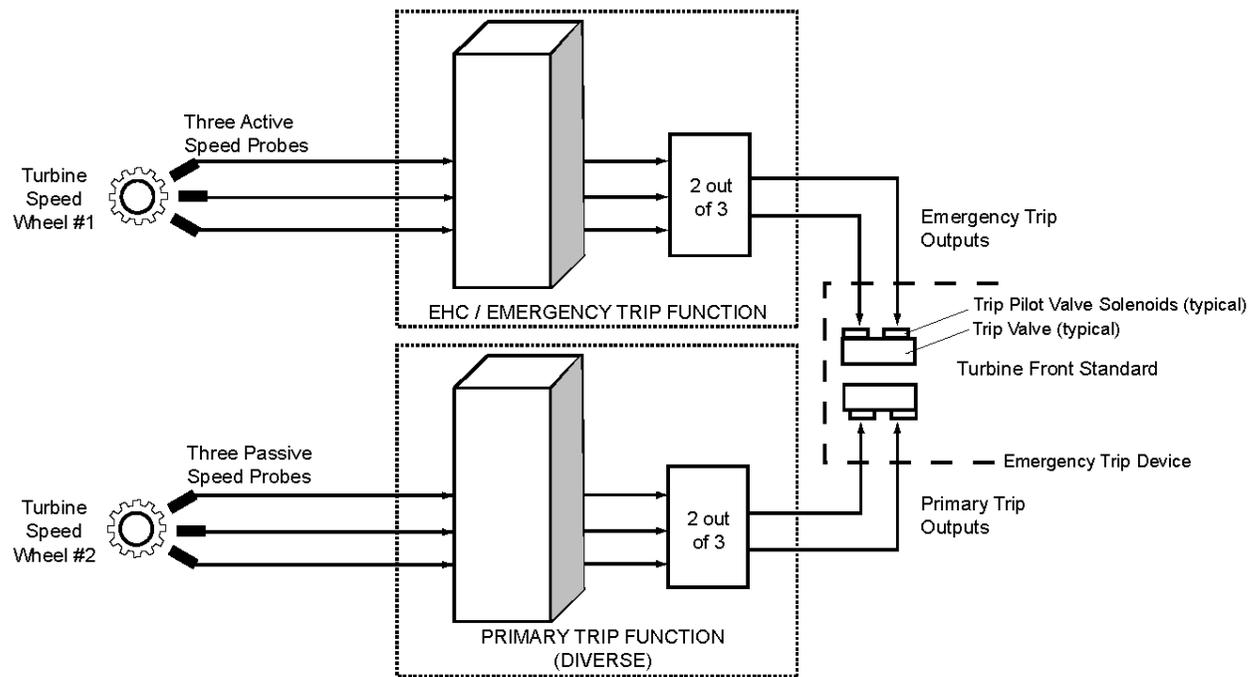


Figure 10.2-5 Turbine Overspeed Trip System Functional Diagram

Items of Interest (cont'd)

Site-specific ITAAC (RAI 10.02-6 revised response):

Design Requirement – Trip signals from the two turbine electrical overspeed protection trip functions are isolated from, and independent of, each other.

- ✓ **Acceptance Criteria** – the two electrical overspeed protection functions have diverse hardware and software/firmware that are isolated from, and independent of, each other.
- This requirement is consistent with AP1000 requirements.
- Independence and diversity between the primary and emergency electrical overspeed systems.
- This site-specific ITAAC is in addition to ABWR DCD Tier 1 ITAAC Table 2.10.7 for the main turbine system overspeed protective actions.

Items of Interest (cont'd)

Site-specific ITAAC (cont'd):

Design Requirement – Trip signals from the emergency overspeed protection trip function are separate from the control signals from the normal speed controllers.

- ✓ **Acceptance Criteria** – the emergency overspeed protection function is implemented in trip controllers that are separate from the normal speed controllers.
- The signals used to generate the emergency overspeed trip are not the same signals used for normal speed control.
- The emergency overspeed protection system is independent and diverse from the primary overspeed protection system.

Chapter 10 Summary

- All COL License Information Items have been addressed.
- All responses to RAIs have been submitted.
- All SER Open Items are closed/confirmatory.
- All related ACRS Action Items have been addressed.

Chapter 10

Questions and Comments





Presentation to the ACRS Advanced Boiling Water Reactor Subcommittee

South Texas Units 3 and 4 COL Application Review

**Advanced SER Chapter 10
“Steam and Power Conversion Systems”**

April 6, 2011

Staff Review Team

- **Project Managers**

- George Wunder, Lead PM, DNRL/BWR Projects Branch
- Tom Tai, Chapter PM, DNRL/BWR Projects Branch

- **Technical Staff**

- SBPA, Chief, John Segala
- SBPB, Chief, Samuel Lee
- SBPA, Reviewers, Devender Reddy, Angelo Stubbs
- CIB2, Chief, Michael Norato
- CIB2, Lead Reviewer, Timothy Steingass
- ICE2, Chief, Ian Jung
- ICE2, lead Reviewer, Dinesh Taneja

Ch. 10 Advanced SER Topics of Interest

| | |
|---------------------------------|---------------------------------|
| Section 10.2 Open Items | Turbine Overspeed |
| Section 10.4.7 Open Item | Condensate and Feedwater System |
| ACRS Action Items | Action Items 43 and 45 |

Section 10.2 Open Items - Main Turbine Generator System

Issue:

- In lieu of primary mechanical and back-up emergency electrical overspeed protection devices, STP proposed two electrical overspeed trip devices.
- The staff's concern was whether the two electrical overspeed protection devices have adequate diversity and redundancy features.

Section 10.2 Open Item - Main Turbine Generator System

Resolution:

- The staff issued RAIs requesting applicant to address staff's concern.
- The staff reviewed and evaluated the applicant's responses based on design features, location and installation, and operational and testing considerations of these devices.
- The applicant also provided a site-specific Tier 1 ITAAC.

Section 10.2 Open Item - Main Turbine Generator System

Resolution:

- The staff found the following diverse and redundant features between the primary and emergency trip devices:
 - ♦ Speed sensors – three passive for primary and three active for emergency
 - ♦ Hardware and software/firmware – trip logic functions for both use diverse electronic means. The primary uses separate speed wheel from the normal and emergency trip device.
 - ♦ Trip logic and signals – two-out-of-three logic is employed in both

Section 10.2 Open Item - Main Turbine Generator System

Resolution:

- Diverse and redundant features (cont.):
 - ◆ Cabinets – each trip device is installed in separate cabinet
 - ◆ Power sources - each has its own redundant power supplies
 - ◆ Control signals from the normal and emergency back-up are isolated from, and independent of, each other.

Section 10.2 Open Item - Main Turbine Generator System

Conclusion:

- The staff determined that there is adequate diversity and redundancy built between the two electrical overspeed devices under emergency and abnormal conditions, and therefore meet the intent of GDC 4 criteria and SRP guidance in this regard.

Section 10.4.7 Open Item - Condensate and Feedwater System

Issue:

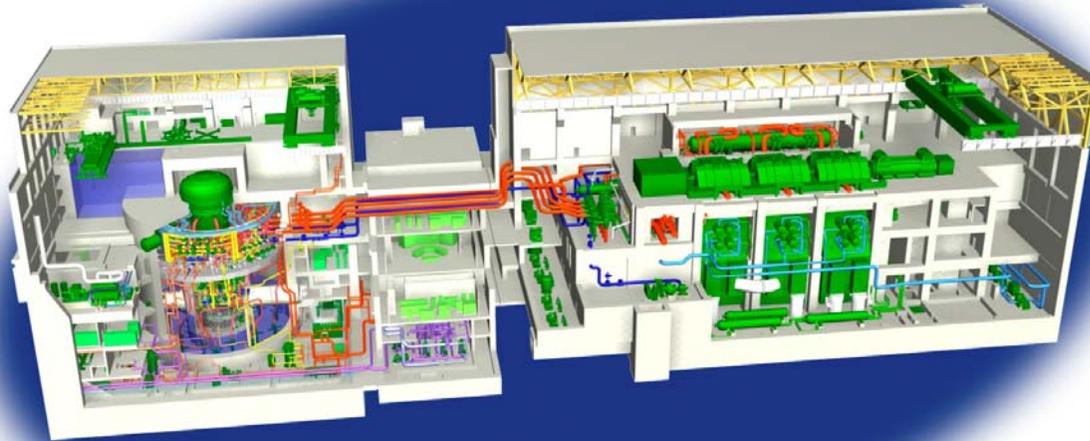
- STP COLA departs from the CFS standard design and adds new SSCs (Condensate Booster Pumps) comparable in importance to those provided in the design description, functional arrangement, and ITAAC Tier 1 design in the ABWR DCD.
- The STP COLA incorporates the associated Tier 1 section of the DCD by reference with no departures. Open Item 10.04.07-3 requested the applicant update the Tier 1 CFS design description and/or functional arrangement in Section 2.10.2 so that it is applicable to the site specific CFS design which uses both condensate and condensate booster pumps.

Section 10.4.7 Open Item - Condensate and Feedwater System

Resolution:

- The applicant proposed a new Tier 1 departure which revised Tier 1, Figure 2.10.2a.
- In the revised Figure 2.10-2a, condensate booster pumps are now included as part of the basic CFS configuration.
- The staff reviewed the proposed revisions to the Tier 1 information and found it acceptable since the information in Tier 1 is now consistent with the plant design described in Tier 2.
- Incorporation of the proposed Tier 1 change is being tracked as a confirmatory Item.

South Texas Project Units 3 & 4 Presentation to ACRS Subcommittee Chapter 14 “Initial Test Program”



Agenda

- Introduction/Attendees
- Chapter 14 Overview
- ABWR Experience
- Items of Interest
- Conclusion

Attendees

Scott Head

NINA Manager, Regulatory
Affairs, STP 3 & 4

Coley Chappell

NINA Licensing, STP 3 & 4

Tom Daley

NINA Mechanical Engineering
Supervisor, STP 3&4

Steve Cashell

NINA Licensing, STP 3 & 4

Chapter 14 Overview

- Standard and site-specific test descriptions
- ITAAC addressed in individual FSAR chapters
- All COL Information Items addressed
 - Testing Requirements
 - Startup Administrative Manual
- Substantial ABWR startup experience

Toshiba Experience in ABWR Construction and Initial Test Program (ITP)

| Plant | Rated power (MWe) | Construction period (months) | Preoperational test period (months) | Start up test period (months) | COD | ITP Lead | Nuclear Island (NI) Constructor | Turbine Island (TI) Constructor |
|----------------------------|-------------------|------------------------------|-------------------------------------|-------------------------------|-----------------|----------------|---------------------------------|---------------------------------|
| Kashiwazaki-6 (K-6) | 1356 | 51 | 10 | 11 | 1996/Nov | Toshiba | Toshiba/GE | Hitachi/GE |
| Kashiwazaki-7 (K-7) | 1356 | 51.5 | 12 | 9 | 1997/Jul | Hitachi | Hitachi/ GE | Toshiba/GE |
| Hamaoka-5 (H-5) | 1380 | 56 | 13 | 11 | 2005/Jan | Toshiba | Toshiba | Hitachi |

Items of Interest

- Revision to site-specific Reactor Service Water (RSW) and Ultimate Heat Sink (UHS) ITAAC.
- Initial RAI responses did not provide clarity
 - Inappropriately referenced Tier 2 figures
 - ITAAC were ambiguous
 - Implied alarms for UHS functions at remote shutdown panel
- Recent submittal clarified Part 9 ITAAC Table 3.0-1 (UHS) and Table 3.0-5 (RSW)

Items of Interest (cont'd)

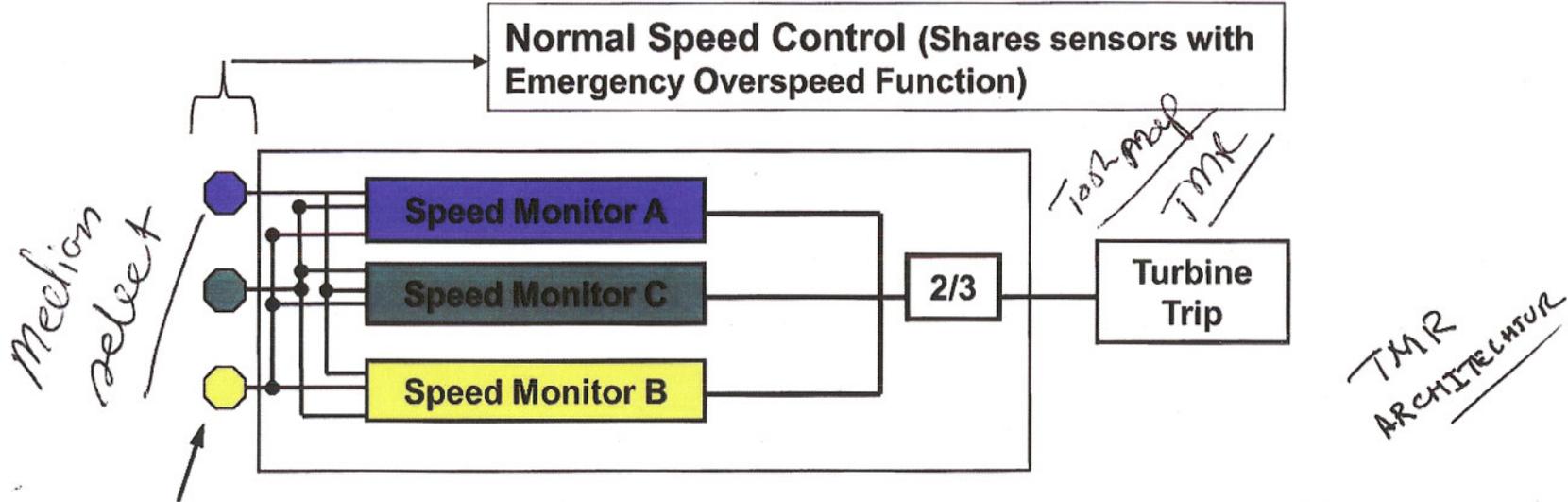
- Flow-induced vibration will be addressed in Chapter 3.

Chapter 14

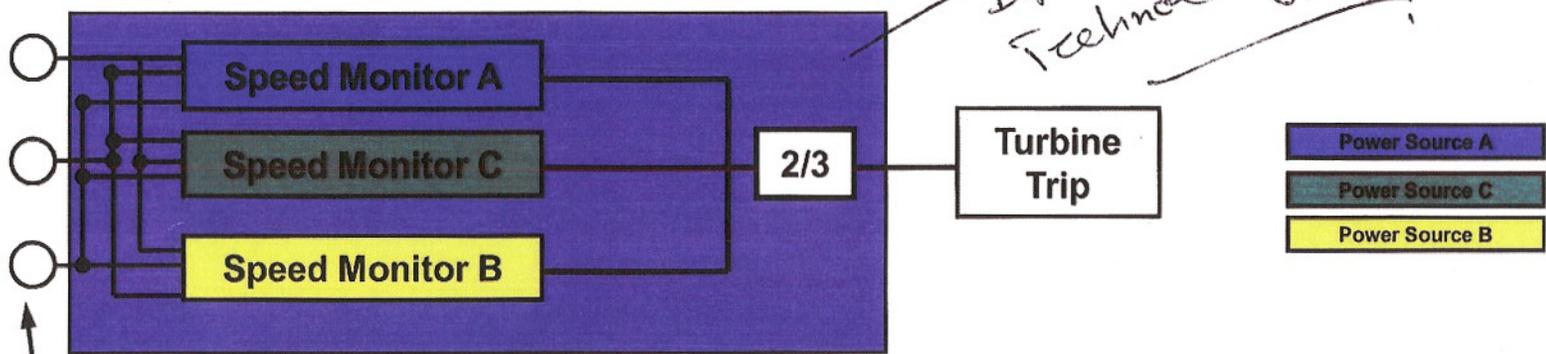
Questions or Comments?



Primary Overspeed Trip and Emergency Overspeed Trip Functions



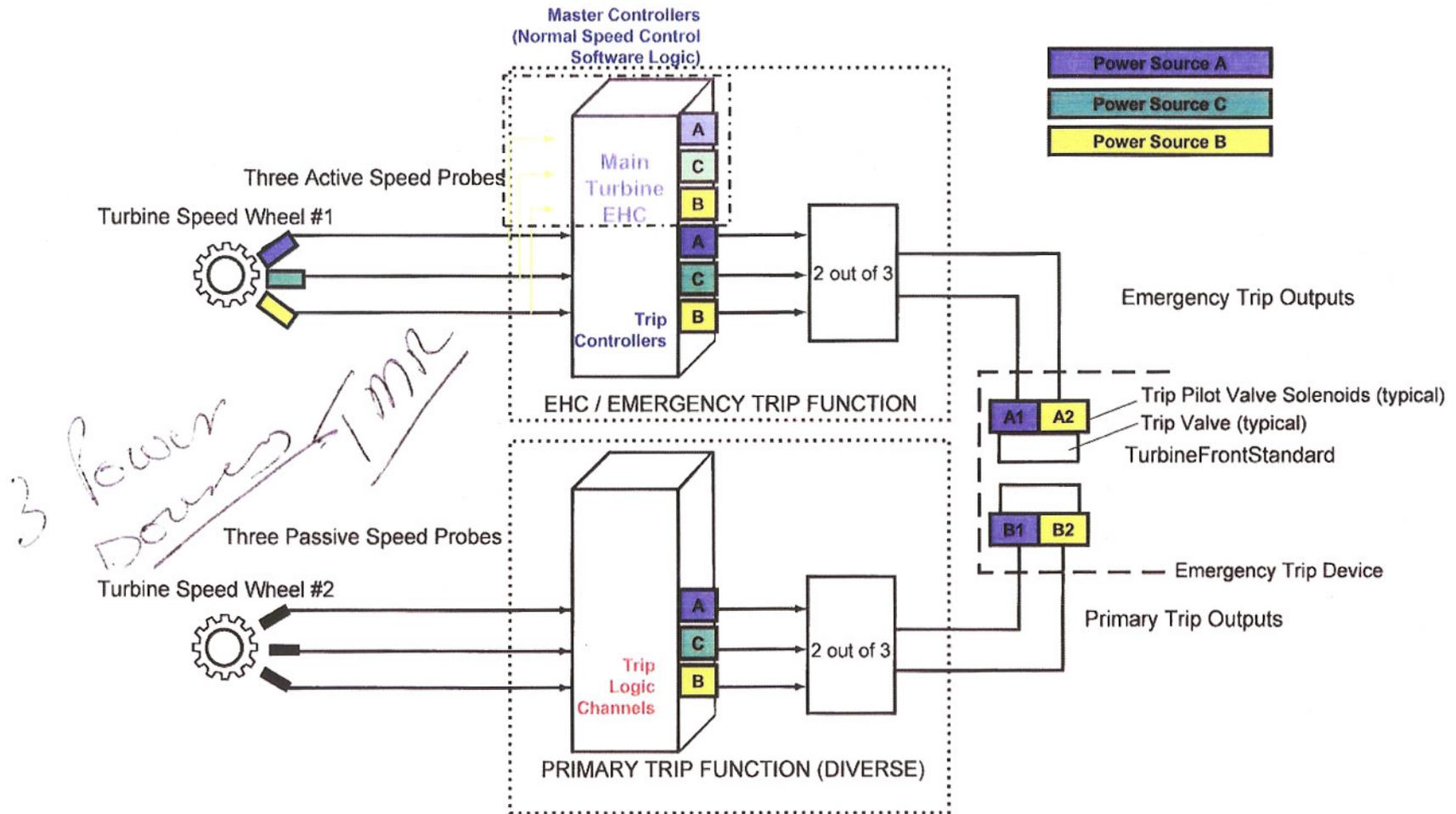
3 Speed Pickups (Active) for Emergency Overspeed Trip Function
(Active detector needs power supply)



3 Speed Pickups (Passive) for Primary Overspeed Trip Function
(Each passive detector needs no power supply)



Summary of Turbine Overspeed Protection including Power Sources





Presentation to the ACRS Subcommittee

South Texas Units 3 and 4 COL Application Review

**Advanced SER Chapter 14
“Verification Programs”**

April 6, 2011



Staff Review Team

- **Project Managers**
 - George Wunder, Lead Project Manager, DNRL/BWR Projects Branch
 - Stacy Joseph, Chapter Project Manager, DNRL/BWR Projects Branch

- **Technical Staff Reviewers**
 - Garrett Newman, Frank Talbot, CQVA
 - Dinesh Taneja, ICE2
 - Bhupendra Bhatia, Amar Pal, EEB
 - David Jeng, SEB2
 - Yuken Wong, EMB2
 - George Thomas, SRSB
 - Raj Goel, SBCV
 - Steven Williams, Robert Kellner, CHPB
 - Devender Reddy, SBPA

Summary of Technical Discussion Points for South Texas COL Chapter 14

| | |
|--------------------------------------|--|
| Open Items 14.02-6 and 14.02-8 | Startup tests related to flow induced vibration |
| Open Item 14.02-4 | License Conditions for Initial Plant Testing |
| Departures New to Section 14.2 | STD DEP T1 2.4-4 STD DEP 10.2-1 |
| Departures New to Section 14.3/14.3S | STD DEP T1 1.1-1 STD DEP T1 2.4-4 |
| Revised Response to RAI 14.03.05-2 | Revisions to Site Specific ITAAC: Table 3.0-1 Ultimate Heat Sink Table 3.0-5 Reactor Service Water |

Flow-Induced Vibration Assessment Program

- Open Items 14.02-6 and 14.02-8 required STP to update the preoperational and startup test abstracts to reflect FIV program
- STPNOC submit revised responses to RAIs and revised 14.2 FSAR to designate that:
 - STP Unit 3 is the US ABWR prototype plant tested in accordance with the ABWR DCD and STP Unit 3 FIVAP (in Chapter 3).
 - STP Unit 4 is a non-prototype category I plant utilizing the inspection method in accordance with RG 1.20 and STP Unit 4 FIVAP (in Chapter 3).
- Flow-induced vibration pre-operational and startup testing for STP Units 3 and 4 is described in Section 3.9.2 of the FSAR and FIVAP references. The FIVAP is evaluated in Chapter 3 of the SER.

ITP License Conditions

- STP proposed post-COL commitments to address COL License Information Item for “Test Procedures/Startup Administrative Manual”
- The staff identified that COL Information Item should be controlled by License Conditions
- The staff sent an RAI requesting applicant to inform the staff if the staff’s proposed license conditions are considered appropriate
- Staff evaluated the applicant’s response to the RAI and proposed license conditions.
 - Provision of Test Specifications and Preoperational and Startup Test Procedures
 - Test Phase Completion and Provision of Results
 - Provision of Test Schedule
 - Control and Reporting of Changes to the ITP

Departures New to Section 14.2

- **STD DEP T1 2.4-4 - RHR, HPCF and RCIC Turbine/Pump NPSH**
 - Test abstracts for RHR and HPCF were revised to remove criterion that temporary strainer be 50% plugged throughout test.
- **STD DEP 10.2-1 – Turbine Design**
 - Test abstracts for “Main Turbine Control System Pre-Op test” and “Main Turbine Auxiliary Pre-Op Test” revised to reflect the correct description of the intercept valves and intercept stop valves. Verification of this change is being tracked as a confirmatory item.

Departures New to Section 14.3/14.3S

- **STD DEP T1 1.1-1 – Definition of “As-Built”**
 - The Tier 1 definition of “as-built” is modified to clarify that the determination of physical properties of an as-built SSC may be based on measurements, inspections, or tests that take place before installation in cases where it is technically justifiable, provided that subsequent fabrication, handling, installation and testing do not alter the properties.
 - This definition is in accordance with the latest guidance endorsed by the staff in NEI 08-01 Revision 4.
- **STD DEP T1 2.4-4 - RHR, HPCF and RCIC Turbine/Pump NPSH**
 - ITAAC for RHR, HPCF and RCIC were revised to remove criterion that temporary strainer be 50% plugged throughout test.

Revised Response to RAI 14.03.05-2

- Ultimate Heat Sink and Reactor Service Water ITAAC revised to clarify requirements for displays, alarms and controls for main control room and remote shutdown system control panels
- Reference to RSW heat exchanger isolation valves removed from site specific ITAAC
- Staff reviewed proposed changes and determined that the changes are acceptable
- SER will need to be revised to address addition of Item 5 in RSW ITAAC. Change does not affect SER conclusions that UHS and RSW ITAAC are acceptable.

Chapter 14 Advanced SER

Conclusion

ACRS Action Items

ACRS Action Items related to Chapter 10 are discussed on the following slides:

- #45 Provide RAI response on turbine overspeed sensor redundancy and diversity
- #42 Main turbine missile analysis and maintenance program
- #59 Value of 10^{-2} per year per plant for product of strike (P2) and damage (P3) probabilities
- #43 Documented basis for turbine rotor integrity (FATT and Cv) departure

Action Item # 45

Provide the RAI responses regarding redundancy and diversity of turbine overspeed sensors including power supplies.

Response: RAI 10.02-1 through 10.02-8 revised responses were submitted (2/21/11).

- Provided additional details on redundancy and diversity for the turbine overspeed protection system in FSAR Section 10.2.2.4
- Provided site-specific ITAAC.
- Discussed on previous slides.

Action Item # 42

Main turbine missile analysis and maintenance program.

Response: As discussed with Chapter 3 presentation on 10/20/2010, FSAR Subsection 3.5.4.5 (COL Item 3.13) provides the following:

“A turbine system maintenance program will be submitted within three years following receipt of a COL that includes the probability calculation of turbine missile generation and shows that the turbine meets the minimum requirements as given in FSAR Table 3.5-1. (COM 3.5-1)”

COM 3.5-1 addresses the COL applicant item stated in Section 3.5.1.1.3 of the ABWR DCD.

Action Item # 42 (cont'd)

- To demonstrate consideration of operating experience obtained from the Japanese plants, the following reports were developed:
 - “Analysis of the Probability of the Generation of Missiles from Fully Integral Nuclear Low Pressure Turbines,” Toshiba Technical Report UTLR-0008-P, Rev 1, September 2010.
 - “Probabilistic Evaluation of Turbine Valve Test Frequency,” Toshiba Technical Report UTLR-0009-P, Rev 1, September 2010.
- The reports provide a basis for, but are not intended to satisfy, the requirements of COM 3.5-1.

Action Item # 59

Explain FSAR section 3.5.1.1.1.3 description "conservative" as applied to the value $1e-02$ per year per plant chosen for product of strike (P2) and damage (P3) probabilities.

Response: STP 3 & 4 FSAR Subsection 3.5.1.1.1.3 states:

“Per Acceptance Criteria 1 of Standard Review Plan (SRP) Section 3.5.1.3 for unfavorable turbine generators, a value of 10^{-2} per year per plant was chosen as a **conservative** value for the product of strike probability (P2) and damage probability (P3).”

From Acceptance Criteria 1 of SRP Section 3.5.1.3:

- Calculations are "order of magnitude" only, and can be reasonably assumed to fall in a range that depends on turbine orientation.
- The staff does not encourage applicants to calculate P2, P3, or their product due to assumptions and modeling difficulties.
- The staff accepts $P2 \times P3$ of 10^{-2} per year per plant for unfavorably oriented turbine.

Action Item # 59 (cont'd)

STP DEP 3.5-1 addresses the change from a single unit with favorable turbine orientation to dual unit STP 3 & 4 in which the orientation is considered unfavorable to safety-related systems of the adjoining unit.

The turbine missile ejection impact on the adjoining unit (P2) can be estimated using a simple model based on information provided in FSAR Figure 3.5-2 and other figures:

- Using this simple model approach results in an estimate for P2 of approximately 0.007, or ~ 0.01 (10^{-2}).
- Result is consistent with SRP 3.5.1.3 accepted value of 10^{-2} for P2 x P3 for unfavorably oriented turbines.
- Estimates do not consider obstructions between the turbine and the adjoining unit safety-related buildings (e.g., turbine building, radwaste building, service building, and control building annex), or locations of specific safety-related targets.

Action Item # 43

Provide the documented basis for adequacy of turbine rotor integrity related to FATT and Cv departure (STP DEP 10.2-2).

Response: This departure, STP DEP 10.2-2, was evaluated as a Tier 2 departure, and complies with Section VIII.B.5 of Appendix A to Part 52, as documented in STP 3&4 COLA Part 7, Departures Report.

- During an audit conducted in 2009, NRC staff reviewed additional documentation related to the bases for departure evaluations, including STP DEP 10.2-2.
- The audit report concluded that there is reasonable assurance this Tier 2 departure does not require prior NRC approval.

Action Item # 43 (cont'd)

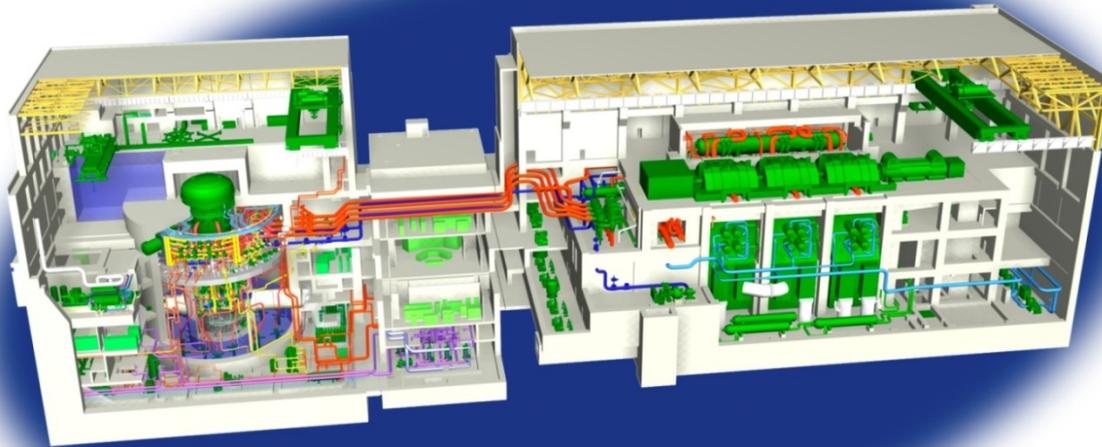
Information contained in the additional documentation included:

- Design of the large low-pressure (LP) rotors will be of the forged, monobloc design, consistent with industry practice.
- The lower stresses experienced in the monobloc design are accommodated with Ni-Cr-Mo-V alloy steel (ASTM A470), the material used in the fabrication of the rotor.
 - Greater material resistance to corrosion.
 - Approach is consistent with industry practice.
- Reports which indicate that, for the rotor design and material properties, design overspeed conditions do not result in significant missile generation probabilities.
 - Reports reference analysis methodologies that are consistent with industry standards.

South Texas Project Units 3 & 4

ACRS ABWR Subcommittee Presentation

ACRS Action Item #68



Agenda

- Introduction/Attendees
- Action Item #68
 - Provide testing of Common-Q platform at 70% loading
 - Overview
 - Discussion
 - Summary and Conclusion

Attendees

| | |
|----------------------|---|
| Scott Head | NINA Manager, Regulatory Affairs, STP 3 & 4 |
| Mike Murray | NINA I&C Manager |
| Warren Odess-Gillett | Westinghouse Engineering |
| Ed Brown | Westinghouse Engineering |
| Coley Chappell | NINA Licensing STP 3 & 4 |

Action Item # 68

Provide documentation of qualification test of Common Q platform at 70% loading (demonstrating AC160 base software testing).

Response Overview

- Generic Common Q AC160 Processor Software Release Test demonstrates Processor Module operates > 70% load
- Generic AC160 Qualification Testing demonstrates response time performance at loads up to 75%
- Application programs are constrained by design requirements
 - Software Program Manual
 - Application Restrictions

Generic AC160 Software Release Test

- Each AC160 Base Software Release undergoes a product type test, conducted under high processor loads
 - Processor load is monitored
 - Results are recorded in the type test record
 - Documentation exists that demonstrate the AC160 base software was tested at $\geq 70\%$ load.
 - For example, latest Release Test demonstrates processor loads up to 80%

Generic Common Q Qualification Testing

- Initial platform qualification was performed for a reactor protection system for a Swedish reactor
- Response time tests were performed at the following conditions
 - Normal load
 - Additional “dummy” logic added to increase load to 75%
- Results indicate that increased load has minimal impact on response times

Response time TEST CASE 1 - NORMAL PROGRAM

| No. | t ₁ | No. | t ₁ | No. | t ₁ | No. | t ₁ | No. | t ₁ |
|------|----------------|-----|----------------|-----|----------------|-----|----------------|-----|----------------|
| 1 | 56 ms | 11 | 56 ms | 21 | 52 ms | 31 | 50 ms | 41 | 54 ms |
| 2 | 53 ms | 12 | 55 ms | 22 | 49 ms | 32 | 50 ms | 42 | 47 ms |
| 3 | 62 ms | 13 | 63 ms | 23 | 49 ms | 33 | 62 ms | 43 | 54 ms |
| 4 | 54 ms | 14 | 59 ms | 24 | 52 ms | 34 | 49 ms | 44 | 48 ms |
| 5 | 52 ms | 15 | 60 ms | 25 | 51 ms | 35 | 58 ms | 45 | 51 ms |
| 6 | 54 ms | 16 | 53 ms | 26 | 52 ms | 36 | 54 ms | 46 | 44 ms |
| 7 | 52 ms | 17 | 61 ms | 27 | 51 ms | 37 | 59 ms | 47 | 54 ms |
| 8 | 57 ms | 18 | 57 ms | 28 | 55 ms | 38 | 51 ms | 48 | 47 ms |
| 9 | 59 ms | 19 | 54 ms | 29 | 51 ms | 39 | 47 ms | 49 | 48 ms |
| 10 | 51 ms | 20 | 52 ms | 30 | 56 ms | 40 | 60 ms | 50 | 51 ms |
| avg. | 55,0 ms | | 57,0 ms | | 51,8 ms | | 54,0 ms | | 49,8 ms |

| No. | t ₁ | No. | t ₁ | No. | t ₁ | No. | t ₁ | No. | t ₁ |
|------|----------------|-----|----------------|-----|----------------|-----|----------------|-----|----------------|
| 51 | 56 ms | 61 | 56 ms | 71 | 65 ms | 81 | 65 ms | 91 | 57 ms |
| 52 | 62 ms | 62 | 60 ms | 72 | 63 ms | 82 | 57 ms | 92 | 49 ms |
| 53 | 64 ms | 63 | 57 ms | 73 | 57 ms | 83 | 59 ms | 93 | 57 ms |
| 54 | 64 ms | 64 | 57 ms | 74 | 46 ms | 84 | 49 ms | 94 | 51 ms |
| 55 | 57 ms | 65 | 52 ms | 75 | 44 ms | 85 | 53 ms | 95 | 44 ms |
| 56 | 62 ms | 66 | 58 ms | 76 | 55 ms | 86 | 51 ms | 96 | 50 ms |
| 57 | 57 ms | 67 | 61 ms | 77 | 63 ms | 87 | 61 ms | 97 | 60 ms |
| 58 | 67 ms | 68 | 56 ms | 78 | 59 ms | 88 | 66 ms | 98 | 57 ms |
| 59 | 68 ms | 69 | 53 ms | 79 | 57 ms | 89 | 60 ms | 99 | 56 ms |
| 60 | 60 ms | 70 | 58 ms | 80 | 52 ms | 90 | 59 ms | 100 | 50 ms |
| avg. | 61,7 ms | | 56,8 ms | | 56,1 ms | | 58,0 ms | | 53,1 ms |

| | |
|------------|---------|
| Total avg. | 55,3 ms |
|------------|---------|

Response time TEST CASE 2 - SYSTEM LOAD AT 75 % USING DUMMY LOGIC

| No. | t ₁ | No. | t ₁ | No. | t ₁ | No. | t ₁ | No. | t ₁ |
|------|----------------|-----|----------------|-----|----------------|-----|----------------|-----|----------------|
| 1 | 73 ms | 11 | 64 ms | 21 | 62 ms | 31 | 60 ms | 41 | 67 ms |
| 2 | 58 ms | 12 | 64 ms | 22 | 65 ms | 32 | 54 ms | 42 | 68 ms |
| 3 | 73 ms | 13 | 51 ms | 23 | 61 ms | 33 | 59 ms | 43 | 69 ms |
| 4 | 64 ms | 14 | 54 ms | 24 | 68 ms | 34 | 61 ms | 44 | 65 ms |
| 5 | 65 ms | 15 | 49 ms | 25 | 73 ms | 35 | 53 ms | 45 | 64 ms |
| 6 | 63 ms | 16 | 62 ms | 26 | 63 ms | 36 | 58 ms | 46 | 45 ms |
| 7 | 69 ms | 17 | 59 ms | 27 | 61 ms | 37 | 52 ms | 47 | 67 ms |
| 8 | 70 ms | 18 | 59 ms | 28 | 67 ms | 38 | 55 ms | 48 | 48 ms |
| 9 | 58 ms | 19 | 63 ms | 29 | 61 ms | 39 | 59 ms | 49 | 62 ms |
| 10 | 68 ms | 20 | 58 ms | 30 | 65 ms | 40 | 57 ms | 50 | 57 ms |
| avg. | 66,1 ms | | 58,3 ms | | 64,6 ms | | 56,8 ms | | 61,2 ms |

| No. | t ₁ | No. | t ₁ | No. | t ₁ | No. | t ₁ | No. | t ₁ |
|------|----------------|-----|----------------|-----|----------------|-----|----------------|-----|----------------|
| 51 | 56 ms | 61 | 60 ms | 71 | 60 ms | 81 | 59 ms | 91 | 54 ms |
| 52 | 57 ms | 62 | 68 ms | 72 | 60 ms | 82 | 69 ms | 92 | 58 ms |
| 53 | 72 ms | 63 | 60 ms | 73 | 52 ms | 83 | 73 ms | 93 | 63 ms |
| 54 | 54 ms | 64 | 56 ms | 74 | 60 ms | 84 | 57 ms | 94 | 57 ms |
| 55 | 61 ms | 65 | 60 ms | 75 | 58 ms | 85 | 68 ms | 95 | 60 ms |
| 56 | 54 ms | 66 | 65 ms | 76 | 58 ms | 86 | 58 ms | 96 | 50 ms |
| 57 | 57 ms | 67 | 68 ms | 77 | 65 ms | 87 | 63 ms | 97 | 54 ms |
| 58 | 61 ms | 68 | 59 ms | 78 | 50 ms | 88 | 66 ms | 98 | 67 ms |
| 59 | 57 ms | 69 | 64 ms | 79 | 53 ms | 89 | 63 ms | 99 | 58 ms |
| 60 | 49 ms | 70 | 66 ms | 80 | 57 ms | 90 | 58 ms | 100 | 59 ms |
| avg. | 57,8 ms | | 62,6 ms | | 57,3 ms | | 63,4 ms | | 58,0 ms |

| | |
|-------------------|----------------|
| Total avg. | 60,6 ms |
|-------------------|----------------|

Summary

- Review of the test records have demonstrated:
 - AC160 continued performance at loads $> 70\%$
 - AC160 response time minimally impacted by loads $> 70\%$
- Software design and V&V processes are governed by Common Q Software Program Manual (SPM) and Application Restrictions for original application and subsequent modifications

Questions and Comments

ACRS Action Item 43 Background

- Departure STP DEP 10.2-2 selected a monobloc turbine rotor design
- The departure lists values of 40 °F and 45 ft-lbs for a fracture appearance transition temperature (50 percent FATT) and Charpy V-notch (Cv) energy at the minimum operating temperature, respectively, which are different from the SRP criteria of 0 °F and 60 ft-lbs

ACRS Action Item 43

Background

- CIB2 performed an audit at Bay City, TX to review the process for determining if NRC approval was required under Part 52.
- Audit team reviewed applicant's validation package and determined that the Tier 2 change proposed by the applicant does not meet any of the criteria identified in 10 CFR Part 52, Appendix A, Section VIII.B.5 that would result in the requirement of NRC approval of the departure.
- ASER was written to reflect staff actions and applicant's compliance with the regulations.

ACRS Action Item 43

Staff Technical Considerations

- The forged monobloc design is inherently superior to the shrunk-on disks
- EPRI report EP-5619, “Center Fracture Toughness of Monobloc Rotors,” dated January, 1988, shows that deep-seated values for FATT and Cv correlate with the outer values in the SRP
- The applicant has committed to meeting the Turbine Missile generation probabilities with these values
- The turbine is not a safety-related component

ACRS Action Item 43

Conclusions

- The staff's ASER reflects the appropriate level of detail in accordance its actions
- The applicant complies with 10 CFR Part 52, Appendix A, Section VIII.B.5
- Not a safety-related component
- Not a safety-significant issue

ACRS Action Item 45

- Action Item: Provide RAI response regarding redundancy and diversity of turbine overspeed sensors including power supply – ITAAC acceptance criteria are very general in scope
- ITAAC included in response to RAI 10.02-6 in NINA letter dated 2/21/2011

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON ABWR

April 6, 2011

Date

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| 3 | Craig Swannell | MPR |
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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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April 6, 2011

Date

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