

**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 – 0001**

August 19, 2011

MEMORANDUM TO: Maitri Banerjee, Senior Staff Engineer  
Technical Branch, ACRS

FROM: Said Abdel-Khalik, Chairman **/RA/**  
Advanced Boiling Water Reactor (ABWR) Subcommittee  
ACRS

SUBJECT: CERTIFICATION OF THE MINUTES OF THE MEETING OF THE  
SUBCOMMITTEE ON ABWR REGARDING COL APPLICATION  
OF SOUTH TEXAS PROJECT (STP) ON FEBRUARY 8, 2011

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting held on February 8, 2011, are an accurate record of the proceedings for that meeting.

/RA/	08/19/2011
Said Abdel-Khalik, Chairman ABWR Subcommittee, ACRS	Date

Certified by: Said Abdel-Khalik  
Certified on: August 19, 2011

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
MINUTES OF THE  
ACRS ADVANCED BOILING WATER REACTOR SUBCOMMITTEE MEETING  
FEBRUARY 8, 2011, ROCKVILLE, MD

The ACRS Advanced Boiling Water Reactor (ABWR) Subcommittee held a meeting on February 8, 2011 in Room T2B1, 11545 Rockville Pike, Rockville, Maryland. The meeting convened at 8:30 am and adjourned at 4:20 pm.

The entire meeting was open to the public. No written comments or requests for time to make oral statements were received from members of the public related to this meeting.

ATTENDEES

ACRS Members/Consultants/Staff

Said Abdel-Khalik, Chairman  
Jack Sieber, Member  
Charles Brown, Member  
John Stetkar, Member  
Dennis Bley, Member  
  
M. Banerjee, Designated Federal  
Official

NRC Staff

Ian Jung, NRO  
Rocky Foster, NRO  
Mark Tonacci, NRO  
Dinesh Taneja, NRO  
Hulbert Li, NRO  
Thomas Fredette, NRO  
Jeff Jacobson, NRO

Other Attendees

Scott Head, NINA  
Michael Murray, NINA  
Coley Chappell, NINA  
Kyle Dittman, NINA  
James Cook, NINA  
Robert Quinn, Westinghouse  
Warren Odess-Gillett, Westinghouse  
Edgar Brown, Westinghouse  
Craig Swanner, TANE  
David Herrell, MPR  
Kiyotaka Wakita, Toshiba  
Akira Fukumoto, Toshiba  
Hiroshi Sakamoto, Toshiba  
Jun Ikeda, Toshiba  
Al Gutterman, Morgan Lewis &  
Bockius LLC

## SUMMARY

The purpose of the meeting was to review Chapter 7 of the Safety Evaluation Report with no open items associated with the combined license application for South Texas project Units 3 and 4. Discussion also included selected ACRS action items resulting from prior ABWR Subcommittee meetings. The meeting transcripts are attached and contain a detailed description of each issue discussed during the meeting. The presentation slides and handouts used during the meeting are attached to the transcripts.

The significant issues discussed during the meeting are listed in the Table below.

SIGNIFICANT ISSUES	
NINA replaced STPNOC as the lead applicant (responsible for licensing, design and construction), with STPNOC being the secondary applicant and at the 103(g) point will be responsible for plant operation.	Transcript page 8
Instrument setpoint methodology – Chairman Abdel-Khalik asked for the code that will be used to generate the DIVOM curve for APRM trip setpoint as the GE code used in the DCD may not be available to the applicant, and that a Part 21 report was issued on the GE code. Mr. Head, NINA, explained that if they decide to go with the original GE7 fuel (very unlikely as the fuel may not be available) then they will use the GE code (with Part 21 resolution) access to which is available through their participation with the BWROWG. If NINA decides to go with more recent fuel (likely case), e.g., Westinghouse Optima-2 design, then they will use the Westinghouse code (POLCA-T) not affected by the Part 21 issue.	NINA slide # 4 under Chapter 7. Transcript pages 10, 95-97, 134-136
FSAR App. 7DS - consolidated information on the reactor trip isolation system (RTIS), safety-related neutron monitoring system (NMS), engineered safety logic and control system (ELCS- implemented by the Common Q platform).	NINA slide # 6 under Chapter 7. Transcript pages 13, 14
(RTIS/NMS)(FPGA platform) <ul style="list-style-type: none"><li>• Member Brown's question on how to achieve satisfactory data transfer between non-synchronized divisions.</li><li>• Watchdog timer functionality – independent and diverse hardware from FPGA – Add to FSAR (Action Item 67).</li></ul>	NINA slide # 7-15, Transcript pages 15-39  Transcript pages 22-24,  Transcript pages 29-32

<p>ELCS</p> <ul style="list-style-type: none"> <li>• During the next Chapter 16 presentation to the ABWR Subcommittee, scheduled for 3/9/11, NINA to address bypass of combination of sensors and channels of ELCS (Action Item 69).</li> <li>• Maintenance and test panel – Member Stetkar asked if surreptitious changes to trip set points for a safety division and controls signals or algorithms out into the normal plant control system can be made from the panel.</li> <li>• Member Bley asked about control room operator response upon notification of bad data coming in, and if there would be a procedure. Ed Brown, Westinghouse, noted alarm response procedures would cover that. Mr. Murray, NINA, noted an ongoing human factors review on the subject. Programs and procedures will be established after COL.</li> <li>• Member Brown raised the question of the need for backup to critical functions when corrupt data may lockup all processors. NINA and staff discussed why such scenario was not possible.</li> <li>• Member Stetkar asked if pre-installation changes to the application software or communications protocols would trigger need for a new timing analysis. Mr. Murray, NINA, was affirmative. Mr. Brown, Westinghouse, noted the documentation requirement following the project's software management plan.</li> <li>• Members Brown and Stetkar asked for clarification regarding operator's ability to control a component at the divisional SLF level vs. the component level. It was explained that auto actuation at the division level comes thru the SLF where as manual operation from the control room is activated at the RDLC. Control from safe shutdown panel is hard-wired to the component. Also, manual control defeats ELCS control (re: FSAR Fig 7C-1)</li> <li>• Member Brown asked for demonstration of qualification of Common Q platform to 70% load (Action Item 68)</li> </ul>	<p>NINA slide # 16-29, Transcript pages 39-134</p> <p>Transcript pages 48-57</p> <p>Transcript pages 59-64</p> <p>Transcript pages 72, 74</p> <p>Transcript pages 75-77, 100-102</p> <p>Transcript pages 80-81</p> <p>Transcript pages 85-88, 132-134</p> <p>Transcript pages 91, 111-131</p>
<p>ACRS Action item #7 – Member Brown's question on inter-channel communication and determinism for FPGA and Common-Q platform, impact of corrupt data, cyber security aspect of safety to non-safety data communication from plant to TSC or EOF were discussed at various times during the meeting – Item closed.</p>	<p>NINA slide #4 on ACRS Action Items, staff slides 6-11, and transcript pages 89, 99-109, 137-138</p>
<p>ACRS Action item #45 - Provide RAI responses regarding redundancy and diversity of turbine over-speed sensors including power supply – ITAAC very general in scope (Update).</p>	<p>NINA presentation slide #5 on ACRS Action Items and transcript pages 139-141</p>

List of action items, resulting from this meeting and actions items from previous ABWR Subcommittee meetings that are closed in this meeting are included in the Table below.

ACRS ABWR Subcommittee Action items

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
March 2, 2010 Subcommittee Meeting							
1	3/2/10	Dr. Armijo expressed interest in the fuel related topical reports and the effect of the fuel change (amendment to COL) on the analyses in Chapters 4 and 15.  Communicate ACRS desire to review fuel amendment (first reload) application that replaces GE 7 fuel (DCD) to contemporary fuel (Armijo)	Chapter 4	SER	ACRS (Abdullahi/ Banerjee)	Potential impact to other areas including Chapters 6 and 15 in addition to Chapter 4.  Closed as Follows: A list of fuel amendment related technical/ topical reports has been provided. ACRS (Dr. Armijo lead) to determine which ones the Committee would like to review and the responsible Subcommittee(s). Proposal to be presented at the April P&P.  ACRS, with Member Banerjee's lead, will review the TRs.	4/9/10

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
2	3/2/10	Future presentation of staff and STP to address diesel qualification to 60 degrees C, related occupancy issues and HVAC changes. (Abdel-Khalik)	Chapter 9	COLA/SER	STP/NRO	STP to provide additional discussion on habitability at future Subcommittee meeting on impact of higher temperature (departure T1 2.15-2) when Chapter 9 is presented to the Subcommittee. The issue of diesel qualification was addressed at 3/18/10 meeting and the issue of habitability was addressed at 10/20/10 meeting satisfactory to the members.	10/20/10-closed
3	3/2/10	Part 21 reports issued on stability analysis post DCD need to be addressed (Abdel-Khalik)	Chapters 4 and 15	COLA/SER	STP/NRO	STP and staff to address at March 18, 2010 meeting. Closed as follows:  STPNOC will provide an updated Stability Option III analyses including resolution of the Part 21 issues before fuel load (COM 4.4-3)  Staff will follow-up commitment through established processes.	3/18/10

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
4	3/2/10	Part 21 reports issued post DCD - how staff identifies, captures and addresses Part 21 issues that affect the ABWR design? (Abdel-Khalik)		COLA/SER	NRO/STP	<p>Staff plans to address it at a future meeting.</p> <p>STP is preparing a list of all applicable Part 21 items since original design certification and will develop a process to address them in the COLA space. Staff to follow-up and address at a future ACRS meeting. STP provided additional information on 6/8/10 (slides 8 and 9) and at 10/20/10 (slides 9 -11, ACRS Action Items). STPNOC made changes to FSAR and TS bases to address 1988 Part 21 on BWR operation with a MSL isolated.</p> <p>Also, how to address it process-wise. The EDO response dated 9/10/10 to ACRS interim letter, dated 8/9/10, committed to develop guidance for addressing Part 21 reports in new reactor licensing process. The staff will update ACRS when such guidance is completed.</p>	This item is closed. See item 51.
5	3/2/10	Deletion of MSIV closure and scram on hi radiation	Chapters 7 & 19	DCD	-	BWROG Topical Report reviewed and approved by NRC. Closed	3/2/10

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
6	3/2/10	FW line break mitigation – This accident is not described in Chapter 15 (Abdel-Khalik).	Chapter 6	COLA/SER	STP/NRO	The applicant stated that this accident does not affect Chapter 15 doses and that the entirety of the accident and its effects will be discussed in the presentation on Chapter 6.  Addressed during 6/24/10 meeting. Refer to Sections 6.2, 6.3 and 15.6.	6/24/10
7	3/2/10	FPGA – address in more detail (e.g., inter-channel communication, determinancy)  Application of Common Q platform (Brown)	Chapter 7	COLA/SER	STP/NRO	Staff to discuss at 5/20 meeting. NRO to provide documents to Subcommittee in advance of briefing on this topic as needed.  Based on 5/20 meeting FPGA is closed. Application of Common Q platform, independence and determinancy are being considered by Member Brown.  Based on the applicant's presentation on Chapter 7 at 2/8/11 SC meeting this item is closed.	2/8/11
8	3/2/10	Address GSI-191 flow blockage (not just for fuel) (Abdel- Khalik)	Chapter 6	COLA/SER	STP/NRO	Staff and STP to discuss this issue during presentation on strainers and downstream effects testing as part of Chapter 6 on 6/24, 2010.  This item is part of item 47.	6/24/10



No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
9	3/2/10	Address how underground release is handled (e.g., H3) in STP design and operational programs. Address if underground piping carrying radioactive liquids run through tunnels, designed for zero leakage, or above/ below the water table. (Ryan)	Chapter 11	COLA/SER	STP	<p>To be discussed at a future meeting. Implementation of commitments made in STP RAI response, letters U7-C-STP-NRC-100156, 6/30/10 and U7-C-STP-NRC-090121, 8/26/09, and staff follow-up will be the subject.</p> <p>AT 10/20/10 ABWR SC - STPNOC slide 12 on Action Items, committed to NEI 08-08A. More details about corrosion resistance of material, coatings, wrappings and types of connection (flanged?) were asked.</p>	

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
10	3/2/10	GALE code – impact of the very conservative approach used by the staff and need for uncertainty analysis and use of actual experience data. (Ryan)	Chapter 12	SER	NRO	<p>Dr. Ryan asked if staff has any insights on how results from the new GALE code will compare to results from the old GALE code. What impact is this likely to have on the application? He also expressed concern regarding the effect on the applicant of making significant changes to RGs in the middle of a review?</p> <p>Staff to address this issue generically at a future meeting.</p> <p>Staff discussed the issue at 3/18/10 SC meeting to Committee's satisfaction. The issue is closed.</p>	3/18/10
11	3/2/10	Disparity between staff and STP presentation related to all x/q values being bounded by DCD.	Chapter 15	SER	NRO	Staff acknowledged error in presentation slides. Issue closed.	3/2/10

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
12	3/2/10	Related to HFE, how specific DAC acceptance criteria be amenable to staff inspection (Bley)	Chapter 18	SER	ACRS	<p>DAC issues will be closed after the issuance of the COL. This means that the Committee will not be able to track the closure of DAC-related technical issues before they are requested to write a letter on the staff's SER.</p> <p>ACRS to receive briefing on digital I&amp;C DAC at 570 ACRS meeting on 3/5/10, and decide if further follow-up is needed.</p> <p>Also see item 17. At 10/20/10 ABWR SC meeting members decided that this issue will be rolled into the generic ACRS comments on the DAC process. This item was closed.</p>	10/20/10
13	3/2/10	Subcommittee would like a better understanding of how adding dry/wetwell pressure indication on SPDS gives higher assurance of control room capability post accident when SPDS is non-safety related (Stetkar)	Chapter 18	SER	NRO	<p>Staff to provide additional information to ACRS.</p> <p>Staff presentation at 10/20/10 ABWR SC meeting. See meeting minutes. This item was closed based on information provided and the application of the HFE process.</p>	10/20/10

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
14	3/2/10	EDG qualification to increased ambient temperature (Stetkar)	Chapters 8, 9	FSAR/SER	STP/NRO	STP to discuss at next meeting. DG qualified to room temperature and electronics are located in cabinet outside room. This item is closed.	3/18/10
15	3/2/10	Subcommittee would like a better understanding of the basis for SER conclusion related to MCR and RSS and operator ability in switching from a digital MCR to analog RSS (Stetkar)	Chapter 18	SER	NRO	Staff to address this question in the context of the Chapters 7 and 18 discussions on RSS. Staff presentation at 10/20/10 ABWR SC meeting. See meeting minutes. This item was closed based on information provided and the application of the HFE process through design and operator training.	10/20/10
16	3/2/10	May need more aggressive staff review of HFE. Dr. Bonaca indicated that he might have questions on Chapter 18 (human factors engineering) after he reflected on the presentation. (Bonaca)	Chapter 18	SER	ACRS/NRO	Staff to address:  Dr. Bonaca referring to questions from Dr. Stetkar above – Treatment of SPDS, core cooling display parameters and their bases. Closed-refer to item 15 above.	Closed

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17	3/2/10	Staff needs to formalize handling of DAC	Chapter 18	NRO Programs	ACRS/NRO	ACRS comments in their 7/24/09 letter applies, plus another letter is expected to be drafted in July 2010. At 10/20/10 ABWR SC meeting members decided that this issue will be rolled into the generic ACRS comments on the DAC process. This item was closed.	10/20/10
18	3/2/10	Related to SER open item 1-3 on aging management, it was noted that detailed technical review is conducted under license renewal process when it should be an issue to consider from the first day on. Dr. Stetkar noted that additional guidance in the area may be helpful.	Chapter 1	Aging management	ACRS/NRO	Staff plans to close this issue in the staff's final SER with no open items.	
19	3/2/10	Occupational doses received from ABWRs and how they compare to occupational doses at other reactors. Can we compare ABWR to other Japanese BWRs as well as to U.S. BWRs? (Ryan)	Chapter 12	ABWR occupational dose	NRO	Staff to address this issue at a future meeting.  At 3/18 SC meeting, NRO and STP provided occupational dose data for Japanese and US BWRs since 1993 and the average dose for the Kashiwazaki-Kariwa plants, two of which are ABWR units, from 1997 thru 2002.	3/18/10

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
March 18, 2010 Subcommittee Meeting							
20	3/18/10	Number of times RCIC is expected to cycle on and off during an 8 hour SBO event (Stetkar)	Chapter 5	RCIC	STP	RCIC qualification and Operator response may be challenged due to repeated cycling (Response-4 times during 8 hr. SBO-STP slide 18 and 19, 6/8/10 ABWR SC-Closed)	6/8/10
21	3/18/10	Rx vessel EOL fluence value and error band (Abdel-Khalik/Armijo)	Chapter 5	Rx Vessel Material	STP	COLA uses DCD value, will be updated once PTLR is finalized/approved	3/18/10
22	3/18/10	Ensure all documents (engineering, design, procedures, PTS etc) at the plant use a consistent set of units (either British or Metric). (Abdel-Khalik)	All	All	STP	Too may number of problems and near misses happen when operators and technicians at the plant have to take action based on inconsistent units.  Closed per STP slide 8&9 presented at 6/24/10 meeting.	6/24/10
23	3/18/10	Address how K6 and K7 RCS leakage TS limits compare with proposed STP numbers, and justify STP limits, if higher.  Also address instrument sensitivity and how it compares with 1 gpm number. (Armijo)	Chapter 5	PTS	STP	Unidentified leakage limit was increased from 1 gpm DCD value to 5 gpm STP TS as STP is not using LBB.  Closed per STP slide 10&11 presented at 6/24/10 meeting.	6/24/10

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
24	3/18/10	Confirm that East transmission lines are capable of supplying all 4 units' safety loads when other lines are lost. (Stetkar/Sieber)	Chapter 8	FSAR	STP	Concern was that given shared transmission right of way and towers, all other lines could be lost under a storm situation. Closed per STP slide 10, ABWR SC meeting 6/8/10.	6/8/10
25	3/18/10	State if there are single or double closing coils on switchyard breakers. (Stetkar)	Chapter 8	FSAR	STP	There may be additional questions if the answer is "single." 6/8/10 ABWR SC – STP slide 11, answer is "single closing coil." Stetkar question-demonstration of capability to reclose upon (single?) failure of DC power under worst switchyard fault to restore one offsite power supply.  Closed per STP slide page 12 presented at 6/24/10 meeting.	6/24/10
26	3/18/10	Provide switchyard control system backup battery discharge time. (Stetkar/Sieber)	Chapter 8	FSAR	STP	Breakers may not close after LOOP clears if battery exhausted. Batteries sized to operate 10 hrs, expected life 15-20 yrs.- re: STP slide 12 at 6/8/10 ABWR SC.	6/8/10

No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
27	3/18/10	Performance of switching logic under various electrical transients. (Stetkar)	Chapter 8	FSAR	STP	STP may want to address it beyond COL while detailed design is finalized. STP slides 14-16, 6/8/10 ABWR SC meeting. Stetkar to review and decide if sufficient to close action item. See STP slides 7-11 on Chapter 8 at 10/20/10 ABWR SC.	10/20/10-closed
28	3/18/10	NRO to address how the SBO rule requirements are being ensured after operator action time is factored into the scenario with STP specification of "less than 10 minutes CT startup time." (Stetkar)	Chapter 8	SER	NRO	As STP chose not to do SBO coping analysis, they have to demonstrate that the CTs are capable of powering shutdown buses within 10 minutes of the onset of SBO (10 CFR 50.63 (c)(2)). The scenario involves needed operator action to shed/load buses before breaker can be closed.  EDO letter, 9/1/10 – discuss at next Chapter 8 briefing	10/20/10 – See NRO slides on Chapter 8, page 4 and backup-closed.
29	3/18/10	Address qualification of submerged 345 KV cables. (Brown)	Chapter 8	FSAR	STP	High water table prompted question on qualified life. STP slide 13, 6/8/10 ABWR SC meeting.	6/8/10



No.	MTG/ date generated	ACTION ITEM	CONTEXT	AREA	LEAD(s)	COMMENTS / ACTION / DISPOSITION	Date Resolved
30	3/18/10	<p>Address when DRAP list will be effectively populated and staff review is completed.</p> <p>How does staff ensure the DRAP list and the process (COLA vs. ITAAC) related to it are acceptable? (Stetkar)</p>	Chapter 17	FSAR/SER	STP/NRO	<p>With evolving plant PRA and DRAP, members were concerned that ITAAC may not be an appropriate closer mechanism for DRAP list. STP slide 20 6/8/10 ABWR SC meeting –List and justifying analysis to be available to ACRS 3<sup>rd</sup> quarter 2011. Staff to address the ACRS review timing question.</p> <p>At the 6/24/10 ABWR SC meeting the staff discussed their review of evolving DRAP list thru an audit (3<sup>rd</sup> quarter of 2010 and inspection late 2011. STP/NRO will brief ABWR SC in future, time to be determined.</p> <p>10/20/10 ABWR SC STP slide 14 – Provided draft DRAP list, staff to provide audit report when available. Future presentation by STP on process with examples.</p>	
31	3/18/10	4.16 kV winding in CTG1 bus could carry two PIP buses together with one safety bus (Stetkar)	Chapter 8	FSAR/SER	STP	<p>STP to confirm at a future meeting. STP slide 17 6/8/10 ABWR SC - confirmed</p>	6/8/10

May 20, 2010 Subcommittee Meeting

32	5/20/10	During the presentation on preoperational testing, members Stetkar and Brown noted that they had identified "overlap testing" requirements for various systems but could not identify end-to-end testing requirements.	Chapter 14	FSAR	STP	STP to address at a future meeting. Closed per STP slide page 13 &14 presented at 6/24/10 meeting.	6/24/10
33	5/20/10	Dr. Abdel-Khalik wanted to know the steam velocity and how it compares to other plants that have undergone extended uprate.	Chapter 14	FSAR	STP	STP to address at a future meeting. Re: STP slide 15 of 10/20/10 ABWR SC presentation on Action items.	10/20/10- closed
34	5/20/10	Dr. Abdel-Khalik wants the staff to provide reports submitted regarding reactor flow induced vibration for review by the Committee, and a briefing on their review of the predictive analysis.	Chapter 14 Section 3.9.2	Tech. Report	NRO	This technical report is due from STPNOC in later 2010.	
35	5/20/10	Member Brown raised the issue of cyber-security ITAAC and whether or not it should be included in Chapter 14.	Chapter 14	ITAAC	NRO	NRO staff to address at a future meeting	

36	5/20/10	Dr. Stetkar pointed out a possible inconsistency between the diagram of the backup SCRAM control circuit and the description of that circuit in the text.	Chapter 14	FSAR/SER	STP/NRO	STP and NRO staff to address at a future meeting. Text clarification withdrawn by STP. Re: Slide 16, 17 of 10/20/10 ABWR SC briefing on Action Items.	10/20/10- closed
June 8, 2010 Subcommittee							
37	6/8/10	Compile ABWR SSAR in a CD and provide to members	-	DCD	ACRS Staff	CD mailed to the members during the week of 6/13/10	Closed
38	6/8/10	STP White paper on PRA screening process for plant changes – provide to members	Chapter 19	FSAR	STP	E-mailed to members on 6/10/10 and a CD provided on 6/11/10.	6/10/10
39	6/8/10	2006 MCR dam failure screening assessment	Chapter 19	FSAR	STP	E-mailed to members on 6/10/10 and a CD provided on 6/11/10.	6/10/10
40	6/8/10	Dam failure risk – Baecher paper, US Bureau of Reclamation data and Army Corps of Engineer report used in SER	Chapter 19	SER	NRO	E-mailed to members on 6/10/10 and a CD provided on 6/11/10	6/10/10

41	6/8/10 10/20/10	DW flooders valve failure modes other than failure of fusible links considered in FSAR. <u>Operating experience? A small leak during normal operation would go undetected thus accumulating water in the lower drywell. Toshiba test results. (Bley)</u>	Chapter 19 Section 9.5.12	FSAR	STP	STP Slide 18, ABWR SC 10/20/10 provided results of a FEMA. Additional question on valve leak during normal operation (10/20/10).	
June 23-24, 2010 Subcommittee Meeting							
42	6/23/10	Main turbine missile analysis and maintenance program will be submitted to the NRC within 3 years after issuance of COL. ACRS wanted to be informed about staff's decision-making regarding adequacy of program.	Chapter 10, 3	SER	STP/NRO	The turbine design will meet acceptance criteria of SRP 3.5.1.3 and RG 1.115, will meet the minimum requirements in Table 3.5-1, STP Commitment. 3.5-1. Expected to be addressed in next Chapter 10 presentation.	At the 10/20/10 ABWR SC meeting STPNOC noted that documents may be submitted sooner.
43	6/23/10	Documented basis for adequacy of turbine rotor integrity related to FATT and Cv departure	Chapter 10	FSAR/SER	STP/NRO	EDO letter, 9/1/10 – discuss resolution at future briefing.	
44	6/23/10	NRO process for review of Tier 2 departures (review if qualifies as T2, not the technical adequacy)	Generic	SER	ACRS	ACRS to decide if they want to raise any issue regarding it.	

45	6/23/10, ACRS Letter 8/9/10	Provide RAI response regarding redundancy and diversity of turbine overspeed sensors including power supply – ITAAC very general in scope  Staff to provide RAI response with or before the SER.	Chapter 10	RAI resp.	STP/NRO	EDO letter 9/10/10 – Resolution will be presented with final SE with no OI.  Update provided by STP at 2/8/11 ABWR SC meeting. NINA will submit additional details on redundancy and diversity and on ITAAC.
46	6/24/10	Identify and justify assumptions regarding ppm Boron in solution used in chemical effects analysis (GSI 191 ECCS Strainer)	Chapter 6	FSAR	STP/NRO	Important contributor regarding concentration of AI in SP (ECCS recirculating water).
47	6/24/10	a.Downstream effects: Future briefing on test and analysis (Lic. Condn.)  b.Basis for assuming destroyed fiber (10% of 1 ft <sup>3</sup> ) reaching fuel	Chapter 6 Chapter 4	FSAR/SER	STP/NRO	<del>STP to brief by 4/2011</del>
48	6/24/10	Provide three ERI reports used in staff review of containment analysis	Chapter 6	SER	NRO	
49	6/24/10	Future briefing on design of vacuum breaker shield	Chapter 6	FSAR	STP	To address loading and height of water level

50	6/24/10, EDO letter 9/10/10	Presentation on Toshiba Technical reports - strainer design and pool swell analyses	Chapter 6	FSAR	STP/NRO	NRO and ACRS staff to schedule.	
51	EDO letter 9/10/10	Staff to update ACRS after developing guidance on the process of addressing Part 21 reports in new reactor licensing.	ACRS Letter dated 8/9/10	COLA/DC review process	NRO	NRO to advise ACRS staff when such briefing can be scheduled.	
52	EDO letter 9/10/10	Staff to brief ACRS on Long term cooling	SRM 5/8/08	COLA	NRO	NRO and ACRS staff to schedule	
October 20, 2010 Subcommittee Meeting							
53	10/20/10	NRO to submit for ACRS review technical report on reactor flow induced vibration	Section 3.9.2	SER	NRO	This technical report is due from STPNOC in later 2010.	Closed, duplicate of 34
54	10/20/10	Basis for STP being bounded by the DCD wind loading and design basis hurricane, i.e., basis for 3 second gust wind loading and the 100 year history record of hurricane within 50 miles of site (Stetkar).	Section 3.3 Chapter 2	FSAR	STP	STPNOC to address at 11/30 ABWR SC meeting. See Slide 41	Closed
55	10/20/10	Basis for the use of Regulatory Guide 1.76 Region II parameters	Section 3.3 Chapter 2	FSAR	STP	STPNOC to address at 11/30 ABWR SC meeting. See Slides 42-44	Closed

56	10/20/10	Confirm rail/truck large equipment access bay door in reactor building is water tight. (Stetkar)	Section 3.4 Chapter 2	FSAR	STP	STPNOC to address at 11/30 ABWR SC meeting. See Slides 45	Closed
57	10/20/10	Confirm levels of water-proofing of foundation of RSW pump house. (Stetkar)	Section 3H.6.6.4	FSAR	STP	STPNOC to address at 11/30 ABWR SC meeting. See Slides 46	Closed
58	10/20/10	Clarify various water level parameters discussed in Chapter 3 and how they were derived. (Stetkar)	Section 3.4	FSAR	STP	STPNOC to clarify FSAR (11/30/10 meeting slide 40)	
59	10/20/10	A value of $1 \times 10^{-2}$ per year per plant was chosen as a conservative value for the product of strike and damage probabilities- provide basis.	Section 3.5, Chapter 10	FSAR	STP	STP to address at next Chapter 10 briefing.	
60	10/20/10	Types of commercial aircraft and frequency considered. (Stetkar)	Sections 3.5, 2.3	FSAR	STP	RAI response dated 9/14/09 provided to members.	10/25/10
61	10/20/10	Justify deviation from SRP related to wave height.	Chapter 2	FSAR	STP	Open item in SER	

62	10/20/10	The basis and application of the 30 minute response time upon a single passive failure of the RSW piping and how the analysis justify a 30 day supply for the UHS while accounting for the pipe failure. (Stetkar)	Section 9.2.5.5.2	FSAR	STP
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63	10/20/10	The basis for approx. 17 meter RSW pump NPSH and how it was calculated (specifically at end of 30d).	Section 9.2.15.2	FSAR	STP
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64	10/20/10	Generation of spurious signals in digital I&C cabinets containing only fiber optic cables due to heat related to fire in the room. (Stetkar)	Section 9.5.1	FSAR	NRO
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#### November 30, 2010 Subcommittee Meeting

65	11/30/10	How MCR breach width derived from Froehlich's equation used in the FLDWAV model compare with the value used in confirmatory BREACH model	Section 2.4.4	FSAR/SER	STPNOC
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66	11/30/10	Comparison of staff's confirmatory SLOSH and STPNOC's ADCIRC at Gulf Coast	Section 2.4.4	FSAR/SER	STPNOC/NRO	The requested information provided by NRO staff was e-mailed to the members present at the 11/30 ABWR SC meeting on 12/1/10.
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February 8, 2011 Subcommittee Meeting

67	2/8/11	Add to FSAR a statement regarding hardware for the watchdog timer that is independent and diverse from FPGA	Chapter 7	FSAR	NINA	
68	2/8/11	a. Provide qualification test of Common Q platform at 70% loading. b. Confirm FSAR App. 7D maintains design to <70% loading.	Chapter 7	FSAR	NINA	
69	2/8/11	During Chapter 16 presentation to ABWR SC (3/9/11) address bypass of combination of sensors and channels of ELCS.	Chapter 7		NINA	



## Documents provided to the Subcommittee

1. ACRS Action Item List – ABWR Subcommittee on STP COLA
2. Background Documents
  - STP SER with No Open Items Chapter 7
  - STP FSAR Rev 4 Chapter 7
  - Tier 1 FSAR Information Rev 4
  - STP ITAAC Rev 4
  - STP Departure Report Rev 4
  - STP COLA Proprietary Report Rev 4
  - WCAP-17119-P, Revision 2, “Methodology for South Texas Project Units 3 and 4, ABWR Technical Specifications Setpoint”
  - STPNOC letter dated 1/19/11, Submittal of I&C Information (proposed FSAR Appendix 7DS, “Digital Instrumentation and Control Design Verification for Safety- Related Systems”)
  - WCAP-16097-P, Rev 1, “Common Qualified Platform Topical Report,” August, 2010
  - WCAP-1 6097-P, Appendix 5, Revision 0, “Common Qualified Platform Record of Changes,” August 2010

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# Official Transcript of Proceedings

## NUCLEAR REGULATORY COMMISSION

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Title: Advisory Committee on Reactor Safeguards  
ABWR Subcommittee on STP COLA

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Tuesday, February 8, 2011

Work Order No.: NRC-696

Pages 1-14

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## 2 NUCLEAR REGULATORY COMMISSION

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## 4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

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## 7 MEETING OF THE ABWR SUBCOMMITTEE ON STP COLA

8 + + + + +

9 TUESDAY

10 FEBRUARY 8, 2011

11 + + + + +

12 ROCKVILLE, MARYLAND

13 + + + + +

14 The Subcommittee met at the Nuclear Regulatory  
15 Commission, Two White Flint North, Room T2B3, 11545  
16 Rockville Pike, at 1:00 p.m., Said Abdel-Khalik,  
17 Chairman, presiding.

18 COMMITTEE MEMBERS:

19 SAID ABDEL-KHALIK, Chairman

20 DENNIS C. BLEY, Member

21 CHARLES H. BROWN, JR., Member

22 JOHN D. SIEBER, Member

23 JOHN W. STETKAR, Member

24  
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1 ACRS STAFF PRESENT:

2 MAITRI BANERJEE, Designated Federal

3 Official

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

12:59 p.m.

CHAIRMAN ABDEL-KHALIK: The meeting will now come to order. This is a meeting of the Advanced Cooling Water Reactor 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, John Stetkar, Dennis Bley and Jack Sieber. Ms. Maitri Banerjee is the designated federal official for this meeting.

All through last year, we were briefed by the Applicant, STPNOC, now called NINA Nuclear Innovation North America, and the NRC staff regarding the South Texas project combined license application, and the corresponding safety evaluation report prepared by the staff. The full Committee was briefed in July and wrote an interim letter to the Chairman.

In today's meeting, we are scheduled to discuss Chapter 7, I&C. This chapter was presented to us before when the SER had open items. Today, the staff will discuss how they have resolved those open items. The staff and the applicant may also discuss follow-up action items from previous ABWR Subcommittee meetings.

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1           The rules for participation in today's  
2 meeting were announced in the *Federal Register* on  
3 January 28th, 2011, for an open/closed meeting. Parts  
4 of this meeting may need to be closed to the public,  
5 to protect the information proprietary to the  
6 Applicant or other parties.

7           I'm asking the NRC staff and the Applicant  
8 to identify the need for closing the meeting before we  
9 enter in such discussion, and to verify that only  
10 people with the required clearance and need to know  
11 are present.

12           We have a telephone bridge line with the  
13 public and stakeholders to hear the deliberations.  
14 This line will not carry any signal from this end  
15 during the closed portion of the meeting.

16           Also, to minimize disturbance, the line  
17 will be kept in a listen-in only mode until the last  
18 15 minutes of the meeting. At that time, we will  
19 provide the opportunity for any members of the public  
20 attending this meeting, in person or through the  
21 bridge line, to make a statement or provide comments.

22           As the meeting is being transcribed, I  
23 request that participants in this meeting use the  
24 microphones located throughout this room in addressing  
25 the Subcommittee. Participants should first identify

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1 themselves and speak with sufficient clarity and  
2 volume, so that they can be readily heard.

3 We will now proceed with the meeting, and  
4 I call on Mr. Mark Tonacci of NRO to begin the  
5 presentation.

6 MR. TONACCI: Thank you Dr. Abdel-Khalik  
7 and members of the Committee. I hope that today we  
8 have a good dialogue, and productive dialogue, and  
9 that in the end, we've addressed all the questions and  
10 concerns that you may have. That is really the full  
11 extent of my opening comments, and I am ready to  
12 begin.

13 CHAIRMAN ABDEL-KHALIK: We'll move on to  
14 the Applicant, Scott.

15 MR. HEAD: Okay, thank you very much.  
16 Yes, today we're going to brief you on Chapter 7.  
17 Here's the proposed agenda for today. As you noted,  
18 we did brief last year on May 20th on Chapter 7.  
19 Discussion points for today, we want to discuss  
20 setpoint methodology, current Reg Guides and codes and  
21 standards applied to Common Q, and then this new FSAR  
22 Tier 2, Appendix 7 DS that we created, and go over  
23 that in some detail for you today.

24 The attendees shown on this slide. I will  
25 go ahead and use this moment to clarify the NINA

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1 perspective. On January 24th, the project  
2 transitioned from STPNOC being the applicant to NINA  
3 being the lead applicant, with STPNOC basically, S-T-  
4 P-N-O-C being the secondary applicant.

5 What that means is that NINA will be  
6 responsible, obviously after NRC approves, NINA will  
7 be responsible for the licensing, design and  
8 construction of the project, and at the 103(g) point  
9 in time, it will transition the STPNOC, S-T-P-N-O-C,  
10 to operate the plan. So that's the application that  
11 we now have in front of NRC. It came in in Rev 5 of  
12 the COLA.

13 With respect to maybe of more interest to  
14 you, your review and the staff's review, and  
15 individuals like myself, Mike Murray, Coley, others,  
16 STPNOC employees and right now loaned employees to  
17 NINA, and we will be continuing to fulfill the  
18 licensing role that we have had and we'll just be  
19 basically seeing that through.

20 So in terms of interactions and  
21 interactions with the staff, you should not see any  
22 change from that perspective. So that's the important  
23 message out of this transition, and the transition  
24 really reflects NINA's desire to not only build 3 and  
25 4, but to be involved in building future units also,

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1 assuming our success.

2 CHAIRMAN ABDEL-KHALIK: Thank you for that  
3 clarification. That's very helpful.

4 MR. HEAD: Okay, and with that, I'm going  
5 to turn it over to Mike Murray.

6 MR. MURRAY: I'm Mike Murray. I'm the IC  
7 manager for NINA in the STP 3 and 4 effort. When we  
8 say setpoint methodology, we have discussed it in  
9 previous meetings, but there was one open item, one  
10 item that needed to be addressed, and that was in the  
11 setpoint methodology, we had referenced a post-COL  
12 stability methodology report.

13 What we did was we moved the methodology  
14 into the -- that we would have expected to see in the  
15 stability report. We moved those type of calculations  
16 into the setpoint methodology. So that the setpoint  
17 methodology now incorporates the oscillation power  
18 range monitor, which was the follow-up item. So  
19 that's been completed.

20 Next slide. We continue to, and this next  
21 one is on the Common Q platform. Originally, our  
22 perspective was that we would use the original Reg  
23 Guides and industry codes that were when the Common Q  
24 platform was approved.

25 CHAIRMAN ABDEL-KHALIK: Can we go back to

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1 the previous slide?

2 MR. MURRAY: Certainly.

3 CHAIRMAN ABDEL-KHALIK: It doesn't specify  
4 which code will be used to generate the DIVOM curve,  
5 the methodology.

6 MR. MURRAY: I don't know the answer to  
7 that. The question is what code issues will the  
8 methodology?

9 CHAIRMAN ABDEL-KHALIK: Right. What code  
10 will be used to generate the DIVOM slope for this OPRM  
11 trip setpoint?

12 MR. MURRAY: We can get you that answer.  
13 Okay. I don't have that with me. Any other  
14 questions? The original Rev 4 guides that we had in  
15 our response was to use the original platform guide  
16 that were -- or the original guides that were in place  
17 when the platform was approved.

18 Since then, what we've done is we've gone  
19 through and we've eliminated those exceptions to the  
20 Common Q platform. So the Common Q platform, as we'll  
21 apply it to STP 3 and 4, we've committed to use the  
22 codes and standards in effect six months prior to  
23 submittal of the COLA. So it will be using the same  
24 codes and standards as the other digital platforms  
25 being developed.

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1 MEMBER BROWN: What's the date of that?

2 MR. MURRAY: When did we make that change?

3 MEMBER BROWN: Yes. You say six months,  
4 and I've forgotten what the dates were.

5 MR. HEAD: That MOA was -- I believe it's  
6 mid-March '07.

7 MEMBER BROWN: March '07.

8 MR. MURRAY: Well, what we've got now is  
9 alignment of the technical standards through all the  
10 digital I&C systems.

11 PARTICIPANT: Yes.

12 MEMBER BROWN: Ed, which -- I've got three  
13 revisions of the WCAT-1, 01 and 2. Which ones are you  
14 --

15 (Simultaneous speaking.)

16 MR. ED BROWN: This is Ed Brown from  
17 Westinghouse. It is Revision 1. Revision 2 has been  
18 submitted to the NRC. It has not been reviewed and  
19 approved.

20 MEMBER BROWN: Okay. So Revision 1 is the  
21 one you're all operating under?

22 MR. ED BROWN: Yes.

23 MEMBER BROWN: Okay, thank you.

24 MR. TONACCI: And Mr. Brown, your question  
25 was when was the COLA submitted?

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1 MEMBER BROWN: Well, when you said six  
2 months prior to submittal of the COLA, and so I just  
3 asked what was the date of the submittal of the COLA,  
4 and you said March '07.

5 MR. TONACCI: No. It was September '07.

6 VOICES: September 2007.

7 MS. BANERJEE: September 20th, '07.

8 MEMBER BROWN: Thank you.

9 MR. TONACCI: Six months prior to that is  
10 when you get into the March time frame.

11 MR. MURRAY: Okay. Any other questions  
12 sir? Next slide. Okay. We've also, throughout our  
13 processes, we received feedback where there was a  
14 simple task to find all the information on the digital  
15 I&C platforms.

16 MEMBER BROWN: Excuse me.

17 MR. MURRAY: Yes sir.

18 MEMBER BROWN: On the platform revision, I  
19 didn't want to read all three of them. Is there a big  
20 difference between 1 and 2? I looked at a few areas,  
21 and a couple of areas between Rev 2 and Rev 0, and I  
22 just wondered if it was a massive revision, or was it  
23 just cleaning up loose ends and consolidating some  
24 stuff?

25 MR. ED BROWN: In Revision 2, there are

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1 some additional information. For example, it  
2 discusses changes in equipment that since the original  
3 revision. That's one of the differences. Another  
4 difference is it describes the process used to  
5 evaluate changes to the hardware and software, to  
6 screen it for prior approval by the NRC, and those, I  
7 believe, were the major changes.

8 MEMBER BROWN: It came another way at the  
9 communication scheme, the whatever the memory thing  
10 was between AC, you know, and all that. Potentially it  
11 stays in that concept?

12 MR. ED BROWN: Yes. Functionally, it  
13 still operates the same, exactly the same, Charlie.

14 MEMBER BROWN: Okay, thank you.

15 MR. MURRAY: Move on to the next slide.  
16 So let's discuss -- what we did is we developed the  
17 appendix for the FSAR. We call it seven delta S or  
18 seven DS is what I refer to it as. Our purpose there  
19 was to consolidate information from various parts of  
20 the COLA, applicable technical reports and topical  
21 reports regarding the design principles, redundancy,  
22 independence, determinism, diversity and discretion on  
23 simplicity.

24 What we included or described, there were  
25 no new design changes or departures, and it was just

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1 consolidation of information. The scope included is  
2 the reactor trip isolation system and the safety-  
3 related neutron monitoring system, as well as the  
4 engineered safety logic and control system, which is  
5 implemented by the Common Q platform.

6 MEMBER BROWN: Do you expect the FSAR,  
7 this appendix to be implemented or included in the  
8 FSAR prior to receiving approval of your --

9 (Simultaneous speaking.)

10 MR. MURRAY: Yes sir, yes sir.  
11 Additionally, where we've had sections in the write-  
12 up, where we've had areas that have covered either  
13 ITAACs or DACs, what we've done is we've mapped over  
14 the specific design criteria as we discussed them, and  
15 made a table that relates it to inspectable DAC in the  
16 area there.

17 So that's the purpose of our seven DS.  
18 What we're going to do now is we're going to  
19 transition into discussions on the two platforms,  
20 specifically our overview, an overview of it,  
21 redundancy, independence, determinism, diversity.

22 What you have is a set of slides that are  
23 brought up. What I've got is for your convenience,  
24 the diagrams. So if we pass one, you can have it to  
25 look at as we continue the discussions through for

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1 convenience. So there should be a set of acronyms, as  
2 well as a set of slides, the slides that are in the  
3 presentation.

4 Okay. So let's go ahead and go on to the  
5 picture there. Okay. So you have a slide there.  
6 I'll just go to the slide, and it's better to see the  
7 picture as we work through this. We have the digital  
8 trip function, which is up at the top, and the digital  
9 trip function, and in this case what it does, and this  
10 is for the RTIS and NMS platform, it takes the -- it  
11 does the digital conversion from the hard-wired  
12 sensors into a digital space.

13 It compares the signals, the setpoints and  
14 determines the sensor trip status, trip and status.  
15 Then the next block down is the trip and logic  
16 function. It receives the sensors. It receives the  
17 input from the digital trip functions, and takes them  
18 in and performs the two out of four voting  
19 determinant. There's an automatic divisional trip  
20 required.

21 It sends the divisional trip and output  
22 information to the, what's shown there as an OLU,  
23 which an operating, output logic unit. The output  
24 logic unit then receives the automatic trip and  
25 divisional data, and then it redistributes it to the

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1 load drivers for reactor trip, and it does it for main  
2 steam isolation.

3 So that's the simplified picture of how  
4 the RTIS works.

5 MEMBER BROWN: If everybody didn't notice,  
6 I don't -- you didn't specifically state it, but the  
7 entire RTIS and the NMS is field-programmable data  
8 array implemented, there's a little word here on the  
9 previous page.

10 MR. MURRAY: That's correct.

11 MEMBER BROWN: You're just amplifying it?

12 MR. MURRAY: That's correct. Okay. So if  
13 you all use this, as we continue this out, keep your  
14 bearings on where we are. Some of the information is  
15 going to be redundant, in the fact that when you get  
16 into independence and redundancy, some of it overlaps  
17 in that area.

18 MEMBER BROWN: Is the overlap?

19 MR. MURRAY: Pardon?

20 MEMBER BROWN: Is the overlap new in FPGA?

21 MR. MURRAY: No sir. It's required not to  
22 be. Is that correct?

23 MEMBER BROWN: Is that explicitly stated  
24 in the FSAR?

25 MR. MURRAY: Yes.

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1 MR. DITTMAN: This is Kyle Dittman. I'm  
2 NINA's supervisor, I&C supervisor. The OLU is due to  
3 D-3 as a diverse type of logic. In this case, it's  
4 gated logic.

5 MEMBER BROWN: Just demand more data and  
6 all that kind of stuff? Okay.

7 MR. IKEDA: This is Jun Ikeda from  
8 Toshiba. What we have is based on the solid state I&C  
9 technology and the real logic.

10 MEMBER BROWN: Okay.

11 MR. MURRAY: So platform redundancy. In  
12 the NMS, there's four independent redundant divisions,  
13 it takes the -- brings the signals to, develops the  
14 trip signals and status to the divisions of RTIS.  
15 RTIS has four independent redundant divisions as well.  
16 Each includes DTF, TLF and OLU. We have some of the  
17 functions are divisions of sensors bypass, and also  
18 trip logic output bypass.

19 Get the divisions bypass, you go to a two  
20 out of three vote logic to accomplish the functions.  
21 Each division is an independent and redundant power  
22 sources. So the division 1 feeds division 1 channels,  
23 two power sources, two, three. So there are four  
24 complete redundant divisions there. Any question on  
25 redundancy?

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1           Let's talk about platform independence,  
2           and we're still talking reactor trip isolation and  
3           neutron monitoring system.           Four independent  
4           divisional power sources, independence from non-safety  
5           systems. Any communication to a non-safety system is  
6           isolated and independent.

7           Electrical isolation and physical  
8           separation, following the criteria that the design  
9           criteria is is isolated between the divisions as well  
10          as non-safety systems. Four independent RTIS and NMS  
11          sensor divisions, and that determines sensor  
12          divisional signals, trip signals.           There's no  
13          communication between the sensor divisions.

14          If you look at the block diagram again,  
15          you'll see that the DTFs do send the signals to the  
16          TLFs, but they don't communicate amongst themselves.  
17          The only trip and status information is communicated  
18          across the division boundaries, and that's for the two  
19          out of four voting logic functions.

20          There are four independent RTIS, TLFs and  
21          OLUs. So trip logic function and the output drivers  
22          are full of those. Communication isolation and  
23          independence is maintained there, as well as  
24          electrical isolation and physical separation. Any  
25          questions?

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1 (No response.)

2 MR. MURRAY: Now we'll discuss more about  
3 the independence of communication and the RTIS across  
4 the divisions. As we discussed, the DTS, when it  
5 sends their signals to the TLFs of the other  
6 divisions, communicates trip and status information in  
7 fixed link, fixed content and predefined format, and  
8 that's very important for finding errors in the  
9 messages.

10 It's qualified, isolated, point-to-point,  
11 unidirectional fiber communication, and each  
12 communication link has its own buffer for a memory  
13 buffer. Yes sir.

14 MEMBER BROWN: Okay. The -- make sure I  
15 get the question right. So this is like a field which  
16 us from the DTF to the other division, TLFs. So and  
17 I'm trying to think this through. It's not the  
18 equivalent of a dry contact open and closed. It  
19 actually has other intelligence, such as a header and  
20 footer and something in between that's supposed to  
21 contribute or communicate?

22 MR. MURRAY: It does have a header, but  
23 when you get into the message, it's almost like a  
24 contact, because in specific locations, it is either -  
25 - one is in that specific location. So once you get

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1 through identification of the message, then there's a  
2 predefined place for each command, and that command  
3 can either -- or not command; that's a bad term.

4 Piece of information. It's either a one  
5 or a zero, which gives you the trip status of that  
6 particular function, or the point status. It gives  
7 the vote.

8 MEMBER BROWN: Okay. Let me ask again.  
9 You've answered the question. Okay so, this is a  
10 single fiber optic wire cable that goes from channel,  
11 Division 1 to Division 2's TLF.

12 MR. MURRAY: Okay.

13 MEMBER BROWN: It goes into fixed  
14 locations, not like it has to be scanned or sampled.

15 MR. MURRAY: No.

16 MEMBER BROWN: It goes from Point A, like  
17 you say and has to go out of the other one.

18 MR. MURRAY: That's correct.

19 MEMBER BROWN: Yes, whatever the  
20 filtering, the buffering you do. What is the purpose  
21 of that header or is something giving it something.  
22 It sounds like an address as opposed to something  
23 that's not necessary to this.

24 MR. FUKUMOTO: I am Akira Fukumoto with  
25 Toshiba again. We do have a header or pipe header to

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1 identify the data piping, and then we do have some  
2 master coding here, and then we do check some goal to  
3 identify it. If we can't find the header, we will  
4 find something wrong in the communication.

5 So with this header we have a set of files  
6 containing the information. Those are the ones going  
7 to one to zero, showing trip status or other status.  
8 Did that answer your question? No?

9 MEMBER BROWN: Oh you probably did, but I  
10 didn't, I won't say I understood it, and you know it's  
11 coming out of Division 1 and it's going to the other  
12 divisions, three divisions, and it's a yes or no,  
13 respectively, and yet you're sending information in  
14 advance of the actual piece of critical information,  
15 which is a trip or non-trip.

16 I guess I'm trying, I was trying to figure  
17 out a reason, and as to why you did that, and I didn't  
18 know whether it was related to the synchronous  
19 operation within each divisions have PGA, they have  
20 PGA, they have PGA.

21 In other words, you have to coordinate and  
22 synchronize within that in order to get your data  
23 transfers and hand-offs, to stay deterministic, I  
24 think. I'm not an expert on this stuff. So I'm  
25 liable to say a lot of wrong things.

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1           When you go division to division, you're  
2 not synchronized between divisions, and so one of my  
3 questions later was how do you achieve a satisfactory  
4 data transfer between non-synchronized divisions? I'm  
5 trying to relate a little bit of the header, why you  
6 do it this way? It just seems an over-complication.  
7 And I'm not questioning that it won't work. That's  
8 not the point. I was just trying to get a better  
9 understanding of how it operates.

10           MR. FUKUMOTO: Each divisions in FPGA  
11 modules and the areas, and then you are right. We are  
12 not doing a synchronization among the divisions. When  
13 we send the data from DTF in the division to other  
14 three divisions across one more division, that's solid  
15 division.

16           This is the data by all fiber optic cable.  
17 That's all sending by in 20 seconds, and then the  
18 FPGA runs. For example, typically for full function  
19 it takes let's say a few, maybe 20 seconds. So the  
20 data transmission rate is very slow the second time  
21 because of processing. It's very time consuming.

22           So the transmission is made a signal, and  
23 if you look at those other divisions, other  
24 transmission is done in signals. In a receiving mode,  
25 you will attach the header to getting the data to the

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1 bottom.

2 From that point, the synchronization among  
3 the modules stops.

4 MEMBER BROWN: Within the TLF?

5 MR. FUKUMOTO: Yes, yes.

6 MR. MURRAY: So the header was the  
7 question. What is the purpose of the header; correct?

8 MEMBER BROWN: Well, it's varying the  
9 other question of how do you transfer the data, to get  
10 it to work properly? Looks like you did talk about  
11 within the division, you have to synchronize and  
12 orchestrate so the next FPGA doesn't do these things.

13 I was told that there's data available, okay, so but  
14 it's got to have proper plugging that it comes and  
15 looks for it at the right time, every cycle.

16 So I'm just -- so I was trying to figure  
17 out, because I presume you don't have headers all  
18 through the division. You only do it when you go from  
19 division to division? Is that, or just --

20 MR. FUKUMOTO: Let me explain.

21 MEMBER BROWN: It's starting to look more  
22 like a microprocessor, if I start throwing headers and  
23 footers and other stuff like that into it. That's  
24 all.

25 MR. FUKUMOTO: Here's a receiver, here's a

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1 sender. Sender don't know what is the status of the  
2 receiver. So this sender send the data periodically  
3 based on this synchronization. This one is really for  
4 the header, and knowing the header, it's diagnosed  
5 that is coming. So based on that information, this  
6 receiver take that data into the buffer. It's all  
7 deterministic by the hour.

8 And if this receiver complete getting the  
9 data from the transmission line to the buffer, then  
10 this guy send a pulse to the next FPGA. So that is  
11 how the divisions work.

12 MEMBER BROWN: So it's a non-synchronous  
13 synchronization at the time of data transfer. Is that  
14 -- I'm trying to simplify this down to something my  
15 simple brain can comprehend. Did I say that wrong? I  
16 mean it sounds like you're providing an ad hoc  
17 synchronization, but not requiring the other divisions  
18 be synchronized. You're starting it out when you want  
19 it to.

20 MR. FUKUMOTO: No synchronized.

21 MEMBER BROWN: All right. Why don't we go  
22 on?

23 MR. MURRAY: Yes. The next point we'll  
24 talk a little bit more about that as well, Mr. Brown,  
25 on the self-diagnostics, and I think that's where this

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1 package also plays in, that header plays into the  
2 self-diagnostic as well.

3 So the next point that we want to make is  
4 on the communication, includes that self-diagnostic  
5 function. It does the quality checks of the data when  
6 it comes in, and it continuously monitors for proper  
7 communications. So that's done in the receiving and  
8 the sending areas.

9 If it detects a failure, the division is  
10 marked inoperable. So if it doesn't get the right set  
11 of framing and communication as it's doing its parity  
12 and framing checks, then it will mark the division as  
13 -- that particular division as inoperable and then  
14 provide a fail-safe trip condition for the -- and the  
15 operator additionally is alerted.

16 MEMBER BROWN: Okay. I read that in the  
17 appendix.

18 MR. MURRAY: Right.

19 MEMBER BROWN: So that when -- is that  
20 within the divisions or the Division 1 or say Division  
21 2, if Division 2 TLF detects that the data sent to it  
22 is wrong? I didn't read that as having a cross-  
23 division. That would just be one data, one of four  
24 pieces of data that would be focused, and you would  
25 still operate on two out of three. So, you know, in

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1 terms of that division of voting?

2 That's -- but the trip function was if you  
3 get something within the division that's incorrect,  
4 then the division itself would be declared out of  
5 service?

6 MEMBER STETKAR: Suppose Division 2 now,  
7 okay, receives an identified corrupt packet from  
8 Division 1. Does Division 2 then interpret that as a  
9 Division 1 trip input signal to Division 2, such that  
10 within Division 2, you then need a coincidence of trip  
11 from Division 2 or Division 3 or Division 4 to satisfy  
12 a Division 2 output signal? Is that the way it works?

13 MR. MURRAY: That's correct. The message  
14 comes in and it's gone through, it goes through and  
15 gets the quality checks on the message, and at that  
16 point the quality checks are successful. Then it will  
17 flag that data --

18 MEMBER STETKAR: Division 2 data.

19 (Simultaneous speaking.)

20 MR. MURRAY: That's correct.

21 MEMBER BROWN: Thank you. That's what I  
22 was --

23 MR. MURRAY: Is that what you were looking  
24 for?

25 (Simultaneous speaking.)

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1 MR. MURRAY: On each input that is  
2 monitoring the quality of the data that's received,  
3 and if it's not, if it doesn't meet the quality  
4 checks, then it flags it as bad data, doesn't accept  
5 that data --

6 MEMBER STETKAR: So it's like in principle  
7 that Division 2 is looking at all four divisions. If  
8 it sees corrupt data from Division 1 and Division 3,  
9 that would satisfy the Division 2 output decision.

10 MR. MURRAY: If you had two divisions that  
11 gave the bad data, you would meet that --

12 MEMBER STETKAR: You wouldn't necessarily  
13 trip the reactor if the other three divisions are  
14 reading something as correct/incorrect. I don't know  
15 how that happens, but --

16 MEMBER BROWN: Going to one of the  
17 questions before, if Division 1 is sending its data to  
18 four different TLFs.

19 MR. MURRAY: Right.

20 MEMBER BROWN: And is it sent over four  
21 separate -- I presume it's sent over four separate  
22 fiber links.

23 (Simultaneous speaking.)

24 MEMBER BROWN: Yes, well yes.

25 MR. MURRAY: This is where the figure, if

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1 you look in the upper part, where the DTFs are sending  
2 to the TLFs, they say there that it's sending to its  
3 own divisional TLF, and then separate fiber optic  
4 links to each of the other TLFs.

5 MEMBER BROWN: Yes.

6 MR. MURRAY: Okay. So they are separate  
7 lines, separate receives, separate buffers. The  
8 diagnostics looked at each one of the --

9 (Simultaneous speaking.)

10 MEMBER BROWN: Okay. That gives --

11 MR. MURRAY: Did I get you there?

12 MEMBER BROWN: Yes. That's what I was  
13 expecting, based on my --

14 MEMBER STETKAR: And each division is  
15 physically separated --

16 MEMBER BROWN: I just didn't know whether  
17 they had a common, a common connection going through  
18 it. It just wasn't obvious.

19 MR. MURRAY: Okay. Starting into the  
20 discussions, so we finished the independence  
21 discussions. We're talking to determinism in the FPGA  
22 platforms. The FPGAs are -- they're a synchronous  
23 clock-sequential circuit. Each FPGA, it only starts  
24 processing if it's seen a completed, completion from  
25 the previous, so they work in a series.

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1           So each only starts when the data is  
2 transferred into the FPGA, and sends the data to the  
3 next module when the process is complete. So it's a  
4 set up with timing. Changes in state occur only at  
5 selected control timing signal. This is within that  
6 functional unit.

7           All FPGAs perform a signal processing  
8 functions. Modules are monitored by a watchdog timer  
9 looking for timeouts and it's a hardware-based  
10 watchdog timer that will again sense that if there's a  
11 stoppage in that process, it will sense it. When it  
12 times out, it marks the module as inoperable again, if  
13 it's a trip signal in for that particular function,  
14 and the operator is alerted.

15           MEMBER BROWN: Okay. I think that answers  
16 one of my other questions, but let me make sure that -  
17 - you didn't explicitly state that the diverse  
18 hardware-based, because I don't remember reading that  
19 or not. So you answered the question here about it,  
20 but it's not --

21           One of my questions is is that going to  
22 be, is it built -- it's not part of the FPGA. You  
23 say it's diverse. To me, that means it's a separate  
24 piece of hardware that monitors the FPGA; is that  
25 correct or not?

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1 MR. FUKUMOTO: Each module has a watchdog  
2 timer, and watchdog timer is included in the IC, not  
3 FPGA. That watchdog timer is in the module.

4 MR. MURRAY: It actuates -- is it a  
5 contact actuation within the module? The contact  
6 actuation within the module hardware?

7 MR. ED BROWN: Yes. It's a circuit. So  
8 it's a circuit in the ICs.

9 MEMBER BROWN: Okay. Well, page eight is  
10 where you talk about that in the first paragraph, and  
11 that's it. There is no other reference in there, and  
12 I couldn't find it anywhere else in chapter, in FSAR.

13 So I mean the issue of being a separate hardware and  
14 watchdog timer that's not built into the FPGA function  
15 itself.

16 It's part of the module where they're  
17 housed, but it's not embedded in the FPGA itself.  
18 It's not addressed. Either that or am I reading it  
19 incorrect?

20 MR. MURRAY: I see what you're saying. We  
21 did discuss the watchdog -- we did discuss the  
22 watchdog timer in that paragraph, that's right.

23 MEMBER BROWN: And I didn't -- I went off  
24 in key word. Hopefully, I got the right key words.

25 MR. MURRAY: You looked at the hardware?

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1 MEMBER BROWN: I did not find anything in  
2 the rest of the FSAR that discusses the diverse  
3 hardware-based functionality of that, which I think is  
4 important to the overall operation.

5 MR. MURRAY: Okay. Did we answer your  
6 question on that?

7 MEMBER BROWN: Yes. Yes, you did.

8 MR. MURRAY: Okay.

9 MEMBER BROWN: As long as it gets  
10 incorporated somewhere.

11 MR. MURRAY: I understand.

12 MS. BANERJEE: Are we taking -- this is  
13 Maitri Banerjee. Are we taking any action item on  
14 this?

15 MR. MURRAY: Yes. We'll respond to that.

16 MR. HEAD: Do we intend toward revising  
17 that?

18 MR. MURRAY: No.

19 MR. TONACCI: This is Mark Tonacci. I'm  
20 sorry. I didn't catch what the request and the action  
21 is going to be there. Can you repeat that please?

22 MEMBER BROWN: One of my questions, based  
23 on reviewing the appendix and the other parts of the  
24 FSAR Rev 4 that was sent out with Chapter 7, was to  
25 look at the watchdog timer and was it independent

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1 hardware and diverse from the FPGA itself, and the  
2 answer is yes. So I went and looked and say is that  
3 anyplace? I asked that question, so I looked in the  
4 other locations. Now whether I found them all, I  
5 don't know. If it's in the FSAR, that's fine. If  
6 it's not, the need for it to be independent and  
7 hardware-based and diverse ought to be in the FSAR.  
8 That's the question.

9 MR. TONACCI: So you're asking for us to  
10 put that information in the --

11 MEMBER BROWN: If it's not there, yes. If  
12 it's not there.

13 MR. TONACCI: And I think I heard STP  
14 saying they're willing to do that.

15 MR. MURRAY: We will.

16 MEMBER BROWN: I didn't hear them say  
17 that.

18 MR. MURRAY: Yes. We agree, that if  
19 that's a bullet factor which we also agree the  
20 hardware diversity there is, that we will take an  
21 action to incorporate it.

22 MEMBER BROWN: Now does the part, does the  
23 watchdog timer, all that uses is just solid state  
24 logic circuits. I take it the watchdog timer ceased  
25 their operations with the FPGA, or did they -- is

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1 there anything in the entire division that you can,  
2 you know, for completing -- I probably think it  
3 would, but I'm just asking the question. Does it stop  
4 at the watchdog timers, the modules that have the FPGA  
5 circuits.

6 MR. FUKUMOTO: Watchdog timer, we put the  
7 watchdog timer in the module. Which through the  
8 essential central processing for safety conscious, and  
9 in watchdog timer, it operates with the --

10 (Simultaneous speaking.)

11 MEMBER BROWN: Okay. So it feeds -- if it  
12 doesn't, if you have a watchdog timer operation, it  
13 feeds the OLU and says hey, go do something?

14 MR. FUKUMOTO: Yes.

15 MEMBER BROWN: But the TLF has a watchdog  
16 timer as part of it, since it's FPGA?

17 MR. FUKUMOTO: Yes.

18 MEMBER BROWN: Okay, and the operation of  
19 the watchdog timer doesn't bypass the OLU and go  
20 directly to the load drivers? It goes into the OLU  
21 and then to the load drivers in terms of triggering a  
22 trip?

23 MR. FUKUMOTO: Let me confirm with my  
24 Japanese authority, sorry.

25 (Off record discussion.)

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1 MR. FUKUMOTO: Yes, sorry. The output of  
2 the, you know, watchdog timer goes to TLU, and TLU  
3 commands, you know.

4 MEMBER BROWN: Well, the TLU is really a  
5 TLF.

6 MR. FUKUMOTO: TLF, TLF.

7 MEMBER BROWN: But the TLF is also in  
8 FPGA. So I presume it has its own watchdog timer.

9 MR. FUKUMOTO: That's right, it does.

10 (Simultaneous speaking.)

11 MEMBER BROWN: So look at something after  
12 that. So it can't feed itself. It's got to do  
13 something else. I'm just trying to figure out where  
14 the watchdog timers execute the designation of the  
15 division as being a trip.

16 MR. MURRAY: And send that to the OLU, is  
17 what I understood from he just, Mr. Fukumotoson said.

18 MEMBER BROWN: All right. Just a standard  
19 solid state line and then you allow process after  
20 that. Okay, all right. You can go on. Thank you.

21 MR. MURRAY: And then the last bullet on  
22 this particular slide is that the timing is verified  
23 by analysis and simulation during the design process.

24 So in platform diversity, RTIS/NMS  
25 platforms are diverse from the engineered safety

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1 features.

2 MEMBER BROWN: Oh, I might as well cover  
3 this one as well, since we're talking about the  
4 timing analysis.

5 MR. MURRAY: Okay.

6 MEMBER BROWN: That's also covered on page  
7 eight, and you refer to Notes 8 and 10 in the table,  
8 which you refer to, where it performs the correlation  
9 over to the ITAAC and back, and those two particular  
10 notes reference DAC 8G and H, and number 11. In  
11 looking at those, there was no change in those from  
12 the old, original DCD approval document in 1993.

13 So they're very, very general and process-  
14 oriented. There's no reference to timing. You won't  
15 find the word in there anywhere, in terms of  
16 confirming the overall timing analysis, which is  
17 critical for a deterministic type performance.

18 All I'm saying is that the deterministic  
19 nature or that need to verify does not explicitly  
20 state it in those DAC items. Now I went back and read  
21 this. The only ones that change are something like  
22 three and four and 11 and 12 or 12 and 13, and this  
23 number 8 and number 10. It's number 8, number 11, and  
24 neither of those had any modifications at all relative  
25 to the whole change in FDDI multiplexing and to the

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1 platforms you have now.

2 MR. MURRAY: And the reference to Note 16,  
3 you just said it was on page eight also?

4 MEMBER BROWN: Yes. You'll see a little  
5 note, second paragraph, the little superscript.

6 MR. MURRAY: Yes.

7 MEMBER BROWN: And then on the next one,  
8 it says superscript 10. If you go into find it, it  
9 refers you to the DAC paragraphs and so I went and  
10 looked at those.

11 MR. MURRAY: And what we've done there is  
12 we've provided the criteria in the FSAR, that's about  
13 the timing and the existence of the timing report. We  
14 pointed it to that DAC, so that you can make that  
15 match back to say --

16 MEMBER BROWN: But you use in these  
17 paragraphs --

18 (Simultaneous speaking.)

19 MR. MURRAY: That is correct, that is  
20 correct.

21 MEMBER BROWN: --to those particular DAC  
22 requirements.

23 MR. MURRAY: Right. So the FSAR will say  
24 these are the important pieces for this particular  
25 design criteria, and it quotes to the DAC. Then you

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1 can cross back and say where can I find the answer to  
2 this question? You go back to the FSAR section, and  
3 it gets you to those, the timing test, description of  
4 the timing. Those are the areas that we cover for  
5 meeting that requirement.

6 MEMBER BROWN: Okay. So by incorporating  
7 this cross-reference table in here to that effect, but  
8 you do include the --

9 MR. MURRAY: That's correct.

10 (Simultaneous speaking.)

11 MEMBER BROWN: Okay.

12 MR. MURRAY: That's fine. So it points  
13 back to the critical reference -- okay. So now we're  
14 moving on to platform diversity. We talked, I think,  
15 first where ESF and reactor trip and makes the  
16 isolation in neutron monitoring, and the systems are  
17 diverse in the ESF function.

18 The RTIS and NMS is diverse for non-safety  
19 balance of plant functions. They're not the same type  
20 platforms. So they're diverse as well. RTIS is  
21 diverse also, as required, from the ATWS circuitry as  
22 well, which is done with relays and relay logic. Any  
23 question on diversity?

24 (No response.)

25 MR. MURRAY: Simplicity, these are our

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1 thoughts on simplicity of the system. Separation of  
2 the safety and non-safety functions. There are no  
3 non-safety functions that are going on in the safety  
4 platforms.

5 Complex activities for calculation of, for  
6 reactor core physics type calculations, they're not  
7 done in this system. It's done in the non-safety  
8 system, so it doesn't complicate or make this system  
9 complex.

10 Uses the non-rewritable FPGA technologies.  
11 Its function uses fixed gate and deterministic  
12 timing, and that timing can't change short of the  
13 design process and redesigning --

14 MEMBER BROWN: But you changed -- I just  
15 wanted to confirm. You changed the design or one of  
16 your algorithms that you used to burn the FPGA. You  
17 want to do that, a modification. You then have to  
18 take the FPGA out and put a new one in.

19 MR. MURRAY: That's correct.

20 MEMBER BROWN: That's my understanding. I  
21 just wanted to make sure of that.

22 MR. MURRAY: You would design the module  
23 to take the place of that functional module that you  
24 were using previously, and it would be redesigned to  
25 implement those modified functions that were required.

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1                   And                   there's                   interdivisional  
2                   communications.   It's only, only where it's necessary  
3                   to get two of four coincident logic, from a  
4                   simplistic perspective.   Any questions?

5                   (No response.)

6                   MR. MURRAY:   I'd like to transition now  
7                   into the ELCS platform, and again, this is --I'll go  
8                   through an overview of redundancy and talk about  
9                   independence, determinism, diversity and simplicity  
10                  also.

11                  In here, I'll bring focus to the diagram's  
12                  page 18 slide that you have on your supplemental  
13                  slides there, and page 19, which are 7 delta S-3 and 7  
14                  delta S-4.   So let's move to four, or to the next  
15                  slide, Craig, and then we'll back up to here, because  
16                  we don't need to talk too much about this slide.

17                  We just wanted to make sure, because of  
18                  the fact that when we get into the ESF area, it's a  
19                  little different in the fact that we've got sensor  
20                  divisions.   We have four sensor divisions, but then it  
21                  goes into three ESF divisions.   So that's the purpose  
22                  of this slide, and also it shows the interrelationship  
23                  there.   Any questions on that?   Again, four sensor  
24                  divisions.   Signals go into the SLS for the three ESF  
25                  divisions, to carry out the three divisions of ESF

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1 functions.

2 Okay. So now we back up to the other one,  
3 if that's okay. Okay. Now in here, looking through  
4 the flow of it, the simplified flow here, we have the  
5 digital trip function, remote digital logic  
6 controllers. These will be in remote locations, and  
7 they do data acquisition. This where the conversion  
8 from analog to digital will happen.

9 That's set to the digital trip function,  
10 which it compares, and this is the point where the  
11 predetermined setpoints are compared to the process  
12 values, and the safety function initiation status for  
13 that division is developed.

14 Then it sends all of the divisions, the  
15 four sensor divisions then send it into the sets of  
16 SLFs, which are division order as well. So the DTFs  
17 send their signals to the SLFs. The SLFs then do the  
18 two out of four vote function.

19 Then get back then, progressing down  
20 through it, if the safety logic function remote  
21 digital controller, it receives the system level, the  
22 system level automatic and manual system actuation  
23 signals to the -- from the SLFs.

24 Then it provides the logic to determine  
25 the component actuation, control functions, commands

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1 to the final vote function, which is shown at the very  
2 bottom, okay. In the final vote function, it receives  
3 the individual inputs from the -- for the component  
4 actuations and controls, and it also performs the two  
5 out of two where necessary, and we've had that  
6 discussion previously.

7 MEMBER STETKAR: And that's documented in  
8 Chapter 16, those drawings?

9 MR. MURRAY: Right. We had had that  
10 previous discussion about where --

11 (Simultaneous speaking.)

12 MEMBER STETKAR: Right. That's not all of  
13 them.

14 MR. MURRAY: Not all of them, that's  
15 correct. So we want to make sure we pointed that out  
16 in the presentation. Okay.

17 MEMBER BROWN: Just a minute. Not all the  
18 -- not all functions are two out of two.

19 MEMBER STETKAR: Not all safety functions.

20 MR. MURRAY: That's right.

21 MEMBER STETKAR: That's the point. ADS,  
22 for example, is definitely two out of two.

23 MR. MURRAY: That's correct. Those  
24 consequential --

25 MEMBER STETKAR: Some others are one out

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1 of one.

2 MR. MURRAY: And some of the voting, two  
3 out of two voting is done with component and valve,  
4 for example, that it may not be with the voting in the  
5 final device, but by system voting. It has to have  
6 both, to this and that, in order to do the function.

7 MEMBER STETKAR: Well, each individual  
8 component might be just a single signal.

9 MR. MURRAY: That's correct.

10 MEMBER STETKAR: A single signal to start  
11 a function, but if the valve doesn't open to --

12 MR. MURRAY: That's correct, and some will  
13 be two of two voting to the components. That's right.  
14 You have a good understanding from our previous  
15 discussions.

16 (Simultaneous speaking.)

17 MR. MURRAY: Yes sir?

18 MEMBER BROWN: I want to make sure I  
19 understood how that worked. Within your picture up  
20 here, all of the SIMs operate based on a two out of  
21 two of the two RDLCS.

22 MR. MURRAY: This typical picture we show,  
23 that you would -- it looks for two of two out of the  
24 SLF RDLCS.

25 MEMBER BROWN: All of those have to go in

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1 order to tell the SIM to actuate a safety function  
2 from that, one of those three divisions?

3 MR. MURRAY: And that's correct. If one  
4 of the, for example, logics are bypassed, then the SIM  
5 is in a one out of one logic when it has that bypass.

6 MEMBER BROWN: Yes. I got that. Now each  
7 division feeds some number of safety functions,  
8 whether it be an ADS command to actuate or a HP  
9 something, whatever, that other thing --

10 MR. MURRAY: High pressure core flooders.

11 MEMBER BROWN: Yes, core flooders or  
12 whatever the number of them are, and you made the  
13 comment in the FSAR that -- in the appendix, that not  
14 all of them, not all of the safety functions are fed  
15 by all three divisions. I can --

16 MR. MURRAY: Right.

17 MR. SWANNER: Yes, that's correct.

18 MEMBER BROWN: What I meant by that is  
19 like the ADS thing. Apparently only two divisions --

20 MR. MURRAY: Two divisions.

21 MEMBER BROWN: --would give a parallel  
22 command to start, for the ADS function to operate.

23 MR. MURRAY: Right.

24 MEMBER BROWN: Others may require all  
25 three, may have three divisions to command. I don't

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1 know --

2 (Simultaneous speaking.)

3 MR. MURRAY: There are some --

4 MEMBER BROWN: I'll have to find a list of  
5 saying which functions have required two divisions,  
6 which ones require only one, which ones require three.  
7 I couldn't find it.

8 MEMBER STETKAR: They pointed us, I think  
9 -- let them answer.

10 MR. SWANNER: There's actually, I think,  
11 two questions here, but there's maybe more. But we'll  
12 start with these two. The first question is how many,  
13 you know, where are the functions of ECCS and how many  
14 divisions there are, and which divisions are on which  
15 division of ELCS.

16 ECCS is broken into three divisions,  
17 excuse me, lower pressure core flooders is in all three  
18 divisions. There are three divisions of that. There  
19 are three divisions of diesel, so they're in each of  
20 the divisions.

21 In ADS, there's only two divisions  
22 necessary, so they only operate on SLF-1 and 2, and  
23 then there is no ADS function on SLF-3, because there  
24 --

25 MEMBER BROWN: SLF-3?

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1 MR. SWANNER: Well, the third division of  
2 ELCS.

3 MEMBER BROWN: You mean the third division  
4 of ELCS?

5 (Simultaneous speaking.)

6 MR. SWANNER: Yes, that's correct.

7 MR. MURRAY: Yes, division.

8 MEMBER STETKAR: It might help, if you  
9 don't have the figure, there's a Figure 7.1-2 --

10 (Simultaneous speaking.)

11 MEMBER STETKAR: That shows what you're  
12 talking about now.

13 MR. SWANNER: That's exactly what --

14 MEMBER STETKAR: That's the easiest to see  
15 the allocation of functions among divisions.

16 MR. SWANNER: FSAR and what Member Stetkar  
17 said was FSAR, Tier 2 Figure 7.1-2 provides a listing  
18 of which ESF functions are on which division of ELCS.

19 (Simultaneous speaking.)

20 MR. SWANNER: That say -- basically it  
21 shows, and let me get to here. It shows Division 4  
22 without any ELCS. Okay.

23 MEMBER BROWN: I understood that. That  
24 part I understand. There's only three divisions that  
25 actuate.

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1 MR. SWANNER: And your next question,  
2 moving a little bit forward, was which functions  
3 require a two out of two vote, and which functions  
4 require only one out of one vote, and that's a  
5 different question. Each function like low pressure  
6 core flooders, Alpha initiation of that pump, all these  
7 functions are listed in the technical specifications,  
8 in Section -- Tech Spec Section 3314.

9 In that section, in the bases for the tech  
10 spec, it identifies which function has redundant  
11 voters and which has only one voter.

12 MEMBER STETKAR: Yes. Now the reference  
13 is you don't have any more figures. It's Chapter 16,  
14 tech spec bases, Figures B.3.3.1.4-1 through -5.

15 MR. SWANNER: Yes. I apologize for that.

16 (Simultaneous speaking.)

17 MEMBER STETKAR: -- to try to figure it  
18 out.

19 MEMBER BROWN: Well, I think you found the  
20 low pressure core flooders even listed in the 7.1-2.  
21 So there's no LP.

22 MR. SWANNER: It's probably called in that  
23 figure RHR, for residual heat removal.

24 (Simultaneous speaking.)

25 MEMBER BROWN: Oh, okay. All right.

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1 MR. SWANNER: Those pumps have multiple  
2 functions, one of them being residual heat removal,  
3 one of them being low pressure core flooders.

4 MR. MURRAY: So the assigned functions are  
5 distributed through the division, D division for the  
6 assigned function off of the -- from the SLFs that are  
7 required to complete those functions.

8 MEMBER BROWN: Okay.

9 MR. MURRAY: So then we start asking why -  
10 -

11 (Simultaneous speaking.)

12 MEMBER STETKAR: Well, there's apparently  
13 a reason. I understand ADS, okay.

14 MR. MURRAY: So what we covered just then  
15 was basically Slide 17 that we passed by, which is  
16 this. We just went through the flow using the diagram  
17 for explanation, because it was just easier to follow  
18 the diagram.

19 So with that, let's move to Slide 20,  
20 thank you, and let's talk about ELCS redundancy.  
21 There's four, again four independent redundant sensor  
22 divisions, as we discussed, three independent ESF  
23 divisions, and it does safety function system level  
24 initiation as well as actuation and control for that  
25 particular division's components.

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1 Four independent redundant divisional  
2 power supplies. They're the power supplies that feed  
3 -- power sources, excuse me, that feed the Division 1  
4 are independent and from the Division 2 power sources  
5 3 and 4. Any questions?

6 (No response.)

7 MR. MURRAY: 21. ELCS independence, and  
8 as we come down, we'll transition into the  
9 communication independence. There will be another  
10 slide that we'll transition into for that section.

11 MEMBER BROWN: Well, let's go back one.

12 MR. MURRAY: Okay, yes sir.

13 MEMBER BROWN: I think.

14 MR. MURRAY: Redundancy, Slide 20?

15 MEMBER BROWN: No. It's on bypass. Go to  
16 the figure on that one.

17 MR. MURRAY: Sure.

18 MEMBER BROWN: Okay. I'm going to have to  
19 wing it and write it down. You talk about bypass of  
20 sensors and how that takes out a division, in terms of  
21 visibility, to develop an actuation signal.

22 MR. MURRAY: Yes sir.

23 MEMBER BROWN: And then bypass of sensors  
24 to me means the first little circles of X's and the  
25 next box, the DTF.

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1 (Simultaneous speaking.)

2 MEMBER BROWN: If you think of what you're  
3 taking out, they'll do the voting from all the other  
4 divisions.

5 MR. MURRAY: That's correct. You do  
6 bypassing of the sensor portion of it. So I could  
7 bypass Division 4 sensors and the Division 1, 2 and 3  
8 would then be voting on 2 and 3, develop signals,  
9 completely completing the functions.

10 MEMBER BROWN: Okay. If a -- is there a  
11 bypass for the entire division?

12 MR. MURRAY: There's a separate bypass for  
13 the logic, the SLF down. There's a separate bypass  
14 for it, and there's -- in this case, you could bypass  
15 either SLF Alpha, shown in that drawing. I'll just go  
16 back to the other ones. It's probably easier to see.

17 If you go SLF down, you could bypass that  
18 logic for the ESF, and then you could also bypass the  
19 Bravo side. So you can bypass those separately. So  
20 if I bypass the Alpha side, I'd have functionality  
21 through the Bravo side that's shown there, to complete  
22 the function as well, and when this is bypassed, I  
23 think it goes to one out of one on the SIM.

24 So I have the ability to test and bypass  
25 the logics with the redundancy, and I also have the

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1 ability to go to one out of one if that bypassed  
2 logic. So I can take -- since there's two different  
3 defined bypasses, sensor function bypass, which is  
4 what we describe first when you asked your question,  
5 and then there's the logic bypass.

6 MEMBER BROWN: Okay. There's a -- is  
7 there a circumstance under which a division could be  
8 out of service, and still remain, the plant could  
9 remain operational? In other words, you don't have  
10 any other. Can you operate under that circumstance?

11 MR. SWANNER: Yes, yes.

12 MEMBER BROWN: Are those safety functions  
13 which only have two actuations, that's the EDFs, that  
14 would mean that I don't have redundancy.

15 MR. MURRAY: The technical specifications  
16 have those rules. That's where you go. You drive  
17 down to the technical specifications. It has rules  
18 for out of service logic bypass, and then it would  
19 have rules for basically your requirements for, I'm  
20 trying to remember the term, and I've lived in  
21 operating plants so much.

22 MR. SWANNER: Limited conditions for  
23 operations.

24 MR. MURRAY: Limited conditions for  
25 operations. So that's where it drives you, what those

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1 requirements are.

2 MEMBER BROWN: I'm going to go back to the  
3 original DCD, Chapter 14.

4 VOICES: Sixteen.

5 MEMBER BROWN: Sixteen, and I'll have to  
6 admit I thought of this late enough that I was not  
7 able to gain a good understanding. I finally found  
8 the one on Instrumentation, OOSs and stuff.

9 But I couldn't find the delineation of a  
10 whole division. I found the breakdown on the sensors.

11 I never saw the whole division and that's -- if it's  
12 -- I'm going to have to take your word for it, I  
13 guess. But that's not a negative comment.

14 MR. MURRAY: I understand that was Craig.

15 (Simultaneous speaking.)

16 MEMBER BROWN: A whole division is out of  
17 service. Somewhere that's specified in that chapter.

18 MR. MURRAY: It may be function by  
19 function specified.

20 MEMBER BROWN: Well, I wouldn't look at  
21 the functions, you know. I picked one or two of them,  
22 the ADS and then I look at the HDCF, not knowing which  
23 ones was which, which ones just had two, or the HPCF,  
24 and those are under the functional safety aspects and  
25 really didn't address the instrumentation system being

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1 out of service.

2 Although I guess if you think about one,  
3 it now takes one -- it takes one of the redundant  
4 paths out. Maybe that's -- but the date, the time for  
5 those was long. It was like days, as opposed to some  
6 of the other stuff was in the category of hours to be  
7 out of service, on the instrumentation side.

8 And it seemed incongruous to have an ADS  
9 system out of service for seven days or something like  
10 that, or HDCF out of service. Anyway, we can go on.  
11 I can do it. I guess I can have somebody explain that  
12 to me out of this meeting.

13 MR. COLEY: We need to understand maybe a  
14 little bit more about the question. So when you ask -  
15 -

16 MEMBER BROWN: A whole division of  
17 instrumentation is out of service. Say it's the ADS  
18 and it feeds the ADS. So that means you've only got  
19 one ADS division that can actuate the ADS. So you  
20 don't have redundancy for it. If you have, if you're  
21 operating with that out of service, you now can assume  
22 one of the other ones failed.

23 MR. COLEY: Well, there should be an  
24 instrumentation spec that covers ADS function, as well  
25 as an ECCS specification that covers ADS.

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1 MEMBER BROWN: Yes, and they are. They  
2 are there. I just said I couldn't find one that  
3 covered the whole division being out of service. I  
4 didn't have --

5 MR. SWANNER: There are some.

6 MR. COLEY: They're broken down by  
7 function, and if you take ADS as an example, it's  
8 broken down by function. So you can look at the level  
9 function, you can look at the drywell pressure  
10 function that ties in, for example.

11 MEMBER BROWN: So if I look for ADS out of  
12 service, a whole system out of service, that would  
13 give me my answer?

14 MR. COLEY: If you look at the  
15 specification, for example, 3.3.1.1, 3.3.1.2, I forget  
16 where it is exactly, the functions are delineated and  
17 will show what that function's for. So if we lost a  
18 division or an entire division of sensors, then it  
19 would impact a number of functions, and those  
20 functions would be used to determine the operability  
21 of the systems.

22 MEMBER BROWN: Yes, I can look.

23 MR. SWANNER: Sensor channels are in  
24 3.3.1.1. The actuation for ESF is in 3.3.1.4.

25 MEMBER BROWN: Yes.

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1 MR. SWANNER: Okay. When you try to pull  
2 those, when you try to pull a full division out, it's  
3 in ECCS. That's a separate specification. That's in  
4 3.6.1, and it permits various different pumps, you  
5 know, pumps, whole trains to be out. So if you take  
6 out a full division, that's a specification that would  
7 end up --

8 MEMBER BROWN: Yes, I saw that, and I  
9 looked at that, and I finally figured out I wasn't  
10 looking for that, and then I never got back to it.  
11 But I finally figured out what I was looking for.

12 MR. HEAD: And John, you should I think  
13 help us here. I mean interpreting the tech specs and  
14 what you -- what action statement you're in, you can  
15 be in different places, and you could take some out  
16 and have a number of different functions out, and the  
17 time would be limited to whatever the sort of time  
18 frame is.

19 So there's, somehow the tech specs are  
20 going to work exactly like the current operating  
21 specs, and the operators are going to have to go in  
22 and say okay, this is inoperable. I may be in this  
23 ECCS spec, I may be driven by something else. The  
24 time would be whatever is the shortest that they'll be  
25 dealing with.

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1 MR. SWANNER: That's right.

2 MR. MURRAY: To restore that function  
3 that's specified. Go ahead and move on?

4 CHAIRMAN ABDEL-KHALIK: Yes, move on.

5 MEMBER STETKAR: I know what? I looked at  
6 this a long time ago and I've forgotten --, but as  
7 long as Charlie raised the question, the tech specs do  
8 allow me to have a sensor division out of service  
9 coincidentally with a logic channel in another  
10 division. For example, I would have Division 1  
11 sensors bypassed and Division 2 logic bypassed  
12 simultaneously, right? Is that true? Are they  
13 explicitly prohibited --

14 MR. HEAD: I never offer an opinion  
15 normally on tech specs, unless I'm looking at them.  
16 That's just my training.

17 (Simultaneous speaking.)

18 MEMBER STETKAR: -- I believe you  
19 understand what I was talking about.

20 MR. HEAD: Well, right. But you still,  
21 you wouldn't trust what I said, I'm sure, unless we  
22 were both staring at them. So that's, you know.

23 I would imagine as time has moved forward  
24 since the 80's, that some of the risk insights would  
25 allow certain configurations to happen for certain

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1 periods of time, just because, you know, we've applied  
2 the risk insights as to the probabilities during those  
3 time frames and the remaining functionality of the  
4 rest of the equipment.

5 But actually I wouldn't offer on what's  
6 actually in there right now, unless I was staring at  
7 it.

8 MR. MURRAY: From a practical perspective,  
9 having the sensor division out, you still have three  
10 functional sensor divisions to carry about that  
11 function, and with the logic out, you still have the  
12 other two channels that have got --

13 MEMBER STETKAR: I'm just interested, you  
14 know, in terms of the tech spec, since we're talking  
15 about tech specs, what is sort of the minimal  
16 configuration that the tech specs will allow you to  
17 legally be in, you know.

18 You obviously can't have ten sensor  
19 divisions out at the same time, if I recall that. I  
20 think that's true. I'm not quite sure if that's true.

21 Anyway, that's -- and I'm trying to look up things  
22 real time here.

23 (Simultaneous speaking.)

24 MEMBER STETKAR: The tech specs are 155  
25 pages between the changes and --

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1 MEMBER BROWN: Are we going to have -- I  
2 think there's a change to Chapter 16. Is there going  
3 to be another meeting on Chapter 16?

4 MS. BANERJEE: Yes. I think it's next  
5 month, if I remember correctly.

6 MEMBER STETKAR: It seems so. I've only  
7 got Rev 3 and 16 also is my problem. I don't have Rev  
8 4.

9 (Simultaneous speaking.)

10 MEMBER STETKAR: So we'll get a chance to  
11 --

12 MEMBER BROWN: That's why I said we ought  
13 to go on, and I can try to --

14 CHAIRMAN ABDEL-KHALIK: We'll look at  
15 Chapter 16 on March 9th.

16 MEMBER BROWN: In March? Okay. Oh, March  
17 9th. I'll be back.

18 CHAIRMAN ABDEL-KHALIK: Please continue.  
19 What page are we on?

20 MR. MURRAY: I'm on page 20.

21 (Laughter.)

22 MR. MURRAY: So we've discussed, I think  
23 we've discussed all of this slide, that we have the  
24 independent redundant divisional power sources, I  
25 think, is where we are going to. Actually on 21 is

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1 where we need to be now.

2 So we're getting into the ELCS  
3 independence discussion, and the independent power  
4 sources again fit into the picture, as well as the  
5 independence from the non-safety system, electrical  
6 isolation, physical separation from non-safety.

7 Four independent ESF sensor divisions,  
8 we've discussed that. Three independent safety  
9 functional actuation systems with electrical  
10 isolation, physical separation. So we've discussed  
11 that. In the communication independence, we'll  
12 transition into the next few slides that talk more  
13 about that. The safety-related communications are  
14 isolated in independent, and non-safety related  
15 communications are isolated in the independent as  
16 well. These are fiber optics.

17 So in this next slide, we'll talk a bit.  
18 In it, we're talking about the communications, and  
19 once you have a picture of it, it's a very simplified  
20 diagram that we consider non-proprietary, of how an  
21 ELCS controller functions.

22 MEMBER STETKAR: Mike?

23 MR. MURRAY: Yes.

24 MEMBER STETKAR: Before we get too deep  
25 here, I'm trying to look ahead. Are you going to talk

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1 about the maintenance and test platform communications  
2 at all?

3 MR. MURRAY: We didn't have a slide for  
4 that.

5 MEMBER STETKAR: Okay. Let me ask you  
6 about that then, while I'm interrupting.

7 MR. MURRAY: Okay.

8 MEMBER STETKAR: Each division has its own  
9 maintenance and test panel that's online, continuously  
10 connected operating; is that correct?

11 MR. MURRAY: That is correct.

12 MEMBER STETKAR: Reading in the appendix,  
13 that thing, that panel seems to provide several  
14 functions, and it also seems to communicate with both  
15 ELCS and the normal plant information control system.  
16 Is that --

17 MR. MURRAY: It is the conduit of  
18 information out of the ELCS system that goes through  
19 the isolation from the maintenance and test panel to  
20 the first status indications out to the plant computer  
21 system.

22 MEMBER STETKAR: From what I read about  
23 it, if you're going to change setpoints, trip  
24 setpoints, for example, in the ELCS, this is the place  
25 where a technician will enter those new trip

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1 setpoints. Is that also true?

2 MR. MURRAY: That is correct, with the  
3 system out of service. It has to be out of service,  
4 and that's the point where that entry will be made.

5 MEMBER STETKAR: Is there something that  
6 prevents the maintenance and test panel from  
7 surreptitiously inserting? I understand  
8 administratively how it doesn't do it, but I'm --  
9 since it's online and continuously communicating.

10 MR. MURRAY: I think there's switch  
11 permissives that have to be made, in order for those  
12 functions to be enabled. The continuous online is the  
13 communication monitoring. Isn't that correct, Ed?  
14 Make sure that I'm correct with this.

15 When you get into the testing, you have to  
16 put it in test configurations, and when you get into  
17 changing setpoints, you have to go into those  
18 configurations, and it requires actual physical switch  
19 manipulations on the maintenance and test panel.

20 MEMBER STETKAR: You also use the  
21 maintenance and test panel to change setpoints or  
22 control algorithms for the normal plant information  
23 control system --

24 MR. MURRAY: No. Remember, maintenance  
25 and test panel is only for ESF functions, okay.

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1 MEMBER STETKAR: Well, but since it  
2 communicates from A to X, it's just --

3 (Simultaneous speaking.)

4 MR. MURRAY: All that goes out of there to  
5 the non-safety systems --

6 MEMBER STETKAR: The communications is  
7 just a conduit to --

8 MR. MURRAY: It is a one-way  
9 communication, and it doesn't look for acknowledgment  
10 from the plant information system.

11 MEMBER STETKAR: I was just curious  
12 whether from that panel you could somehow affect both  
13 trip setpoint signals into a safety division, and  
14 controls signals or algorithms out into the normal  
15 plant control system. It wasn't -- it's clear that  
16 it's a conduit from PLCS out to PICS -- it was used  
17 otherwise.

18 MR. MURRAY: There's no shared function  
19 between the ELCS and the ESF, and the non-safety  
20 functions.

21 MEMBER STETKAR: I'm thinking of things  
22 like steam generator level, trip actuation, EFW,  
23 emergency feed water actuation on steam generator  
24 level and, for example, algorithms to control feed  
25 water flow out in the non-safety part of the plant.

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1 Does that somehow affect both of those things from the  
2 same place?

3 MR. MURRAY: I can only speak from my  
4 analog background in that, and those functions were  
5 diverse there as well. The controls were in a NSSS  
6 group that did the controls, that used the control  
7 signals that came in to control. But I couldn't  
8 change the algorithms from the protection sets. So it  
9 was diverse in that, and it's very similar here, is  
10 the -- only in the actual signals, make sure I'm right  
11 with this, the plant information control system's not  
12 using the data out of ELCS for decision-making or  
13 control algorithms anywhere.

14 MEMBER STETKAR: I understand that, but  
15 I'm not quite sure that -- I might not be  
16 communicating very well here. I'm concerned that if -  
17 - let me ask it this way. If I want to change the  
18 steam generator level program out in the secondary  
19 side of the plant, the thing that's -- I'm sorry.

20 (Simultaneous speaking.)

21 MEMBER STETKAR: The reactor vessel level  
22 control. That's, sorry --

23 PARTICIPANT: He can do that one too.

24 MEMBER STETKAR: I can be stupid. I'm  
25 allowed to be stupid.

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1 (Laughter.)

2 MEMBER BROWN: It's a steam generator.

3 MEMBER STETKAR: It's a steam -- yes,  
4 that's -- a good steam generator.

5 (Laughter.)

6 MEMBER STETKAR: Anyway, reactor vessel  
7 level program or heat up/cool down or something like  
8 that, out, you know, which is a secondary -- well, I'm  
9 not sure it's reactor vessel level control. I'm  
10 trying to think of a secondary function that would add  
11 a program, let's say --

12 MR. MURRAY: Feed water control.

13 MEMBER STETKAR: Turbine, you know, feed  
14 water control is a good one. Yes, boiler level,  
15 reactor vessel level feed water. Is that information,  
16 how is that information entered into the -- you know,  
17 you have digital feed water controls, part of the  
18 PICS.

19 How do you enter a new algorithm for  
20 changing, you know, bias, for example, on a feed water  
21 flow control valve? Is that entered through this same  
22 maintenance and test panel?

23 MR. MURRAY: That vessel. Well, that  
24 would be in feed water control system, where you would  
25 actually go in and it's a non-safety system. There,

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1 you would take and make this algorithm, control  
2 algorithms changed if you needed to change the tuning  
3 parameters for that particular function.

4 MEMBER STETKAR: Okay, okay. That's  
5 basically what I was looking for. I'm looking for  
6 common points where I can affect control and  
7 potentially protection things. Thanks.

8 MR. MURRAY: Okay.

9 MEMBER STETKAR: Sorry about the --

10 MR. MURRAY: You have a question.

11 MEMBER BROWN: Yes. I could take it  
12 somewhat more simplistic. It's a very complicated  
13 thought process, and I thought that the MTP, it may be  
14 a misconception; that's why I'm asking the question.  
15 While it's there and online all the time, it's all --  
16 by being online, it's in the receive mode from the  
17 ELCS, as opposed to an active transmit mode, unless  
18 into the actual safeguards processing of all these  
19 core divisions.

20 MR. MURRAY: I'm going to try to answer  
21 that, because --

22 MEMBER BROWN: Unless you turn those  
23 switches. That's, I thought it was isolated.

24 MR. MURRAY: For testing and taking it in  
25 bypass, you have to use the switches, and you need to

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1 remember that in the control room, you have flat panel  
2 displays, okay. The flat panel display commands come  
3 back through the maintenance and test panel. I mean  
4 that's why it's on the AF-100. That's wrong. Thank  
5 you. So it is in a receive mode until it's --

6 MR. ED BROWN: It's in a receive mode, I  
7 mean other than transmitting information for the  
8 control room for certain displays. I imagine you can  
9 monitor it up there.

10 MEMBER BROWN: It doesn't do that either?

11 MR. ED BROWN: It does it only for  
12 diagnostic alarms. It's sitting there passively in  
13 the system. It does do one active thing for the ABWR.  
14 There's a function called an automatic ESF logic  
15 channel bypass, that's as a result of a diagnostic  
16 failure, and the MTP will be utilized for that  
17 function.

18 MEMBER BROWN: So it sends a fail signal  
19 or initiates a trip or --

20 MR. ED BROWN: No. It analyzes failure,  
21 which is usually reported multiple times. It ensures  
22 that the redundant feature on the channel is not, and  
23 it's a logic channel only, so there's two redundant  
24 logic channels. But the redundant channel is  
25 operable, and then it will allow an automatic bypass.

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1 MEMBER BROWN: You're talking about the A-  
2 B?

3 MR. ED BROWN: Yes.

4 MEMBER BROWN: Sequence, the SLFs and the  
5 RDLCS?

6 MR. ED BROWN: Right. It will allow one  
7 of those two to be automatically bypassed if there's a  
8 failure in one, if there's a fatal error.

9 MEMBER BROWN: But does it initiate that  
10 bypass itself?

11 MR. ED BROWN: Yes. The diagnostic is set  
12 to it, and it will allow that automatic bypass. The  
13 operator can disable the automatic bypass feature, and  
14 use only the manual bypass feature. That's been a  
15 design feature of the original DCD since day one.

16 MEMBER BROWN: So it senses, it senses  
17 some problem with the information it's receiving.

18 MR. ED BROWN: Right, receiving.

19 MEMBER BROWN: Relative to the SLFs and/or  
20 the RDLCS, for either A or B in all four --

21 MR. ED BROWN: No, only in one. One MTP for  
22 each division.

23 MEMBER BROWN: Oh. So it only looks at  
24 one division. Okay. So it can't communicate an  
25 allowance mode to all four divisions, based on

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1 erroneously obviously, but it couldn't -- okay. I  
2 guess I didn't understand that. That's a nuance.  
3 I'll probably forget that one.

4 MR. ED BROWN: That's unique to the ABWR.

5 MEMBER BROWN: I understand what you said.

6 Thank you.

7 CHAIRMAN ABDEL-KHALIK: Okay.

8 MR. MURRAY: So focusing back on the  
9 diagram we have up there, this is an ELCS controller.  
10 Within the ELCS controller is two microprocessors.  
11 One is the communication processor; the other is the  
12 application processor. A communication comes in, a  
13 message comes in and it comes in on a unidirectional  
14 serially fiber-isolated signal.

15 It has a fixed periodicity transmissions,  
16 and it has fixed length, fixed format. The data  
17 mapping is fixed and data redundancy is also provided  
18 in those messages, and then also the cyclical  
19 redundancy checks, CRC check is done in that  
20 diagnostics.

21 So the message comes in and the  
22 communication processor looks at it and does the  
23 diagnostics, to see if the message is an acceptable  
24 message. Acceptable message, it takes the  
25 information, put it in the shared memory buffer.

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1           The application processor that is running  
2 and is on cycle, not dependent on the communication  
3 processor, will go read these, the shared memory and  
4 use the data to perform its applications.

5           If faulty data comes in, use the word  
6 "corrupt" or bad data is the best word for it, if bad  
7 data's coming in, the diagnostics that were described,  
8 which is -- it will flag that data as bad. It will  
9 take in the right-hand side of the picture, as you're  
10 looking at it, it will take its last good data, read  
11 it to the shared memory buffer, and it will also carry  
12 the bit that says "this data is bad."

13           The application processor sees that, says  
14 the data that's in the register or the data coming in  
15 from this particular area is bad data. Then it goes  
16 from its local memory and extracts out a predetermined  
17 value that it uses for those calculations.

18           At the same time, the operator is notified  
19 of bad data through watchdog parameters and the data  
20 diagnostics. So a bad message comes in. First, the  
21 communication processor will detect it, analyze it,  
22 detect it as such. It would then flag the data as bad  
23 for that particular input. The application processor  
24 would not react to bad data. It would only take the  
25 data that comes in.

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1           It would see bad data coming from that  
2 particular location, and for that location it would  
3 then use a predetermined value. So the data coming in  
4 bad doesn't make it to the application processor.

5           MEMBER BLEY:       So when you say a  
6 "predetermined value," that's some value that's deemed  
7 to be safe under most conditions?

8           MR. MURRAY:   It's according to what the  
9 function is, but that's correct.

10          MEMBER BLEY:   I'm sorry?

11          MR. MURRAY:   It's according to what the  
12 function is, whether it's a fail/safe or fail as is.

13          MEMBER STETKAR: Well, all of this is fail  
14 as is.

15          MR. MURRAY:   I can't answer that. There's  
16 a part that is finessed. The DCD requires --

17          MR. SWANNER:   LDS.

18          MR. MURRAY:   That LDS, link detection is  
19 actuate, right.

20          MEMBER STETKAR: So in some cases, if I  
21 can just call it true and false, true being a trip  
22 actuate and false being do not actuate the trip. In  
23 some cases, function let's say. In some cases that  
24 bit would be set to true, and in other cases it would  
25 be set to false, based on whatever function is being

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1 evaluated.

2 MR. MURRAY: Correct, on the application  
3 side.

4 MEMBER STETKAR: On the application side.

5 MR. MURRAY: On the application side.

6 MEMBER STETKAR: Because I was confused.  
7 You know, the words in the appendix just says "a  
8 predefined value based on the desired failure state,"  
9 which to me doesn't say anything.

10 MR. MURRAY: Right. You get into whether  
11 it's fail as is or --

12 MEMBER STETKAR: Does that predefined  
13 failure state then, in the application bring the  
14 renewed coincidence log to a one out of three, if I  
15 understand how it works?

16 MR. MURRAY: This is a single one of the  
17 SLFs, and it was four. So you still would go out, and  
18 you'd still have the two out of the four vote. So  
19 you'd still have to take -- excuse me, two out of  
20 three vote. So you'd have a two out of three vote  
21 with one set of bad data. Is that correct Ed?

22 MEMBER BROWN: That's going to have a two  
23 out of four vote.

24 MR. MURRAY: Let Ed answer this one.

25 MR. ED BROWN: It's essentially two out of

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1 three, except for LDS, which would be one out of  
2 three. You'd have one LDS that would be in because of  
3 the predefined state. So another --

4 MEMBER STETKAR: So Ed, let me see if I  
5 understand this. For LDS, you're saying that they  
6 remain -- if we talk about divisions, if Division 1  
7 SLF, you know, receives bad data input from Division  
8 1, let's say. For LDS, you would then get an actuate  
9 signal if you had a valid actuate signal from any one  
10 of the three remaining divisions. Is that correct?

11 MR. ED BROWN: Yes. This is Ed Brown,  
12 that's correct.

13 MEMBER STETKAR: Okay. But for example,  
14 for high pressure core flood, under the same  
15 conditions, Division 1 would require two of three  
16 valid signals from the remaining three divisions; is  
17 that correct?

18 MR. ED BROWN: That's correct sir.

19 MEMBER STETKAR: Okay.

20 MEMBER BLEY: Something that I hadn't  
21 thought about as you go through this. The old  
22 systems, if we have a logic failure and we get a trip  
23 or whatever, the operators respond to the trip and  
24 carry on. Now in the control room, we have a signal  
25 saying what's going on now is due to bad data.

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1           If you guys thought through two things.  
2           One is do you have any idea how often bad data signals  
3           come in? Two, what are you telling the operators to  
4           do when they see this thing coming in?

5           MR. ED BROWN: You are telling them that  
6           there is a failure, and this is Ed Brown from WEC.  
7           You're telling them that there's a failure.

8           MEMBER BLEY: Are we writing any  
9           procedures about this?

10          MR. MURRAY: It would be Annunciator  
11          Response Procedures, which are typically you would  
12          expect to go --

13          MEMBER BLEY: So wherever we go we'll have  
14          those Annunciator Procedures.

15          MR. MURRAY: In fact, the human factors  
16          team is looking at the response to those particular --  
17          that's part of their function, looking at response and  
18          making sure that it's properly -- one, what level is  
19          responding, making sure that the operator has the  
20          right information to provide the right decisions, just  
21          what you're talking about.

22          MR. SWANNER: But it's important to also  
23          understand the frequency, so that it doesn't become a  
24          distraction. You have intermittent pieces, so they  
25          have the capability to disable, you know, disable a

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1 sensor that was causing an alarm, or if the alarm has  
2 failed, then they can take it to a failed state.

3 But that it's not, it's managed. It's  
4 information that's managed, and Human Factors are  
5 looking at that and it can be the programs and  
6 procedures will be in place should those evolve.

7 MEMBER BROWN: But that won't be in place  
8 until much later in the process?

9 MR. MURRAY: That's correct.

10 MEMBER BROWN: After the COLs. Okay.

11 MR. MURRAY: Ed, did you have something  
12 that you needed to add on the operator experience.

13 MR. ED BROWN: Yes, just the operating  
14 experience of the system, which has been in service in  
15 a number of safety-related applications in the U.S.  
16 and Europe. It's a very infrequent occurrence, and  
17 typically occurs when a module failure occurs, and  
18 typically fails hard. So you very seldom get bad  
19 data, because the transmission medium is fiber optic.

20 MEMBER BLEY: But you'd see something.  
21 Any valid idea of how often you see it in a plant?

22 MR. ED BROWN: The key words are very  
23 infrequent. Very few.

24 MEMBER BLEY: Once a month?

25 (Laughter.)

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1 MR. ED BROWN: I would say less than once  
2 a month.

3 MR. MURRAY: But that's an opinion from  
4 operating experience.

5 MR. ED BROWN: Where else would they come  
6 from?

7 MR. MURRAY: So in looking at it, this is  
8 what we try to get the points across, of how the data  
9 is managed through the processors. So going into  
10 the, and we'll repeat some of the same information  
11 again. I'm on Slide 23, and here, the DTF transmits  
12 the trip signals the SLFs, and it's unidirectional,  
13 serial-linked, fiber.

14 It's fixed periodicity of transmission.  
15 All the data's transmitted. Even if it's not changed,  
16 it doesn't do different reporting. It basically  
17 transmits it again, cyclic processes there. It's  
18 fixed link, fixed format. The data map is the same  
19 data point, the same position. The data redundancy is  
20 provided in the message and the CRC functions are  
21 being reported there.

22 This all supports the detection of  
23 corrupted data, and preventing it from being carried  
24 forth into the system. I just wondered if you had a  
25 question.

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1           MEMBER BROWN: I already had my robust  
2 discussion with Warren in several other meetings, and  
3 I'm not going to repeat that discussion again.

4           MR. MURRAY: Okay, okay.

5           MEMBER BROWN: I won't get to the  
6 inability to lock up all the processes. It's still  
7 there. But it's all good stuff, and this system is  
8 the same configuration, a similar configuration. So  
9 you'd have to make the same argument. It is a fail,  
10 fundamentally fail as is, and you have to -- except  
11 for the LDS function.

12           My fundamental thoughts are, you know,  
13 you've got to have a backup to it. We haven't gotten  
14 to that point. There is -- maybe I'll just ask the  
15 question. If after going through everything, there is  
16 no diverse, automatic diverse actuation system in this  
17 design. It's all manual, from what I could gather.  
18 It's all manually actuated by somebody.

19           MR. MURRAY: It is hard-wired.

20           MEMBER BROWN: It's hard-wired, but it's  
21 going to be somebody to actually do something.

22           MR. MURRAY: Right.

23           MEMBER BROWN: And you -- and I couldn't  
24 find any real analysis that said, or a reference to an  
25 analysis that said there's enough time for a manual

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1 backup based on a realistic, not a worst case  
2 analysis, but based on a best estimate of realistic,  
3 or a PRA or something like that, that says hey, the  
4 operators have enough time before you do some damage.

5 It's just that's the way it is. That's  
6 the design as it's been explicitly defined. With no  
7 other backup for critical functions, and/or an  
8 analysis that says the manual is okay. That raised a  
9 little bit of question, that if they all locked up,  
10 nothing happens. You've got to, somebody's got to  
11 figure out to go do something, and hopefully the  
12 timing is okay.

13 So that's -- but we can go on, but that's  
14 just the way it is.

15 MR. ED BROWN: Mike?

16 MR. MURRAY: Yes, Ed.

17 MR. ED BROWN: We do not believe that all  
18 the processors can be locked up.

19 MEMBER BROWN: Oh, I know that. I just  
20 don't want to go through that again. I've had to  
21 argue -- I've had that discussion with Warren at least  
22 twice, and there's no reason to work ourselves back  
23 through that one again.

24 I mean I've had personal experience where  
25 everything locked up on me, and it actually created

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1 two things: an over-speed trip device to say I'm not  
2 going to trip, and a command to have the turbines to  
3 speed up simultaneously.

4 Everybody said it never happened and it  
5 did happen, and we just barely caught it before it  
6 exceeded 150 percent RPM and almost killed people. So  
7 when people tell me something's never going to happen,  
8 I don't really -- but I've accepted it. So if you  
9 want to move on, you can. I really won't work on this  
10 one anymore.

11 MR. MURRAY: So let's go on through the  
12 discussion and --

13 MEMBER BROWN: Yes, I can go on. I just  
14 want to make sure you knew I just hadn't changed my  
15 position. That's all. I'm consistent, even if you  
16 think I'm wrong.

17 MR. MURRAY: We've completed -- okay. So  
18 we're on Slide 24 now. The SLF, when it receives the  
19 data communication, the communication processor,  
20 application is communicating through shared memory, as  
21 we discussed previously. Communication receives. Its  
22 link failure diagnostics are checked, provides error  
23 status for bad messages.

24 Additionally, the CRC diagnostics provides  
25 error status for bad message. Data redundancy

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1 diagnostics provides error status, and stores the  
2 message in a unique location in the shared memory, if  
3 it's acceptable data.

4 The application processors reads the  
5 message. Bad message status causes the data to be  
6 replaced by a predetermined value. We've already  
7 discussed that, and then the alarm message is sent to  
8 the operator. That's where it's detected, if there's  
9 a problem with the data.

10 Next slide, 25. Okay. The ELCS  
11 application processor. The application processors has  
12 no external interrupts. It does have clocks and it  
13 has internal but not external interrupts. The  
14 internal clock uses a precision timer, cyclic  
15 execution of the application software, based on the  
16 timing, predetermined fixed execution cycles. Maximum  
17 processor load is maintained at less than 70, and it's  
18 actually reinforced by continuous monitor, a self-  
19 diagnostic that verifies that it's less than 70  
20 percent loading on the processor.

21 The buffer from external communication,  
22 the read and write data buffered the memory on the  
23 fixed cycle, and it's independent communication on the  
24 interface data system. Communication interfaces flags  
25 -- the interface flags the corrupt data, as we

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1 discussed previously. Then the application uses then  
2 again the predetermined value for bad messages.

3           Diagnostics will provide an operator  
4 alarm. The watchdog hardware timer output would be  
5 monitored by an independent controller, and overrun of  
6 cyclic execution times is monitored by self-  
7 diagnostics and then communication also is monitored  
8 by the application.

9           Slide 26. Determinism of the  
10 communication processor, it uses a deterministic  
11 protocol, which will be described further down in the  
12 billets, and all data, again, is transmitted, even if  
13 none is changed. It's doesn't, it's not doing  
14 exception transmission. Fixed link, fixed format  
15 message is mapped. Redundancy checks and CRC checks  
16 on it.

17           Deterministic intervals, based on the  
18 fixed, the internals of the application processor  
19 requests that messages be sent. Deterministic  
20 reception intervals based on fixed message. Again,  
21 reception intervals and transmitting are in from  
22 transmitting controllers.

23           The communication process is buffered from  
24 the application processor by shared memory, and then  
25 basically the diagnostics again provides operator

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1 Annunciation, watchdog, loss of communication and  
2 message diagnostics is communicated to the operators  
3 for status and conditions.

4 In the determinism, response time analysis  
5 is done. The criteria is based on the safety analysis  
6 requirement for the system. It includes all delay  
7 elements, and in the criteria, both the minimum and  
8 the maximum acceptance criteria, the response time out  
9 is established for the validation testing. This is  
10 all documented in a report.

11 Then validation testing itself validates  
12 the analysis and is documented in a report.

13 MEMBER STETKAR: I understand, you know,  
14 that this will be done on day one, zero minus or  
15 whenever, for the original system.

16 If you make changes to the application  
17 software or communications protocols or whatever, does  
18 that then -- this is not post-installation. Does that  
19 then trigger need for a new timing analysis, to verify  
20 that that timing is still, and where is that  
21 requirement documented anywhere?

22 MR. MURRAY: I would answer it would, but  
23 where it's documented I'm not certain.

24 MR. ED BROWN: It's documented in the  
25 project's software management plan, which states the

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1 requirements for software changes, configuration  
2 control throughout the entire process.

3 MR. MURRAY: And it would be through a  
4 design change modification process also. Any other  
5 questions on this slide?

6 (No response.)

7 MR. MURRAY: Diversity and ELCS. Are we  
8 on, am I on the right one? Next slide. I was. ELCS  
9 diversity. Diverse equipment accredited for  
10 mitigation of ELCS failure and it's the diverse  
11 equipment that's hard-wired. Then there's diversity  
12 between the RTIS and NMS in the microprocessor base  
13 and then also from the FPGA and microprocessor bases,  
14 system are diverse.

15 It is also diverse from safety-related  
16 control systems. Different microprocessors are used  
17 in different software, different communication  
18 technologies and equipment.

19 MEMBER BROWN: I did have a question on  
20 there. You made a comment about hard-wired switches,  
21 manual switches to do this, and in your Appendix 7C,  
22 there's a, I don't know if it's a contradiction or  
23 not, and it talks about -- let me get the right words.

24 It says "control switches for individual  
25 control pumps and valves are transmitted from the

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1 operator's control stations to the SSLC, and then  
2 through ECF, as stated above." Yet the statement's  
3 been made, is that those switches someplace, I  
4 couldn't find it, but the switches go directly to the  
5 actuating component.

6 I couldn't find an explicit statement in  
7 the FSAR or in the appendix, the new appendix that you  
8 submitted, that explicitly stated that those switches  
9 go directly to the components, like the pumps or the  
10 valves, etcetera. That's on page 7C-3 under "Common  
11 Mode Failure Analysis."

12 Now it's under a header that talks about  
13 June 1993, but yet you have changes to it, based on  
14 the last -- this is Rev 4 of the FSAR.

15 MR. MURRAY: Right.

16 MEMBER BROWN: So that there seemed to be  
17 a conflict or an inconsistency between the -- which  
18 implied to me that the switches go into the SLL, and  
19 then get transmitted down to the OLU.

20 Now if you look at your picture at 7,  
21 there's another figure you can look at also, and that  
22 figure shows manual switches going to the SLF, and it  
23 shows something else going down to what looks like an  
24 either/or gate for the components. That's why I'm  
25 asking the question.

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1 MR. MURRAY: Okay. So let me try to  
2 explain that then. From ELCS, from a control room  
3 perspective, even if it's one of the diverse  
4 components, high pressure core flooders. Charlie, is  
5 that right? Let's use that for an example.

6 The operator has full capabilities of  
7 operating it in the ways that he would have for Bravo,  
8 for example, in the control room, to go --

9 MEMBER BROWN: What do you mean for Bravo?

10 MR. MURRAY: For which it doesn't have  
11 diverse, okay.

12 MEMBER BROWN: You mean just different  
13 components?

14 MR. MURRAY: Different components. He has  
15 the ability to interface with the ESF system, to start  
16 and stop the pump and those functions. In the event  
17 of the loss of the system, then you go to the remote  
18 shutdown control function of it, which basically  
19 isolates the digital system inputs and you use the  
20 manual hard-wired control of the device, which is as  
21 described.

22 MEMBER BROWN: So there's a nuance. If I  
23 look at Figure 7C-1, where that -- in other words,  
24 there's a set of manual controls that go into the  
25 SLFs, and then there's another set of manual controls

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1 that go directly to the components?

2 MR. MURRAY: I'd like to see the figure.  
3 Let me make sure I understand it. That is correct, in  
4 that the SLFs -- in other words, operator ability to  
5 control the component from the control room, he has  
6 the ability to start and stop it with logic that's  
7 carried out through the ESF -- ELCS system basically.

8 In the event of an ELCS failure, and he  
9 has to go to the remote operation of it, there is --  
10 you basically have to transfer it to a set of  
11 independent switches that can perform start/stop  
12 functions off that same high pressure core flooders,  
13 and monitor it with diverse indications.

14 MEMBER BROWN: So that's in the remote  
15 shutdown procedures?

16 MR. MURRAY: Remote shutdown systems.

17 MEMBER BROWN: In another location?

18 MR. MURRAY: That is correct, outside  
19 control room location.

20 MEMBER BROWN: So that's the difference.

21 MEMBER STETKAR: But from the control  
22 room, that comes through the SLF, not to the output.

23 MEMBER BROWN: That's what's implied by  
24 the ELCS. Now that I've heard this --

25 MR. MURRAY: Ed, you want to clarify

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1 something there?

2 (Simultaneous speaking.)

3 MR. ED BROWN: Yes. I believe the diverse  
4 controls are in the control room, and the control  
5 circuit is wired, is that the manual control will  
6 defeat the ELCS control.

7 MEMBER BROWN: Or bypass it or whatever?

8 MR. ED BROWN: Well, defeats it. For  
9 example, if the ELCS control sends "stuck pump," it  
10 disconnects that part from the --, so there's no  
11 conflict. It's all hard-wired.

12 MEMBER STETKAR: That's, for example, for  
13 high pressure core flood sealing. Let me take like  
14 RHR Train B, which doesn't have a diverse actuation,  
15 is that true?

16 MR. ED BROWN: As far as I know.

17 MR. MURRAY: Yes, that's true.

18 MR. SWANNER: That's correct. There is no  
19 diverse.

20 MEMBER STETKAR: If I'm an operator, I  
21 push a button that says "start RHR Pump B." That  
22 signal goes to the SLF four division, two I guess it  
23 would be.

24 MR. SWANNER: That's correct.

25 MR. ED BROWN: If you're going to manually

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1 an individual component, it goes, using the F-100, it  
2 goes directly to the SLF RDLIC and starts that pump.  
3 It bypasses the --

4 MEMBER STETKAR: Does it go to the SLF,  
5 which now communicates through the ELCS?

6 (Simultaneous speaking.)

7 MR. ED BROWN: Yes. It does through the  
8 SLF RDLIC.

9 MEMBER STETKAR: Only that's not what this  
10 drawing says.

11 MEMBER BROWN: Well, there's only three  
12 functions shown: the RCIC, the CUW and the HPSF.  
13 Those are the only ones shown that have a direct  
14 connection to the hardware.

15 MEMBER STETKAR: Because those are the  
16 diverse -- I'm trying to get to non-diverse. I'm  
17 trying to figure out what a divisional SLF failure  
18 prevents me from doing manually.

19 When I put, if I had a Division 2 SLF  
20 fail, and I'll just call it failed, not there, and I  
21 push a button to start RHR Pump B, will it start from  
22 the control room?

23 MR. ED BROWN: You have -- let me just  
24 clarify. This is Ed Brown from WEC. Let me just  
25 clarify the question for a second. I have RHR to an

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1 Alpha and a Bravo SLF. If one of those SLFs has  
2 failed, the operator can manually bypass that SLF, or  
3 he can -- it will be automatically bypassed by a  
4 diagnostic.

5 The logic will change to the other logic  
6 channel, one out of one. So that the system level  
7 controls will still operate. The manual control, an  
8 individual component with a flat screen display, soft  
9 control, that does not go through the SLF. The SLF is  
10 for system level functions.

11 Individual component control goes from the  
12 flat screen through the AF-100, down to the area where  
13 component control was done, which is the SLF RDLC, and  
14 it controls that component. So a malfunction of the  
15 SLF --

16 MEMBER STETKAR: Will not prevent that way  
17 of--

18 MR. ED BROWN: Will not prevent.

19 MEMBER STETKAR: I may have to circle the,  
20 you know, I may have to open three valves separately  
21 and start a pump, but I can still do that, for  
22 example.

23 MR. ED BROWN: That's correct.

24 MEMBER STETKAR: Okay.

25 MEMBER BLEY: Because we almost had an

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1 opposite comment, and I thought --

2 MR. HEAD: Could I suggest maybe at the  
3 break we look at this drawing and make sure that we're  
4 all in agreement, and then we'll report back after the  
5 break, to make sure if there's any clarifications?

6 CHAIRMAN ABDEL-KHALIK: We're getting  
7 close to the end of your presentation. But is this a  
8 good time to take a break, or should we wait --

9 (Simultaneous speaking.)

10 MR. HEAD: I'd like to suggest a few  
11 minutes before we take a break.

12 CHAIRMAN ABDEL-KHALIK: Great, thank you.

13 MR. MURRAY: So we were on Slide 28, where  
14 we talked about the differences between the non-safety  
15 and the -- the non-safety systems from the out  
16 system. So in page 29, like simplicity, separation of  
17 the non-safety. There are no shared votes again.  
18 ELCS controls are performed in ELCS, within ELCS.

19 No non-safety digital control  
20 communication links have -- we don't use any priority  
21 modules in our design. So that's a point of  
22 simplicity. Unidirectional serial links, automatic  
23 and manual isolation, ESF safety functions simplify  
24 the architecture. We minimize inter-divisional data  
25 communication as well.

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1           The next slide was, and we've already  
2 talked through an example of this, by the way, of the  
3 discussions we've had. But this was an example of one  
4 of the attributes out of the 7 delta S. For example,  
5 if there's a -- this happens to be a Tier 1, Table  
6 2.75. ITAAC-2 requires deterministic communication.

7           So in the FSAR section, we basically  
8 bracketed the area that was applicable to  
9 deterministic communication, and have mapped that over  
10 to the ITAAC in this case, so that they point back and  
11 forth as we discussed previously. We just wanted to  
12 show one example of this.

13           So coming to a summary in this, we had an  
14 Action Item 7 from the May 20th discussion, which was  
15 to further discuss the need on the application of  
16 Common Q independence and determinism. I feel that  
17 we've, the explanation in the Tier 2 appendix 7 delta  
18 S and the ELCS presentation information, we feel that  
19 we've explained the data corruption does not  
20 compromise communication and independence.

21           We feel we've explained the  
22 interdivisional communications and compliance with the  
23 independence and determinism requirements, and also  
24 explained the compliance to determinism requirements  
25 additionally, okay. So in our opinion, we feel that

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1 the platform has overall compliance with the design  
2 requirements.

3 CHAIRMAN ABDEL-KHALIK: Thank you. Before  
4 we take a break, I think we ought to capture the  
5 briefings that you need to clarify. Number one,  
6 you're going to go back and look at Figure 7C-1, 7C-1  
7 to try to answer John's question; is that correct?

8 MR. HEAD: Yes sir. We'll do that on  
9 break.

10 CHAIRMAN ABDEL-KHALIK: The other thing, I  
11 guess Charlie had a question about incorporating the  
12 statement regarding the watchdog timer.

13 MR. HEAD: Yes sir.

14 MEMBER BROWN: Yes, the explicit.

15 CHAIRMAN ABDEL-KHALIK: Right, an explicit  
16 statement.

17 MR. HEAD: Specifically that it's a hard-  
18 wired device.

19 MEMBER BROWN: That it's hard-wired  
20 diverse. Just replicate what they said in the slide.

21 MR. HEAD: Right.

22 CHAIRMAN ABDEL-KHALIK: And the third  
23 thing, you were going to find out which code is going  
24 to be used to generate the DIVOM slope, to set the OPR  
25 intercept point.

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1 MR. HEAD: Yes, sir, and my proposal is  
2 that after the NRC presentation, that we would, you  
3 know, review on that.

4 CHAIRMAN ABDEL-KHALIK: On these three  
5 items?

6 MR. HEAD: Right, and then -- yes. Well,  
7 yes. We will certainly cover that, and the other item  
8 is that's a commitment to adjust our appendix, and  
9 we'll do that. The fourth one I've got is a future  
10 action item, I guess, is in our tech spec discussion  
11 on Chapter 16, we need to have some discussion --

12 MEMBER STETKAR: Be aware of that. We  
13 won't let you off the hook.

14 MR. HEAD: Well, yes. No, no. We will  
15 have some stuff in front of us just to show what can  
16 be out of service and the time frames and  
17 configurations that could be -- we could continue to  
18 operate and then maybe some configurations obviously  
19 would require an immediate shutdown.

20 MEMBER BROWN: One more item that I didn't  
21 bring up, because it wasn't germane. On the  
22 determinism side, the Common Q platform deterministic  
23 behavior was based on a less than seven percent load,  
24 and similar to what we discussed before, there ought  
25 to be some explicit test for that.

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1           Once they have their application defined  
2           and all that other type stuff, put it in there, load  
3           it up, and then make sure it meets their actual,  
4           whatever their time response is when we're looking at  
5           similar, previous comments we've made.

6           There's no ITAAC or DAC for that right  
7           now. It's not explicitly called out. We did that  
8           before.

9           CHAIRMAN ABDEL-KHALIK: We can bring this  
10          point up when the staff makes the presentation --

11          (Simultaneous speaking.)

12          MEMBER BROWN: Yes, we'll bring it up. It's  
13          a matter for us to determine as a committee what we  
14          want to do with that, when we get to the point of  
15          writing the letter or what have you.

16          CHAIRMAN ABDEL-KHALIK: About the 70  
17          percent load.

18          MEMBER BROWN: The 70 percent, that's  
19          right.

20          CHAIRMAN ABDEL-KHALIK: Okay. All right.  
21          Let's take a 15 minute break. We'll be back at ten  
22          after three.

23          (Whereupon, the above-entitled matter went  
24          off the record at 2:58 p.m. and resumed at 3:16 p.m.)

25          CHAIRMAN ABDEL-KHALIK: We're back in

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1 session. At this time we'll hear from the staff.

2 MR. MUNIZ: Good afternoon. The staff is  
3 here today to present the Chapter 7 Advance SER of the  
4 STP COLA. My name is Adrian Muniz, the Chapter 78  
5 Project Manager. Here with me today is Dinesh Taneja,  
6 the lead technical reviewer for Chapter 7. Our  
7 presentation will be focused on an open item related  
8 to the instrument setpoint methodology, and a  
9 discussion of a revised response to RAI 7.01-14.

10 The staff will also address an ACRS action  
11 item related to the Common Q platform, as well as  
12 evaluation of the Appendix 7 Delta Sierra, 7DS. With  
13 that, I would like to turn it over to Ian Jung, who  
14 has some remarks to make before we go into the  
15 technical presentation.

16 MR. JUNG: I am Ian Jung, and branch chief  
17 for the Instrumentation Control Branch in the Division  
18 of Engineering. I just have a couple of comments  
19 before Dinesh Taneja starts his briefing. We thank  
20 the Committee for this opportunity today, and we came  
21 before you in May in 2010, and this a follow-up to  
22 that meeting.

23 We'd like to be covering some of the open  
24 issues at the time and the progress that we've made.  
25 Two comments. We thank the Committee for your

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1 continuous and valuable advice on instrumentation  
2 control over the last couple of years.

3 You really helped us, working with the  
4 Applicant, and also for the staff ourselves, we have  
5 become the beneficiary of your comments. So we really  
6 value that and appreciate that.

7 Another note that we note that South Texas  
8 Project has been very, very responsive to both the  
9 ACRS, as well as the staff. As you know, South Texas  
10 has voluntarily participated in design acceptance  
11 criteria pre-fuel inspections, which is very valuable  
12 to both South Texas as well as the staff.

13 So I just want to recognize that, and we  
14 hope to receive your recommendation on Chapter 7  
15 through this meeting, as well as the full Committee  
16 meeting coming up. So thank you. With that, Dinesh.

17 MR. TANEJA: So Slide 4. I'm Dinesh  
18 Taneja. You know, I've been involved with the review  
19 of this Chapter 7 from the start. So I've been  
20 familiar with the history, where we were and where we  
21 are going with the design here.

22 There was an open item we had in our May  
23 2010 presentation, and in that open item was related  
24 to the setpoint methodology document, which was  
25 submitted as part of the setpoint control program

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1 under Chapter 16.

2 In that document, there was a reference  
3 made to a Westinghouse stability methodology topical  
4 report, which is a report that is being prepared for  
5 the fuel amendment, which is a post-COL activity,  
6 okay.

7 So we saw that in the methodology and we  
8 questioned it, saying that how can that be referred to  
9 if it is -- most of the design is based on the  
10 existing fuel design.

11 So that was retracted as a result of that  
12 RAI, and they put in the typical setpoint values in  
13 the methodology for coming up with the OPRM setpoints,  
14 and that methodology is based on what we already have  
15 in our certified design. So they didn't depart from  
16 that essentially.

17 CHAIRMAN ABDEL-KHALIK: But the point is  
18 the setpoints for the OPRM require the cycle-specific  
19 calculation of the DIVOM slope, and if they do not  
20 make any changes or do not have any departures from  
21 the current statement, the question is do they have  
22 access to GE codes that would allow them to calculate  
23 those DIVOM slopes?

24 MR. TANEJA: Yes. What the existing  
25 design is based on a BWR owners group stability

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1 analysis methodology, which is a owners group  
2 document, and you know, being part of the BWR owners  
3 group, you know, that was one of the documents that  
4 they do have access to. I think we looked into that.

5 CHAIRMAN ABDEL-KHALIK: But that was shown  
6 to be inadequate through a Part 21.

7 MR. TANEJA: Apparently, I think the OPRM  
8 methodology part of it, I went and I had discussion  
9 with our Systems Group people, and you know, about  
10 specifically on that methodology portion of it. I  
11 forget it was Method 2 or Method 3 in the OPRM.

12 CHAIRMAN ABDEL-KHALIK: It's Option 3.

13 MR. TANEJA: Was it Option 3? And they  
14 felt that, you know, that was okay, the Option 3  
15 method. I don't know whether -- I'm not familiar  
16 with the Part 21 on that one. I did have a discussion  
17 with our Systems people on that one.

18 CHAIRMAN ABDEL-KHALIK: Are you going to  
19 have a discussion of this later on? Okay.

20 MR. TANEJA: So yes. So you know, I had,  
21 you know, up to that level. I went and I discussed  
22 with them, and they said well, this is what we already  
23 have in the certified design, and it's not a  
24 departure, and if they are staying with that.

25 I think the underlying reasoning is that,

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1 you know, as soon as this thing is done, there's going  
2 to be fuel amendment, and then we are reviewing this  
3 other methodology, WCAP, yes. But right now, you  
4 know, looking at, you know, it's exactly --

5 Assuming that we are staying with the  
6 certified fuel design, the BWR owners group  
7 methodology Option 3 is what is being used to  
8 demonstrate that they are going to use that for the  
9 OPRM calculation.

10 CHAIRMAN ABDEL-KHALIK: But that requires  
11 a cycle-specific calculation.

12 MR. TANEJA: Right.

13 CHAIRMAN ABDEL-KHALIK: For the DIVOM  
14 correlation, and that requires a specific code. The  
15 question is do they have access to the code that was  
16 specified for determining that DIVOM slope?

17 MR. TANEJA: Okay.

18 CHAIRMAN ABDEL-KHALIK: And that's -- we  
19 just have to focus on the task at hand.

20 MR. TANEJA: All right, understand. I  
21 think I understand.

22 CHAIRMAN ABDEL-KHALIK: Rather than saying  
23 we'll look at it when the fuel amendment comes in.

24 MR. TANEJA: Yes. I understand that.

25 CHAIRMAN ABDEL-KHALIK: At any rate, we

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1 will address this later on today. Thank you. Let's  
2 move on.

3 MR. TANEJA: You know, but from the design  
4 of the logic, you know, that design, you know, we  
5 looked at the design as for the logic. The settings  
6 come from that analysis, and the design was looked at.

7 Next slide. This one also, you know, the  
8 Common Q platform that's being used for the ELCS  
9 application, it's already been reviewed and approved  
10 by the NRC, and our review was done based on a topical  
11 report dated 2000.

12 The basis for our review was the SRPs and  
13 the IEEE standards that were, you know, in effect at  
14 the time of our review. So in the initial part of the  
15 COL application, the Applicant was, you know, staying  
16 with the standards and SRPs and Reg Guides at the  
17 time.

18 Since then, you know, this one basically  
19 commits to meeting the current regulations and current  
20 Reg Guides and standards, which we were okay with, and  
21 we found that to be acceptable, and it's being tracked  
22 as a confirmatory item.

23 You know, from that May 2010 meeting, we  
24 came away with this one ACRS action item, which was  
25 very specific to the application of Common Q platform

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1 for the ELCS, and specifically I think there were two  
2 items of interest at that time, is the independence  
3 and determinism implementation of the Common Q  
4 platform.

5 You know, the Applicant has submitted  
6 that 7DS and we've looked at it. It consolidates the  
7 information and you know, what we had presented back  
8 then, I'm going to just go a little bit more, you  
9 know, into the same information, and hopefully we can  
10 address these two issues of independence and  
11 determinism.

12 So speaking of the independence, what  
13 there are in the Common Q system, there are -- it's a  
14 communication independence is a key issue here, what  
15 we felt, and that's really what I want to focus on, is  
16 that there are three or four different ways that the  
17 Common Q platform communicates.

18 One method for the inter-division  
19 communication is done by a unidirectional point- to-  
20 point fiber optic communication, okay. That is done,  
21 you know, they went over that slide this morning,  
22 which shows that a processor module has two sections.

23 It has a processing section, and then it has the  
24 communications section. The communication processor  
25 is a separate processor which validates the signal

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1 adequacy and it does all kinds of checks, right?

2 Then the dual-coded RAM that is used as a  
3 buffer between the processing and the communication  
4 processors is a means of providing independence  
5 between the processing section and the communications  
6 section, okay. Now on the upstream of that processing  
7 module is the IO bus, okay. So all the IO data from  
8 the field and going out of the component is  
9 communicated on that bus.

10 That bus is totally independent of the  
11 point-to-point communication that's occurring inter-  
12 division, okay. So we have that communication. That  
13 has no relationship with the inter-channel  
14 communication, right.

15 Now each processor is limited to one  
16 output, okay, and it only can receive two outputs. So  
17 when I'm doing three out of four ruling, right, I have  
18 multiple processors.

19 Now, you know, I thought about the  
20 question that you brought up Charlie, about corrupt  
21 data, and I really, I looked at the topical report  
22 and, you know, I have taken the training, Common Q  
23 training. So I have the training manual, and for the  
24 last couple of weeks I've been really studying that.  
25 How can a corrupt data come in and take all four

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1 divisions out, right?

2 Data input comes into the communication  
3 part of the processor, right, which does all the  
4 checking, and after doing all the checking it places  
5 the data in a specific location of that dual-coded  
6 RAM.

7 The processor multiple is a cyclical  
8 operation. It looks at the IO bus for the new  
9 information; it looks at the dual-coded RAM, reads  
10 that information and does the processing of that  
11 information.

12 Now if that data, like explained this  
13 morning, if that data is going to be corrupt, that  
14 data is alarmed. Corruption is alarmed, and then it  
15 works to a known fail safe value, which is used by the  
16 processor at that time.

17 If it's a fail as is, then we are down to  
18 doing a two out of three essential voting on that,  
19 right. Now if a corrupt data did come in from a  
20 Division 1, right, it's going to go to a multiple  
21 different processors, okay. Plus it has to go through  
22 the communication processor, and it has to do that.

23 Now for me to have failures in all of  
24 them, all four of the communication processors have to  
25 go screw up, okay. Now if a data formatting is

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1 restricted, if it is of a certain structure, you know,  
2 I think I'm looking at multiple failures, not a single  
3 failure then, you know, if that is to happen.

4 You see, each division has not only --  
5 even for voting purposes, you know, it is going to be  
6 more than one processor. Each processor is capable of  
7 only taking one input, so you have to use multiple  
8 processors.

9 So you know, for me to make that scenario  
10 work, I cannot. I can sit down with you outside of  
11 that; I can walk you through that, you know. I mean,  
12 I've got notes and I've got red lines and white lines,  
13 and I essentially could not get to that conclusion,  
14 that there is a corrupt data that's going to lock up  
15 all three processors.

16 MEMBER BROWN: Okay.

17 MR. TANEJA: All right. We can do that,  
18 you know. I mean but that was my thinking that, you  
19 know, I have these barriers, and you know, this is  
20 what we've seen over ISG-4 also. This is an  
21 acceptable means of providing, you know, independence  
22 between two different communications, okay. So that  
23 is on the inter-division communication part of it.

24 Then on the next slide, you know, we're  
25 talking about the inter-division communication. Now

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1 that inter-division communication occurs on the admin  
2 field bus, which is a different communication  
3 controller that's plugged into the rack, the 19-inch  
4 rack.

5 Now the inter-division was happening on  
6 the processor controller itself, on the high speed  
7 links. There are two ports of high speed links right  
8 on the microprocessor bolt, you know, plugs in, right.

9 For the AF-100 bus, the admin field bus  
10 100, whatever. It's a proprietary field bus. There  
11 are two separate communication modules that got  
12 plugged into that rack, okay, to come up with a  
13 redundant communication network.

14 Now on that redundant communication  
15 network is your nodes for the -- I believe there are  
16 two nodes in the control room for each division, for  
17 the human machine interface, the operator control  
18 console. So each of them is on that same node.

19 Now each division is independent, right.  
20 So we have -- each division has a separate, you know,  
21 human interface on two separate controllers. Then  
22 also on that controller resides the MTPs, the  
23 maintenance test panel, okay. That's a separate node  
24 that's not -- it doesn't have the same functionality  
25 as the operator control console, okay.

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1           So that bus really works very  
2 independently of the inter-channel communications,  
3 okay. It's totally independent. It works off of it,  
4 and that communication I believe occurs, and I wasn't  
5 able to clarify that information, but that  
6 communication occurs from the back plane of those, you  
7 know, of the rack.

8           You know, there is really -- that's the  
9 only way it communicates with the processors through  
10 the back plane in a global memory location, because  
11 there is no wires that jump over from the controller,  
12 right. So a means of independence is there for even  
13 that bus from that bus. So I corrupt that bus or that  
14 controller, my processor continues to function. It  
15 doesn't have any --

16           MEMBER BROWN: I never disagreed with  
17 that.

18           MR. TANEJA: Okay. So that part of it is  
19 what I came up with, the conclusion. Now we have  
20 another communication occurring, which is a  
21 communication through text, okay. Now that happens  
22 through the MTP. So MTP that the field bus has  
23 actually a dedicated bandwidth for the data  
24 communication, which is deterministic.

25           Then it has other communication feature

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1 that's happening on the field bus. That's one part of  
2 it, and then there is a separate communication coming  
3 out of the MTP through a fiber optic cable, one-way  
4 isolated communication going out the back. That's  
5 strictly one where there's nothing coming back.

6 Now that is a transmit-only function, so  
7 it doesn't read anything back into that network. So  
8 we felt that that was, you know, adequate for  
9 maintaining, you know, independence for non-safety  
10 systems.

11 MEMBER BROWN: I didn't have a real  
12 problem with that part of it. My concern on the  
13 safety to non-safety aspects are when it leaves the  
14 PICS area, that function area and gets sent out like  
15 the technical support center in the EOL, which then  
16 has a set of what's called secure, I've forgotten the  
17 full name, secure communication -- I don't know.

18 Secure something. I have to go back and  
19 look at the figure and see what the word is. Secure  
20 something box, and then there's some words in the FSAR  
21 and the appendix, whichever one it was, that says "For  
22 example, a firewall."

23 Well, I don't think I've ever seen a  
24 firewall that couldn't get hacked, and that's what  
25 takes it into the corporate network.

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1 MR. TANEJA: Yes.

2 MEMBER BROWN: So they even started  
3 talking about that. I think that's a cyber security  
4 issue.

5 MR. TANEJA: Right, it is.

6 MEMBER BROWN: I don't know how we do  
7 that, so I hadn't brought that up in the context of  
8 this particular discussion, relative to the operation  
9 of the retention system and the ELCS. I'm not looking  
10 at it from a corruption of getting down into the  
11 plant. It's only in terms of the communication  
12 between, you know, the situation between the main  
13 control room and the advice that may be gotten from  
14 technical support center folks, and are they looking  
15 at the same information.

16 In other words, if someone's able to done  
17 so, be it hack in via the corporate bus, -- that data,  
18 severed what this very sophisticated worm did and the  
19 destruction-type thing, okay. And we've had that  
20 discussion in another context. So I hadn't addressed  
21 that issue. But within the plant, I don't have any  
22 big particular problem with the -- unless John and  
23 Dennis have found something. I didn't see --

24 MR. TANEJA: From the safety system  
25 perspective, right, you know, we're looking at the

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1 independence of safety system from non-safety.

2 MEMBER BROWN: Yes. I didn't --

3 (Simultaneous speaking.)

4 MR. TANEJA: That one, you know.

5 MEMBER BROWN: I saw that seemed to be  
6 fairly healthy. I thought about it in terms of a 571.

7 I thought that was kind of a Level 4 type  
8 differentiation. I didn't see where that was getting  
9 communicated back in. Now it may be because I don't  
10 understand all that much, and as I think about that  
11 some more, but I just haven't got to that point yet.

12 MR. TANEJA: You know, so you know, that I  
13 think is another area that probably, you know, the  
14 cyber area. It's outside, but I think right now we  
15 are trying to figure out what belongs within the  
16 Chapter 7 purview, and what belongs in Chapter 13, you  
17 know.

18 (Simultaneous speaking.)

19 MEMBER BROWN: I mean that's why --.

20 MR. TANEJA: So here, you know, my focus  
21 was, you know, hey. Is there anything in non-safety  
22 side that could propagate into safety and make it, you  
23 know, do an adverse impact to it, and I didn't find  
24 anything in their design, in that respect of it.

25 I am not a cyber expert. I wouldn't be

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1 able to answer that question right now. I mean I have  
2 to become one, but not right now. I wouldn't be able  
3 to.

4 You know, we do have, you know, that  
5 document, 7DS, does a pretty decent job of mapping to  
6 the ITAACs, you know, and the different features of  
7 the, critical features of the design. But we do have  
8 an ITAAC Item 3 in Table 2.75 that requires testing to  
9 verify that only one-way data transfer occurs from  
10 safety to non-safety related systems.

11 Then we have another ITAAC, you know, Item  
12 5 in that same table, that requires testing to verify  
13 that any loss of data or any bad thing happening in  
14 one division doesn't result in a transient or an  
15 erroneous signal, you know, going in and corrupting  
16 the other things.

17 MEMBER BROWN: Well, that's always -- but  
18 that depends on our data set. You can't test all  
19 possible data sets.

20 MR. TANEJA: True.

21 MEMBER BROWN: So you'll test multiple  
22 data sets within some, whatever you determine  
23 reasonable.

24 MR. TANEJA: And you know, what we are  
25 hoping is given that these data sets are

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1 prestructured data sets, you know, that it's not  
2 unlimited, you know, we could do a pretty decent  
3 amount of testing on that one. But that's up to, you  
4 know, that ITAAC activity is really, you know,  
5 something that they have show us, you know, how  
6 they've done it and we have to buy into that.

7           Next slide, number nine.       On the  
8 deterministic performance, you know, one thing that we  
9 saw in their design is that they don't have any  
10 external interrupts coming into the processor, okay.  
11 There is a number of allocation of these ECCS  
12 functions occurring. I think there is within a  
13 division, there may be an allocation of ECCS functions  
14 between the low pressure and the high pressure. So  
15 they're allocated to a different processor. They're  
16 not running on the same processor, right.

17           Then within a processor, you know, the  
18 task manager, which has the highest priority, and then  
19 the control modules, which are running on that thing,  
20 that design, which requires that priority functioning  
21 to be allocated with the timing of the priority of  
22 running those controls, with no external interrupts.

23           The only interrupt that I saw in their  
24 design is the internal interrupt, which essentially  
25 interrupts these overhead tasks to start the necessary

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1 tasks that need to be performed in a given cycle.

2 MEMBER BROWN: I've forgotten what the  
3 time is, we had that discussion, I think Warren and I  
4 did, when he explained the timing in another aspect.  
5 But every two or five milliseconds, whatever it is,  
6 that task is interrupted and it's going and stopping  
7 whatever's going on and it's looking, do I need to do  
8 something else, yes or no, it's a higher priority, and  
9 then it restarts again, and you just keep on going.

10 MR. TANEJA: Right.

11 MEMBER BROWN: But there is an interrupt  
12 every two to five milliseconds.

13 MR. TANEJA: There is. There is.

14 MEMBER BROWN: So that is an interrupt  
15 that stops everything, and every time an interrupt  
16 occurs, you have -- that's an opportunity to have  
17 something not work right. You've got to go back,  
18 you've got to return.

19 MR. TANEJA: Right, right.

20 MEMBER BROWN: That's one point, and he  
21 went through the whole drill and that's why I -- my  
22 focus on the other thing was when they find that's the  
23 way it is.

24 MR. TANEJA: That is a design of this  
25 processor, right.

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1           MEMBER BROWN: That's the way it is, and  
2 the key feature there is to take the application  
3 program, make sure you meet the metrics that are  
4 called out, and that they test to meet and show that  
5 they meet it with the 70 percent loading, in terms of  
6 all the stuff, and he figured out some way to do that.

7       So I walk away happy; their specific thing stated to  
8 resolve the issue and that was the discussion. So  
9 that is -- do you want to amplify that?

10           MR. ODESS-GILLETT: Yes. This is Warren  
11 Odess-Gillett. My name is being used here.

12           (Simultaneous speaking.)

13           MEMBER BROWN: And you weren't satisfied?

14           MR. ODESS-GILLETT: Well, no. It's just  
15 that I just wanted to clarify in the other project  
16 that we, to the best of our ability, let's say we're  
17 moving unessential IO modules, that we'll try to  
18 maximize the CP load to the best we can. But to get  
19 to 70 percent, there's no guarantee we can get to 70  
20 percent without actually manipulating validated  
21 software.

22           MEMBER BROWN: I accepted your resolution  
23 with some fuzzballs in there because you said there  
24 might be another platform in some time, and you  
25 couldn't define whether there would be a different

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1 number, and therefore you didn't want to use that  
2 number.

3 So I walked away that you were going to do  
4 it on this one to get to the 70 percent, even though I  
5 understood the methodology. So maybe I should have  
6 been more persistent.

7 MEMBER BLEY: I think you had the same  
8 caveat the last time.

9 MEMBER BROWN: Yes. I don't remember  
10 that. I told you I'm too old to remember that stuff,  
11 whether it's a day or an hour away with something like  
12 that. Thank you, Warren.

13 MS. BANERJEE: So we don't have an action  
14 item?

15 MEMBER BROWN: Yes, you do.

16 MS. BANERJEE: Okay.

17 MEMBER BROWN: You've got the same thing.  
18 They've got a whole set of different applications  
19 over here than what you're going to be running in the  
20 other --

21 CHAIRMAN ABDEL-KHALIK: Let's let the  
22 staff continue, please.

23 MR. TANEJA: Right. You know, processor  
24 loading is, you know, one of the functions of assuring  
25 deterministic behavior. Now limiting the load to an

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1 acceptable limit, I mean that is, you know, that is a  
2 given, okay, that we have to do that, and part of the  
3 -- you know, part of the exercise here is that for  
4 each of the applications, there is going to be an  
5 application-specific timing analysis, you know.

6 That is it's a formal analysis, a  
7 documented analysis, you know, and that analysis is  
8 validated by a formal testing, okay, and that's a  
9 given. Then you know, we do have ITAACs already in  
10 place which requires the communication protocols to be  
11 deterministic, okay, and this is -- in the certified  
12 design already we have those ITAACs.

13 (Simultaneous speaking.)

14 MEMBER BROWN: -- getting up to the 70  
15 percent as close as possible.

16 MR. TANEJA: Now you see, if they have --

17 MEMBER BROWN: I love the analysis, but  
18 that's where the rubber hits the road.

19 MR. TANEJA: And I'm sure you've seen the  
20 topical report on the Common Q that, you know, the NRC  
21 staff has already looked at and approved, and there is  
22 a specific discussion in there about the loading to 70  
23 percent in that topical report as well. Let's see.

24 So you know, we felt that we already had  
25 what we needed, you know, as far as the acceptance

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1 criteria, to assure deterministic performance of its  
2 controller.

3 MEMBER BROWN: If all you need is 22  
4 percent and you need it, then that's what you -- you'd  
5 meet the performance and that's not good enough if  
6 you're at 50 percent or 60.

7 MR. TANEJA: Right.

8 MEMBER BROWN: So you don't know if future  
9 changes will run it up, what that will be --

10 (Simultaneous speaking.)

11 MR. TANEJA: Well, you know, there is a  
12 process in place for future changes, okay. The future  
13 changes have to be done formally. They cannot just be  
14 done ad hoc. There's a 5059 process that requires a  
15 thorough analysis of all these impacts, and then there  
16 is anything that is software, we have a software in a  
17 management plan, which has a formal, you know,  
18 modification to the software as a formal  
19 reverification process that has to be gone through,  
20 you know.

21 So it's not like an ad hoc that somebody's  
22 going to go and make a change. I mean we have a  
23 program that is already developed, verified, tested  
24 and locked in. Now you have that, you're running the  
25 plant. The change that you're going to make, whether

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1 you bring in new inputs or whether you put in new  
2 functionality, is going to require a formal change  
3 process.

4 So it's not something that is just done,  
5 you know, by an operator or a technician out in the  
6 field or anything like that, you know.

7 So you know, so we had looked at this  
8 topical, and here I went through all of the discussion  
9 on the deterministic performance, and looked at how  
10 the tasks are handled and how they are located, and  
11 this is part of the inspection that we'll do, you  
12 know, as part of the ITAAC inspection and DAC  
13 inspection, when they are actually developing and  
14 building these systems for STP-3 and 4.

15 MEMBER BLEY: Charlie's point there is  
16 that, and I'm going to rephrase it a little  
17 differently.

18 MR. TANEJA: Okay.

19 MEMBER BLEY: Even if you have a formal  
20 analysis process, if the requirement in the regulation  
21 and this will be essentially a regulation, is 70  
22 percent loading, then when you do your calculations  
23 and they do their calculations, as long as they aren't  
24 approaching that 70 percent, they're meeting all the  
25 requirements.

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1           The point that was raised if you've never  
2 tested the device up to that point, you don't know for  
3 sure if it's going to happen when you get there. So I  
4 think all of the safeguards aren't safeguarding  
5 against the point Charlie raised in the beginning.

6           MR. TANEJA: So what, I mean you know, I  
7 guess the worst case loading, you know, we could not  
8 figure that out, I mean what the worst case loading  
9 would be on the processor. There's a maximum/minimum  
10 times that we know that would be needed to complete  
11 that cyclical function that it needs to perform,  
12 right.

13           So we are setting up a cycle time for each  
14 of the applications that needs to run on a given  
15 processor, right. We have this logic diagram, okay.  
16 Typically, you know, if I look at a lot of logic, you  
17 know, the way it reads, it goes from left to right,  
18 you know. It will start here and I'll start looking  
19 at this input, this input, this input and on this  
20 function block, then it runs this function block, this  
21 function block.

22           From start to finish, from grabbing the  
23 input to generating an output, you know, it's going to  
24 take a certain time, right. So that timing, okay, I  
25 can test that timing. When I design it, I can run

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1 that on a simulation and I can look at that timing,  
2 right.

3 MEMBER BLEY: Yes.

4 MR. TANEJA: So I can look at that time  
5 and make multiple runs and say, you know, I can come  
6 up with a minimum/max under various conditions. So  
7 you know, the 70 percent, there was a white paper that  
8 I read. This task allocation, it said, you know, if  
9 we keep it below 70 percent, it will show the  
10 deterministic performance of a given processor.

11 It's just, you know, that margin is not  
12 really the margin for future changes, I don't think.  
13 That margin is just to assure that I can get a  
14 deterministic performance. Now if I want to build in  
15 --

16 MEMBER BLEY: And what Charlie has said is  
17 --

18 MR. TANEJA: If I build in capacity --  
19 (Simultaneous speaking.)

20 MEMBER BLEY: --for that point, all you  
21 have is an analysis. You don't know for sure.

22 MR. TANEJA: No, no, no, no. The testing  
23 is part of the ITAAC that we have. It requires, ITAAC  
24 requires a test. It's not only an analysis. So there  
25 is a formal analysis, and that analysis is validated

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1 by a test.

2 MEMBER BLEY: Let me try something with  
3 what might sound like a stupid analogy, but it's the  
4 only way I can do this. We traditionally, in the old  
5 days, required strict time testing for motor operated  
6 injection valves. People did that under zero EP  
7 conditions. They met all of the things and the motors  
8 didn't over-torque.

9 Yet we had events when the valve had to  
10 stroke with actual real world EPs, and the valves  
11 didn't work, because we'd never designed the test to  
12 verify that indeed the equipment would perform its  
13 designed function under its design basis conditions.  
14 We just didn't do that.

15 This to me sounds like an analogous  
16 situation. We're not testing the system under its  
17 design basis conditions as specified in the regulation  
18 or the rule. So we don't know how it's going to work,  
19 the same way that we didn't really know, we convinced  
20 ourselves we know how those valves were going to work,  
21 but we were wrong.

22 MR. TANEJA: Well, I guess that's where  
23 some of the operating experience comes in. I would  
24 probably ask Westinghouse what's their experience has  
25 been with these type of issues, you know, because

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1 they've had application in Korea of the Common Q  
2 platform.

3 MEMBER BLEY: And I think, from what we've  
4 heard, they've never loaded them anywhere above 25-30  
5 percent.

6 MR. TANEJA: That's fine then, right.

7 MEMBER BLEY: No.

8 MR. TANEJA: I mean, I'm just saying --

9 MEMBER BLEY: I don't think we're  
10 communicating.

11 (Simultaneous speaking.)

12 MEMBER BLEY: It's right now. It's fine  
13 right now, but when --

14 MR. TANEJA: So what you're saying is, you  
15 know, we don't know what the maximum load it can take  
16 and still perform, right?

17 MEMBER BLEY: That's what we're saying.  
18 If you test it at 70 percent load, then you'll know  
19 that, and if later people loaded up to 50 percent, you  
20 won't have any qualms.

21 MR. TANEJA: Yes. That's a very valid  
22 point, you know. I mean I guess --

23 MEMBER BLEY: And what will all those  
24 analyses --

25 (Simultaneous speaking.)

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1 MEMBER BLEY: --loaded over 70 percent.  
2 That's all.

3 MR. ED BROWN: This is Ed Brown from  
4 Westinghouse.

5 MEMBER BLEY: Yes.

6 MR. ED BROWN: We have run tests at loads  
7 of 70 percent during the original qualification of the  
8 platform, and the equipment worked satisfactorily at  
9 70 percent. We do have some applications that run 65  
10 percent, the time. The more correct analogy is like a  
11 setpoint versus the safety analysis limit.

12 Seventy percent is a maximum, and anything  
13 you run below 70 percent is margin. So typically you  
14 don't test your system by eating into your margin.  
15 The system will run satisfactorily at 70 percent load.  
16 That's been demonstrated through the original  
17 qualification testing.

18 MEMBER BLEY: Well, see now I don't recall  
19 ever hearing --

20 (Simultaneous speaking.)

21 MEMBER BROWN: There's no report of any of  
22 that testing --

23 MEMBER BLEY: Well, at least that's come  
24 through, through anything we've seen.

25 MEMBER BROWN: That's right.

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1 MEMBER BLEY: This is the first time we've  
2 heard that --

3 (Simultaneous speaking.)

4 MEMBER BROWN: You know, we've only seen  
5 the topical report.

6 MEMBER BLEY: Or that you've got some  
7 running somewhere at 65 percent. Never heard that  
8 before. That's brand new information.

9 MEMBER BROWN: We haven't seen the actual  
10 test results.

11 MEMBER BLEY: It would be nice to see the  
12 test results. That would probably go a long way.

13 MEMBER BROWN: If the platform and its  
14 configuration have been tested at 70 percent, and the  
15 data is available to demonstrate, then I wouldn't have  
16 asked the question. But it's not there, or hasn't  
17 been presented to us.

18 MR. ED BROWN: Well, the data was  
19 presented during the original review in the 2002 time  
20 frame. I'm sure we can resurrect the data, and  
21 resurrect --

22 MEMBER BROWN: I'm open to any technical  
23 presentation that demonstrates that the thing  
24 performs.

25 MR. TANEJA: Now you know, to go back to

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1 your --

2 MEMBER BROWN: Let me make one point,  
3 in that that was in the configuration of the  
4 specific controllers that were being used, the AC-  
5 160s, etcetera, etcetera, with whatever  
6 configuration, those components or those assemblies  
7 had at that time.

8 MR. ED BROWN: That's correct.

9 MEMBER BROWN: If in the ensuing eight  
10 year, nine year period, the constituency of those  
11 assemblies has changed somewhat, based on  
12 components that are either available or not  
13 available, even though the module and assembly  
14 stays the same, have each of those substitutions  
15 been tested to ensure that you still maintain the  
16 same performance?

17 That's another open question that  
18 comes along. But the concept of how the controller  
19 works is kind of universal, but is also somewhat  
20 dependent on the constituency and the types of  
21 devices, whether it's the memory devices or the  
22 processors or the blah blah blah. So you can get  
23 changes, just due to the nuances within the  
24 processors themselves.

25 MR. ED BROWN: Well, you have to test

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1 the larger configuration with more applications to  
2 get to the 70 percent load. I guess that's the  
3 quandary. For the validated and verified software,  
4 unless it's changed, you can't change it above what  
5 its loading is at that time.

6 However, you can take a test  
7 configuration that's larger, has more software in  
8 it, and make it 70 percent and verify that it  
9 operates at 70 percent.

10 MEMBER BROWN: That's what we've asked  
11 for.

12 MR. TANEJA: See, the position would  
13 be -- Charlie, for the way the DCD right now is  
14 written, okay, the configuration for the safety  
15 system as it's configured is required to be tested,  
16 okay. It's required to be tested and verified to  
17 be deterministic. Now the question is if they do  
18 make a change and increase the loading on that, it  
19 has to go through the same validation and  
20 verification process just like the original design.

21 You're not just going to arbitrarily  
22 add load to it. It's going to have to go through  
23 the same testing process all over again if you were  
24 to change that loading. That's the way I  
25 understand the software program manual to be, you

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1 know.

2 CHAIRMAN ABDEL-KHALIK: I think  
3 several points have been made. Let's continue.  
4 This is an open issue that will be revisited. It's  
5 one of the four or five open items that we have.

6 MR. JUNG: Mr. Chairman, just to add,  
7 to wrap up, it's not clear and the staff's not  
8 against adding 70 percent capacity to that. I  
9 think it's, the burden should be on the South  
10 Texas.

11 I wonder if South Texas is willing to  
12 modify 7DS to include more specifics on 70 percent  
13 loading, to verify that either the loading is below  
14 70 percent or, when it's in 70 percent or above,  
15 demonstrate through the testing there's a report  
16 that exists that demonstrates these functions.

17 It should be on South Texas to propose  
18 a solution for this.

19 CHAIRMAN ABDEL-KHALIK: It may be that  
20 the old data, the old tests that were run at 70  
21 percent may satisfy the issue here. But we need to  
22 look at it. I'm sorry.

23 (Simultaneous speaking.)

24 CHAIRMAN ABDEL-KHALIK: If you were to  
25 resurrect that data and present it, that may

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1 satisfy that, I'm sure. But for the time being,  
2 this remains open. We're not going to resolve it  
3 here and now. Please continue.

4 MR. TANEJA: You know, the specific  
5 ITAAC that I was talking about is the Table 2.75,  
6 Item 3, which requires the testing of all the  
7 communication functions for deterministic  
8 performance, you know. There is a, it's a broad  
9 ITAAC, but all these specifics fall within that  
10 category.

11 You know, the point that I think is a  
12 slight dilemma, you know, this is really going back  
13 to the Common Q topical report, that we have a  
14 proprietary copy of that we had reviewed and  
15 approved as part of the overall Common Q  
16 qualification.

17 And you know, in that SER that we had  
18 also concluded in that SER that the operation of  
19 the AC-160 was determined to be a deterministic  
20 operation, and it met the guidance of BTP 7-21.  
21 In that SER, we have a plant-specific action item,  
22 6.6, which also requires the licensee to review the  
23 timing analysis and validation tests, in order to  
24 verify that it specifies the plant-specific  
25 requirements for a system response and display

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1 response time presented in Chapter 13 action  
2 analysis.

3 So we have these specific requirements  
4 even in the SER for a very specific test that needs  
5 to be performed. I just wanted to, you know.

6 Slide 12. We had the opportunity to  
7 go through the Appendix 7DS, and you know, what we  
8 found in that is that it took and it consolidated  
9 the information that's already there in various  
10 different sections of the application. You know,  
11 it's a good, you know, piece of document. It's  
12 very helpful, you know. It actually helped me and  
13 you know, to --

14 But you know, we didn't find anything  
15 that would change our SER, you know. So it's a  
16 good addition to the COLA, with no impact to the  
17 SER.

18 Now if you guys would like, you know,  
19 the backup slides I have, our discussions from the  
20 May 2010 meeting, and at that time we talked about  
21 that the worse backup design that is part of the  
22 original certified design. I know, John, you had  
23 some questions about the hard-wired controls, and I  
24 can shed some light on that from my perspective,  
25 you know, what I know about that design. If you'd

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1 like.

2 MEMBER STETKAR: That's up to you and  
3 the rest of the Subcommittee.

4 MR. TANEJA: I'm just offering that  
5 information.

6 MEMBER STETKAR: Waste time to --

7 CHAIRMAN ABDEL-KHALIK: I think at  
8 this time, I'd like to move to next item on the  
9 agenda, which is a discussion of ACRS action items,  
10 unless there are some questions from the  
11 Subcommittee to the staff on the Chapter 7 material  
12 that has been presented. Any questions to the  
13 staff on Chapter 7 material that has been  
14 presented?

15 (No response.)

16 CHAIRMAN ABDEL-KHALIK: Okay, thank  
17 you. We'll move on to the next item on the agenda,  
18 which is discussion of ACRS action items.

19 MEMBER BROWN: While they're setting up,  
20 could I ask one question? This is for Ed or  
21 Warren.

22 MR. ED BROWN: Yes.

23 MEMBER BROWN: This is about the  
24 Common Q platform. Do you expect it from a -- the  
25 advertising is that the 70 percent allowed you to

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1 meet the deterministic behavior, okay, and was  
2 predictable in the field. As the bus loading --  
3 this is an information question. As the bus  
4 loading increases, does the response time of the  
5 platform increase?

6 MR. ED BROWN: No, it does not.

7 MEMBER BROWN: It stays the same. So  
8 when you say it maintains its original performance  
9 characteristic over that 70 percent range, based on  
10 your own testing. So if the response time for that  
11 platform is advertised at 250 milliseconds, just to  
12 pick a number, that you can load it to at least 70  
13 percent, and it will demonstrate that response each  
14 time, or within that range?

15 MR. ED BROWN: Yes, sir.

16 MEMBER BROWN: It may move around a  
17 little bit, which it most certainly will, because  
18 of the interrupt-driven nature of the processors,  
19 but it will still --

20 MR. ED BROWN: No. Actually, it will  
21 stay the same. The only reason that the response  
22 time would change is if the timing of the event  
23 relative to the cyclic nature. In other words, if  
24 an event occurs and the system has just read the  
25 process data before the event, it will have a

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1 longer response.

2 MEMBER BROWN: Right. I got that, and  
3 that's sometimes hard to achieve when you're  
4 inputting data. You've got to run a series of  
5 tests. I don't know. That's what I used to have  
6 to do. I used to go on multiple tests, because I  
7 knew I wasn't sure where the timing cycle I was  
8 getting.

9 MR. ED BROWN: That's how we get the  
10 maximum --

11 MEMBER BROWN: Yes.

12 MR. ED BROWN: It occurs just before or  
13 just after.

14 MEMBER BROWN: Okay, thank you.

15 CHAIRMAN ABDEL-KHALIK: Okay.

16 MR. HEAD: Before we went into the  
17 action items, we were going to address some of the  
18 issues or action items from the previous  
19 discussion.

20 CHAIRMAN ABDEL-KHALIK: Yes, sir.

21 MR. HEAD: Mike, did you want to say  
22 anything about the 70 percent discussion?

23 MR. MURRAY: Yes, I do. I want to  
24 present our position on the 70 percent discussion,  
25 but understanding that the qualification of the

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1 platform was qualified at 70 percent, and in  
2 expected configurations of the platform.

3 We'll design it to be less than 70  
4 percent. We'll test and verify that we are less  
5 than 70 percent. We'll test, and those are normal  
6 configurations expected of the platform, and as we  
7 go through our development processes, we  
8 continually test for that loading.

9 If we were to do a test to 70 percent  
10 for our design, we would not test our design, is  
11 the point to be made, okay. We would have to  
12 configure a design that is not our design, that is  
13 not expected performance of our system, in order to  
14 make a test like that.

15 So on our position, we feel that  
16 understanding the continuously monitored 70 percent  
17 diagnostics, along with the design of the system to  
18 maintain less than 70 percent than is normally  
19 expected configurations, we feel is adequate for  
20 that particular --

21 CHAIRMAN ABDEL-KHALIK: What is  
22 missing in this argument is the first point you  
23 made, which is --

24 MR. MURRAY: The qualification.

25 CHAIRMAN ABDEL-KHALIK: That the

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1 platform was qualified at 70 percent. We haven't  
2 seen that data.

3 MR. MURRAY: You haven't seen that  
4 then. Okay.

5 MR. ED BROWN: The committee might  
6 have seen that ten years ago, but this committee --

7 CHAIRMAN ABDEL-KHALIK: Has not.

8 MR. ED BROWN: Hasn't seen it, hasn't  
9 been able to resurrect it.

10 MR. HEAD: Okay. So that now, I would  
11 say, is a discrete action item that we have, to  
12 present that in a future discussion.

13 CHAIRMAN ABDEL-KHALIK: To show that  
14 the platform was qualified at 70 percent.

15 MR. HEAD: At 70 percent. That's what  
16 we're going to do.

17 CHAIRMAN ABDEL-KHALIK: Okay.

18 MR. HEAD: Is that all right?

19 MEMBER BROWN: Yes. The 70 percent.  
20 Yes. I thought I'd brought the SER with me for the  
21 Common Q platform, a copy of it, which had a very  
22 explicit statement at the end that said if anything  
23 changes, the NRC has the right to revoke.

24 CHAIRMAN ABDEL-KHALIK: Yes, but I  
25 understand the logic of your argument.

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1 (Simultaneous speaking.)

2 CHAIRMAN ABDEL-KHALIK: We're just  
3 trying to make sure that all the pieces are there.

4 MR. HEAD: We understand, okay. Thank  
5 you. So the first one I propose is to go back to  
6 Figure 7C-1, which we have on the board, excuse me,  
7 on the board, sorry.

8 MR. SWANNER: On the large screen TV  
9 everywhere. Okay, and I think I could repeat Member  
10 Stetkar's question, which was how does the diverse  
11 actuation equipment work with, and what are the  
12 requirements of it? Basically, one of -- there are  
13 several diverse components that are in place in the  
14 design, in the original certified design, to  
15 mitigate common cause failure.

16 One of those is HP Charlie, or excuse  
17 me, HPCF Charlie. There's a manual start. That  
18 push button is in the control room, and it can  
19 start hard-wired, as shown here, the HPCF. It can  
20 start the pump, open the injection valve, close the  
21 test return valve, close the test bypass valve and  
22 it can auto start.

23 MEMBER STETKAR: And that's in your  
24 jargon a system level manual action?

25 MR. SWANNER: That's correct.

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1 MEMBER STETKAR: One button, all of  
2 those things happen, the switch --

3 MR. SWANNER: That's correct. The  
4 same thing we were asked about where do the manual  
5 controls from the control room come into it. If  
6 there were a system level actuation, it would come  
7 into the SLF right here as shown. On a component  
8 level, if they just wanted to actuate a valve or a  
9 pump, it would actually come into the RDLIC.

10 So that's where -- that was the  
11 confusion in the response. So and the other manual  
12 controls, as shown here, are similar. There's a,  
13 you know, RCIC steam supply inward isolation valve.

14 You can control that manually, hard-wire directly  
15 from the control room to the component, as well as  
16 the cleanup system, inboard containment isolation  
17 valve as well.

18 And the components needed to safely  
19 shut the reactor down in the event of a common  
20 cause failure, all of that equipment and the  
21 diversity is listed in two places in the  
22 application. One is in Tier 1, 3.4 Charlie, and  
23 the other is in Tier 2, Appendix 7 Charlie.

24 One thing to point out is essentially  
25 these were incorporated by reference from the

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1 original ABWR DCD design. So if you just look at  
2 the COLA application, which only has the change  
3 paragraphs, you won't get much of the text there.  
4 So the actual requirements for the diversity are  
5 listed, you know, if you combine the documents.

6 MEMBER STETKAR: The question I had  
7 today didn't relate to the diverse equipment.

8 MR. SWANNER: Sure.

9 MEMBER STETKAR: It was making sure  
10 that the normal equipment could indeed be operated,  
11 albeit individually, perhaps starting several pumps  
12 and opening several valves individually. But still  
13 the operators had that capability to do that from  
14 the main control panel somehow, under a condition  
15 where ESLF itself, where you didn't have the system  
16 level --

17 MR. SWANNER: I understand.

18 MEMBER STETKAR: And, thanks. That  
19 helped.

20 MR. SWANNER: No problem.

21 MR. HEAD: Okay. The next one I think  
22 we'd like to discuss is the DIVOM question.

23 CHAIRMAN ABDEL-KHALIK: DIVOM.

24 MR. HEAD: Excuse me. That's what I  
25 wrote down, sorry. And I sense from the discussion

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1 that it's, at least initially, the GE7 aspect of  
2 it.

3 CHAIRMAN ABDEL-KHALIK: Well, there's  
4 a GE method.

5 MR. HEAD: Yes.

6 CHAIRMAN ABDEL-KHALIK: A GE set of  
7 codes that have been approved by the staff to do  
8 this, and the question is do you have access to  
9 those codes.

10 MR. HEAD: Well, we're a member of the  
11 owners group, and those, the analysis that's done  
12 is, you know, core-specific, and that's something  
13 that we would be expecting to do post-COL. If we  
14 decided to stay with the GE7 fuel, then that's what  
15 we would have to go do, and we would expect GE to  
16 have fixed their Part 21 issues.

17 Sorry. I was headed to where I think  
18 you were going, that they would have addressed  
19 their Part 21 issues. Now for what -- we obviously  
20 plan to make that irrelevant by what our plans with  
21 respect to Optima-2, and that we expect to being  
22 calculated with POLCA-T, and that's one of the  
23 codes that we presented to you back in October as  
24 part of the fuel --

25 CHAIRMAN ABDEL-KHALIK: The fuel

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1 amendment aside, let's just look at your  
2 application right now, with GE7 fuel, what you're  
3 telling me that if you need to contract with GE to  
4 generate the DIVOM correlation, if that's what is  
5 needed, that's what you'll do.

6 MR. HEAD: Yes, sir.

7 CHAIRMAN ABDEL-KHALIK: Is that the --

8 MR. HEAD: Yes, sir.

9 CHAIRMAN ABDEL-KHALIK: Okay, I accept  
10 that.

11 MR. HEAD: Okay. Then I believe, as a  
12 result of the Chapter 7 discussions, I now have  
13 five action items. Oh, excuse me, there were five.

14 One is the watchdog, which is -- we've agreed to  
15 correct. One is the tech spec discussion that  
16 we'll have on Chapter 16. The DIVOM I believe  
17 we've just answered.

18 The seven, Figure 7C-1, I believe  
19 we've just answered, and the 70 percent loading is  
20 a new one that we will carry and address in a  
21 future discussion. Okay. Maitri, is that --

22 MS. BANERJEE: So we have three?

23 MR. MURRAY: Correct.

24 MR. HEAD: Yes. Okay, so with that, I  
25 will turn it over to Coley to go through the two

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1 that we would like to talk about today.

2 CHAIRMAN ABDEL-KHALIK: All right,  
3 thank you. Thank you very much.

4 MR. COLEY: So this is our  
5 presentation that covers a couple of action items,  
6 basically a recap of an action item, and also a  
7 look ahead as to how we might address a future  
8 action item that is related to some of the  
9 discussions that this group has been involved in.

10 We have our same personnel up here,  
11 and we'll cover these two action items. Next slide  
12 please. So this is a recap of the inter-channel  
13 communication and determinacy for the FPGA and  
14 Common Q platform. This was Action Item 7 that was  
15 on the list, that we covered and summarized in the  
16 Chapter 7 presentation.

17 I know we have some additional action  
18 items that came out of the overall discussion, but  
19 this is intended to see if we've covered all the  
20 pieces, and then also the redundancy and diversity  
21 of the overspeed on the turbine generator.

22 So we had a, I'll give a brief  
23 discussion on that as well. So slide, please. All  
24 right. So this is the question that we were  
25 carrying forward as an action item, dealing with

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1 independence and determinacy, specifically for  
2 Common Q. I know we got into some pieces. So we  
3 captured all of the follow-on discussion from this,  
4 and can we consider this particular item close to  
5 those follow-on action items at this point.

6 CHAIRMAN ABDEL-KHALIK: From my  
7 perspective they have, but other Committee members  
8 may feel differently. The question has been posed.

9 MEMBER BROWN: Yes. The only items  
10 are confirming the 70 percent issue and the FPGA  
11 watchdog timer implementation, and other than --

12 MEMBER STETKAR: There's essentially  
13 no more information that they can -- we understand  
14 how that works.

15 MEMBER BROWN: Yes.

16 MR. HEAD: So our proposal would be  
17 since we have the two new ones, can we say that  
18 we've addressed this one?

19 MEMBER BROWN: I don't care how we do  
20 it administratively.

21 (Simultaneous speaking.)

22 MR. HEAD: Okay. I mean we'll just  
23 open two new ones, you know. We'll trade you two  
24 for three.

25 (Simultaneous speaking.)

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1 MR. HEAD: Well, this was a big one.  
2 We had two very -- okay, all right. Now I feel  
3 better. All right.

4 MR. COLEY: The next one, quite the  
5 opposite. We're not attempting to close this one  
6 at all, but we want to give an update. Based on  
7 the meeting that we had with the staff last  
8 Wednesday to discuss some turbine overspeed RAIs,  
9 we discussed the acceptance criteria at this  
10 meeting for the SRP. We also discussed ITAAC and  
11 we've come out of that meeting with more  
12 understanding about how we're going to revise those  
13 RAIs.

14 So we'll put additional information in  
15 the FSAR, additional information that will explain  
16 how the SRP acceptance criteria is met, and provide  
17 more detail that supports the ITAAC. We expect  
18 those RAIs, we said in that meeting that we have  
19 RAIs to the staff for them to look at by next  
20 Wednesday.

21 So that's the time frame associated  
22 with that. I understand Chapter 10's coming up, so  
23 we wanted to give you an update as to this  
24 information. It will be available soon.

25 CHAIRMAN ABDEL-KHALIK: Chapter 10

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1 will be discussed on April 6th. So that should be  
2 plenty of time for you to provide that information.

3 MR. COLEY: I believe that's the  
4 current schedule, yes, sir.

5 MR. HEAD: Did you summarize the  
6 middle -- do you want to summarize the middle  
7 paragraph?

8 MR. COLEY: I just -- yes, I didn't  
9 read. I mean we have, this is all stemming from a  
10 departure, in which we replaced the primary  
11 overspeed mechanically with the second electrical  
12 overspeed.

13 CHAIRMAN ABDEL-KHALIK: You sort of  
14 had some hesitation about the April 6th date.

15 MR. COLEY: I have heard that it may  
16 not be certain, but that's all I know.

17 MEMBER BROWN: It may not be what?

18 MR. COLEY: Certain.

19 MR. HEAD: We're striving to make it  
20 certain.

21 MR. COLEY: Okay.

22 (Laughter.)

23 MR. HEAD: If you get your stuff to  
24 us, it will be certain.

25 MR. COLEY: Exactly.

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1 (Simultaneous speaking.)

2 MEMBER BROWN: I'm presuming, I mean  
3 I'm looking at our action item list, and there was  
4 -- I mean I had the question, and I think John also  
5 asked the question at the time. I'm frankly  
6 working the details --

7 (Simultaneous speaking.)

8 MEMBER BROWN: And we were kind of  
9 said hey look. In September, we were told this  
10 would be resolved later, and so we said okay, we'll  
11 wait. I presume we'll get this information prior  
12 to the meeting.

13 MR. HEAD: Yes.

14 MEMBER BROWN: Okay, all right.

15 MR. HEAD: Well, I mean --

16 MEMBER BROWN: That's not your action.  
17 That's their action.

18 MR. HEAD: Yes, part of the chapter.  
19 But when the RAI response comes in, that will be  
20 the detail of our position. So --

21 MR. COLEY: So I'm feeling very  
22 confident about April 6th.

23 CHAIRMAN ABDEL-KHALIK: That's really  
24 great to hear.

25 MR. COLEY: Okay. I think that's it.

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1 Are there any additional questions? That's just  
2 an update on action items.

3 CHAIRMAN ABDEL-KHALIK: Are there any  
4 question to the Applicant regarding these two  
5 items? Charlie.

6 MEMBER BROWN: Not to the Applicant.  
7 Just a comment to the staff on one of them.

8 MR. TONACCI: Go ahead.

9 MEMBER BROWN: And that just you all  
10 commented that -- the comment was that we would see  
11 it with the final SEI with no open items. That was  
12 45, the turbine overspeed trip, and all I would  
13 like to see is to make sure that we just don't see  
14 the safety evaluation that says we accepted the  
15 RAI and we agree with its conclusions.

16 I'd like to actually see the RAI  
17 performance. That's all. That was just an  
18 execution item, but that's all.

19 MR. TONACCI: Maitri, if we can amend  
20 that, so that we won't forget to see the RAI.

21 CHAIRMAN ABDEL-KHALIK: Anything else  
22 regarding these two items? Okay, so thank you very  
23 much. Is the staff prepared to present any  
24 discussion of any ACRS action items? No. Thank  
25 you. Okay. At this time, I would like to open the

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1 phone bridge line, in case there are any members of  
2 the public.

3 MS. BANERJEE: Yes. I was told last  
4 time that we have six people attending through the  
5 bridge line.

6 CHAIRMAN ABDEL-KHALIK: Well, let's  
7 open the bridge line and see if any members of the  
8 public would like to make a statement.

9 MEMBER STETKAR: This is always an  
10 uncertain process.

11 CHAIRMAN ABDEL-KHALIK: What was that?

12 MEMBER STETKAR: This is always an  
13 uncertain process. You typically have to ask  
14 somebody to make some sound.

15 CHAIRMAN ABDEL-KHALIK: Is the line  
16 open? Okay. Are there any members of the public  
17 on the phone line?

18 (No response.)

19 CHAIRMAN ABDEL-KHALIK: Okay, let me  
20 ask it again. Do we have anyone on the phone line?

21 MR. PINTO: Yes, you do.

22 CHAIRMAN ABDEL-KHALIK: Yes, sir.  
23 Could you please identify yourself?

24 MR. PINTO: Yes. This is Johnny  
25 Pinto, Sarasota, Florida.

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1 CHAIRMAN ABDEL-KHALIK: Okay. Let me  
2 ask the question in a little more specific way.  
3 Are there any members of the public who wish to  
4 make a comment or a statement?

5 (No response.)

6 CHAIRMAN ABDEL-KHALIK: Okay. Hearing  
7 none, then I guess that item is closed. So we will  
8 close the phone line again, please. Before we  
9 conclude the meeting, are there any additional  
10 comments or questions that members of the  
11 Subcommittee would like to make?

12 MEMBER SIEBER: Nothing from me.

13 CHAIRMAN ABDEL-KHALIK: John?

14 MEMBER STETKAR: No. I think I'd like  
15 to congratulate STP. Good presentations.

16 CHAIRMAN ABDEL-KHALIK: Charlie?

17 MEMBER STETKAR: Oh NINA, I'm sorry.

18 (Simultaneous speaking.)

19 MEMBER BROWN: Yes. I'd just like to  
20 amplify that, that the Appendix 7DS I thought was  
21 extremely valuable, in terms of providing a raft of  
22 clarifications that weren't available in any other  
23 piece of paper or documents that you have, and  
24 they're pretty well presented. So I wanted to  
25 congratulate you. I thought that was a good job

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1 and I appreciate the effort that went into that.

2 MR. HEAD: Thank you.

3 CHAIRMAN ABDEL-KHALIK: Well, thank  
4 you very much. The meeting's adjourned.

5 (Whereupon, at 4:20 p.m., the meeting  
6 was adjourned.)

7

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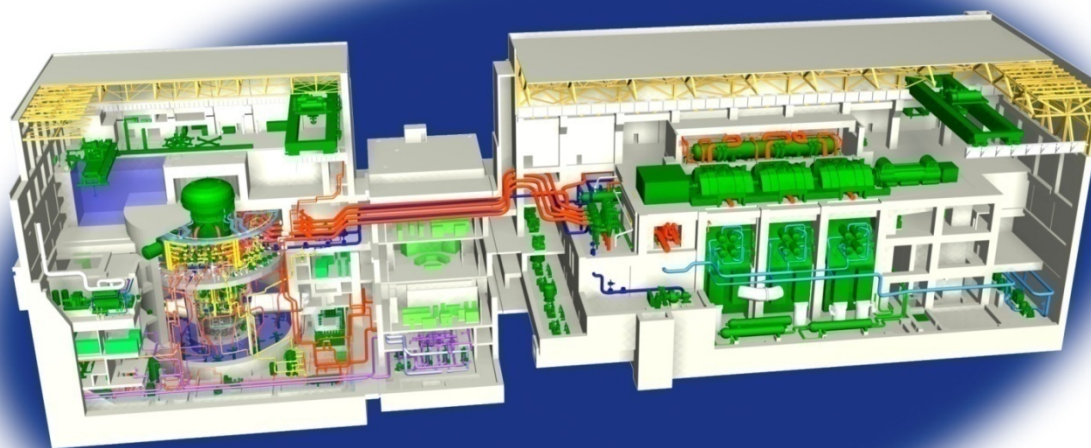
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# South Texas Project Units 3 & 4

## Presentation to ACRS Subcommittee

### Chapter 7

### Instrumentation and Control Systems



# Agenda

Chapter 7 was discussed at ACRS ABWR Subcommittee on May 20, 2010.

Discussion points for status update since last meeting:

- Setpoint Methodology
- Current RGs and Codes and Standards applied to ELCS (Common Q)
- FSAR Tier 2 Appendix 7DS
  - Four Design Principles
  - Simplicity

# Attendees

Mike Murray (NINA)

Scott Head (NINA)

Coley Chappell (NINA)

Kyle Dittman (NINA)

James Cook (NINA)

Akira Fukumoto (Toshiba)

Hiroshi Sakamoto (Toshiba)

Kiyotaka Wakita (Toshiba)

Jun Ikeda (TANE)

Ed Brown (WEC)

Warren Odess-Gillett (WEC)

Bob Quinn (WEC)

David Herrell (TANE)

Craig Swanner (TANE)

# Instrument Setpoint Methodology

- Response to RAI 07.01-16
- WCAP-17119-P Revision 2, “Methodology for South Texas Project Units 3 & 4 ABWR Technical Specification Setpoints” submitted on July 29, 2010
- Included a summary of methodology application and typical setpoints for the OPRM trip function



# Current RGs and Codes and Standards applied to Common Q Platform

- Revision 2 to Response to RAI 07.01-14
- Westinghouse Common Q Platform (WCAP-16097) approved applying RGs and industry codes and standards in effect at the time
- NINA has committed to apply the RGs and codes and standards in effect 6 months prior to submittal of the COLA for all safety related DI&C platforms including ELCS (Common Q)

# FSAR Appendix 7DS

- Consolidates information from various parts of COLA and applicable technical or topical reports regarding
  - Four Design Principles (redundancy, independence, determinism & diversity)
  - Simplicity
- Includes or describes no new design changes or departures
- Scope includes safety-related DI&C
  - Reactor Trip and Isolation System (RTIS) & safety-related Neutron Monitoring System (NMS) using Field Programmable Gate Array (FPGA) based platform
  - Engineered Safety Features Logic & Control System (ELCS) using Common Q based platform
- Maps Design Principles to applicable ITAAC and DAC

# RTIS/Safety Related NMS

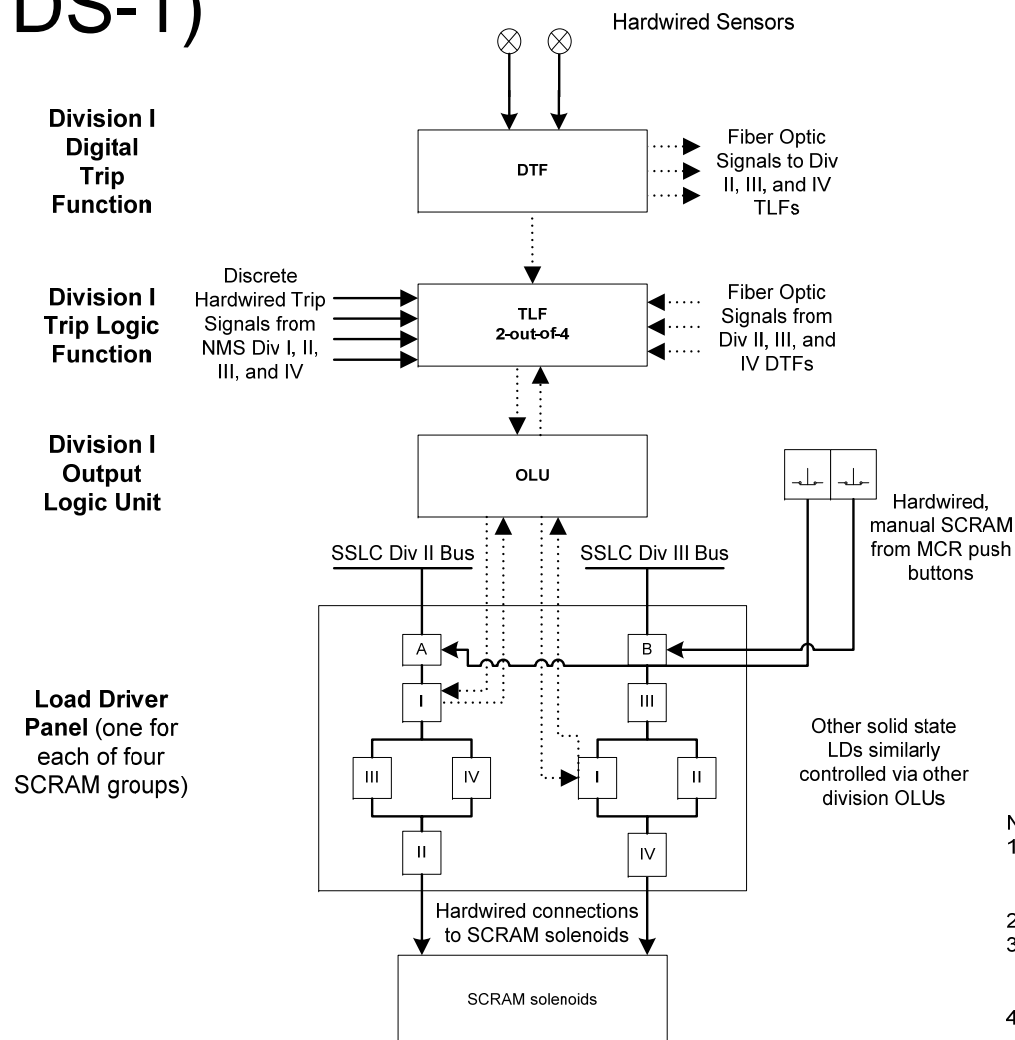
- Overview
- Redundancy
- Independence
- Determinism
- Diversity
- Simplicity

# RTIS/NMS Platform Overview

- Digital Trip Function (DTF)
  - Analog to digital conversion of hardwired sensor input
  - Compares signal values to setpoints to determine sensor division trip and status
- Trip Logic Function (TLF)
  - Receives sensor division trip and status information from four redundant DTFs
  - Performs 2-out-of-4 voting to determine automatic divisional trip
  - Sends divisional trip to Output Logic Unit
- Output Logic Unit (OLU)
  - Receives automatic divisional trip from its divisional TLF
  - OLU distributes trip outputs to Load Drivers (LDs) for reactor trip and Main Steam Isolation Valve (MSIV) closure

# RTIS/NMS Platform Overview

## (Figure 7DS-1)



### Notes:

- 1) RTIS-RPS Division I shown; other divisions typical. RTIS-MSIV equipment similar.
- 2) Not all communication links shown.
- 3) Figure 7DS-1 derived from Tier 1 Figures 2.2.7b and 3.4b and Tier 2 Figures 7.2-8 through 10.
- 4) Fiber Optic communication is denoted by dotted lines and hardwired communication is denoted by solid lines.

# RTIS/NMS Platform Redundancy

- NMS has four independent & redundant divisions that provide trip and status to each division of RTIS
- RTIS has four independent & redundant divisions
  - Each division includes a DTF, a TLF, and an OLU
  - Division-of-Sensors bypass
  - Trip-Logic-Output bypass
- Each division has independent & redundant power sources

# RTIS/NMS Platform Independence

- Four independent, divisional power sources
- Independence from non-safety systems
  - Communications isolation and independence
  - Electrical isolation and physical separation
- Four independent RTIS/NMS sensor divisions to determine divisional sensor trips
  - No communication between sensor divisions
  - Only trip and status information is communicated across division boundary to support 2-out-of-4 voting function
- Four independent RTIS TLF and OLU divisions
  - Communication isolation and independence
  - Electrical isolation and physical separation

# RTIS/NMS Platform Independence – Communication

## ■ RTIS Communication Across Divisions

- Communicates trip and status information of fixed length, fixed content, and predefined format
- Qualified, isolated, point-to-point, unidirectional fiber optic communication links
- Each communication link has its own independent buffer

## ■ Communication to Other Systems

- Qualified, isolated, point-to-point, unidirectional fiber optic communication links
- Each communication link has its own independent buffer

## ■ All communications include Self-Diagnostics functions

- Continuously monitor proper communication performance
- Upon detection of failure, division marked as inoperable (i.e., tripped) and operator is alerted



# RTIS/NMS Platform Determinism

- Each FPGA is a synchronous, clocked sequential circuit
  - Each FPGA only starts processing data when data is transferred into that FPGA, and sends data to the next FPGA or module when processing is complete
  - Changes of state occur only at selected times, controlled by a timing signal
  - All FPGAs performing signal processing functions on a module are monitored by a diverse, hardware based watchdog timer
  - Watchdog timer time out marks module as inoperable (i.e., tripped) and operator is alerted
- Timing is verified by analysis and simulation during design

# RTIS/NMS Platform Diversity

- RTIS and NMS platforms diverse from the Engineered Safety Features (ESF) Control and Logic System (ELCS) which actuates ESF functions
- RTIS and NMS diverse from non-safety and balance of plant I&C systems
- RTIS diverse from Anticipated Transient Without Scram (ATWS) mitigation equipment

# RTIS/NMS Platform Simplicity

- Separation of Safety and Non-Safety Functions
  - Non-safety functions are not performed in safety related equipment
  - Complex activities (e.g. cross channel checks and historian functions) are performed in non-safety equipment
- Non Re-Writable (NRW) FPGA
  - Functionality implemented in fixed gates with deterministic timing that cannot be changed
- Minimization of Interdivision Communication
  - Communication across division boundaries limited to trip and status information for 2-out-of-4 coincidence logic

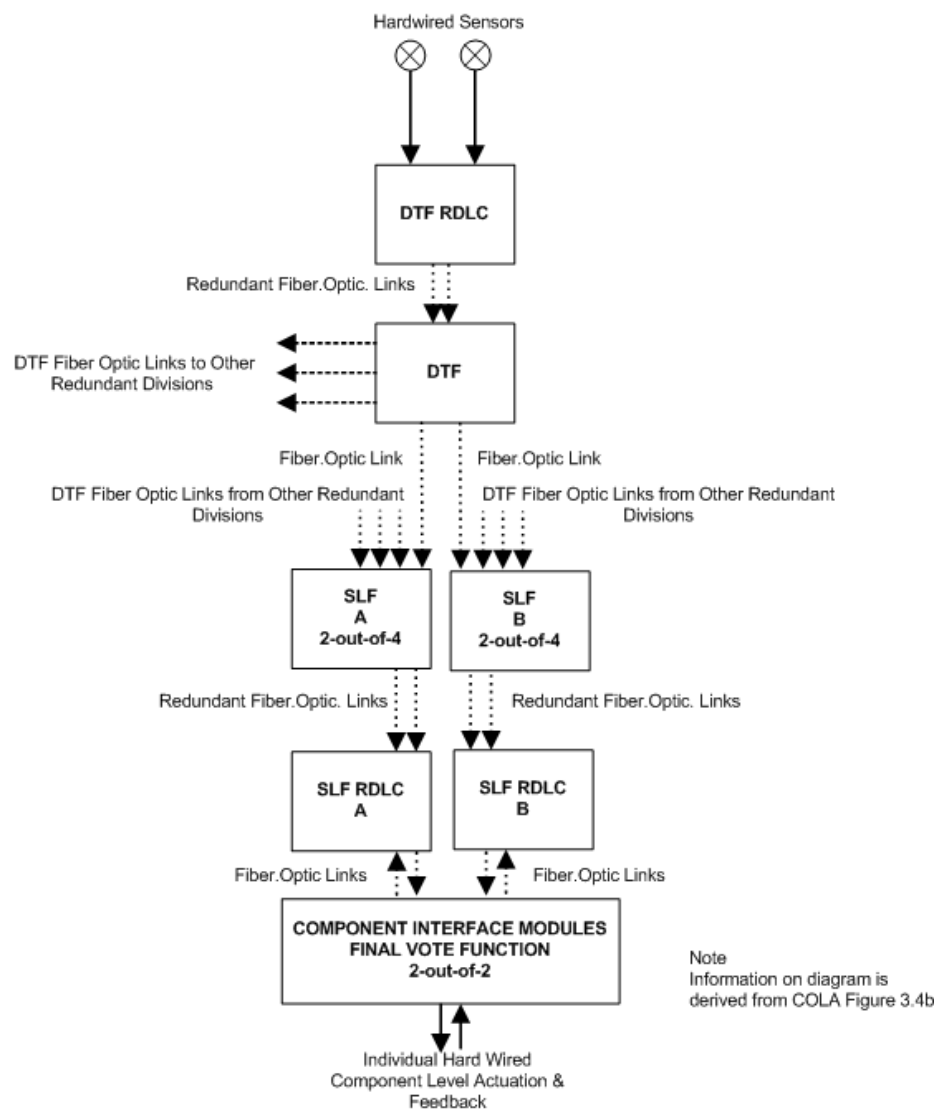
# ELCS

- Overview
- Redundancy
- Independence
- Determinism
- Diversity
- Simplicity

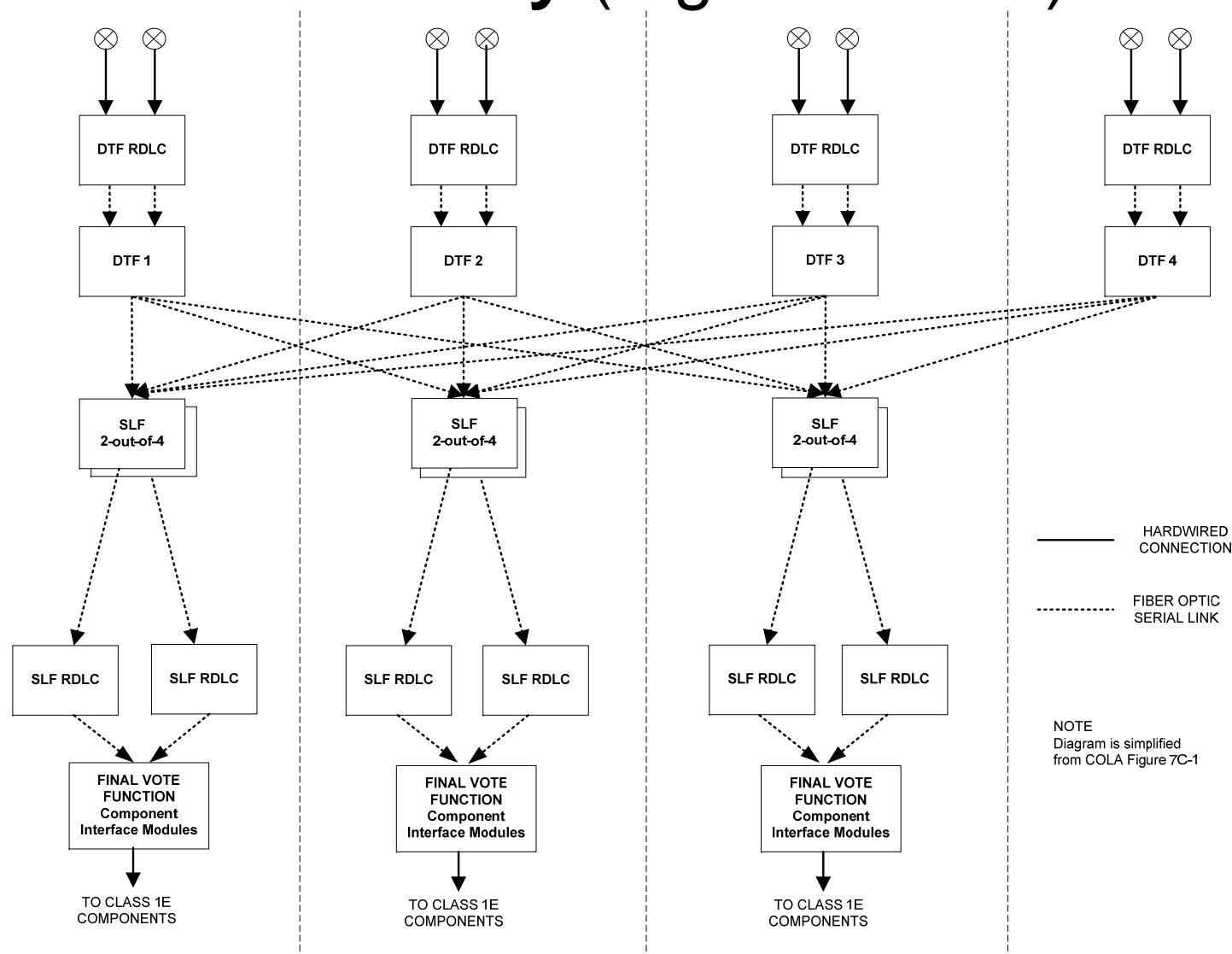
# ELCS Overview

- Digital Trip Function Remote Digital Logic Controller (DTF RDLC)
  - Remote data acquisition of Engineered Safety Feature (ESF) sensor signals
- Digital Trip Function (DTF)
  - Compares signal values to setpoints to determine division ESF safety function initiation status for one division
- Safety Logic Function (SLF)
  - Performs 2-out-of-4 coincidence logic to determine system level automatic initiation status
- Safety Logic Function Remote Digital Logic Controller (SLF RDLC)
  - Receives system level automatic and manual system level actuation signals from SLFs
  - Provides logic to determine component actuation and control commands to Final Vote Function
- Final Vote Function
  - Receives individual component actuation and control commands
  - Performs 2-out-of-2 coincidence logic (where necessary) for component actuation and control

# ELCS Platform Overview (Figure 7DS-3)



# ELCS Redundancy (Figure 7DS-4)



# ELCS Redundancy

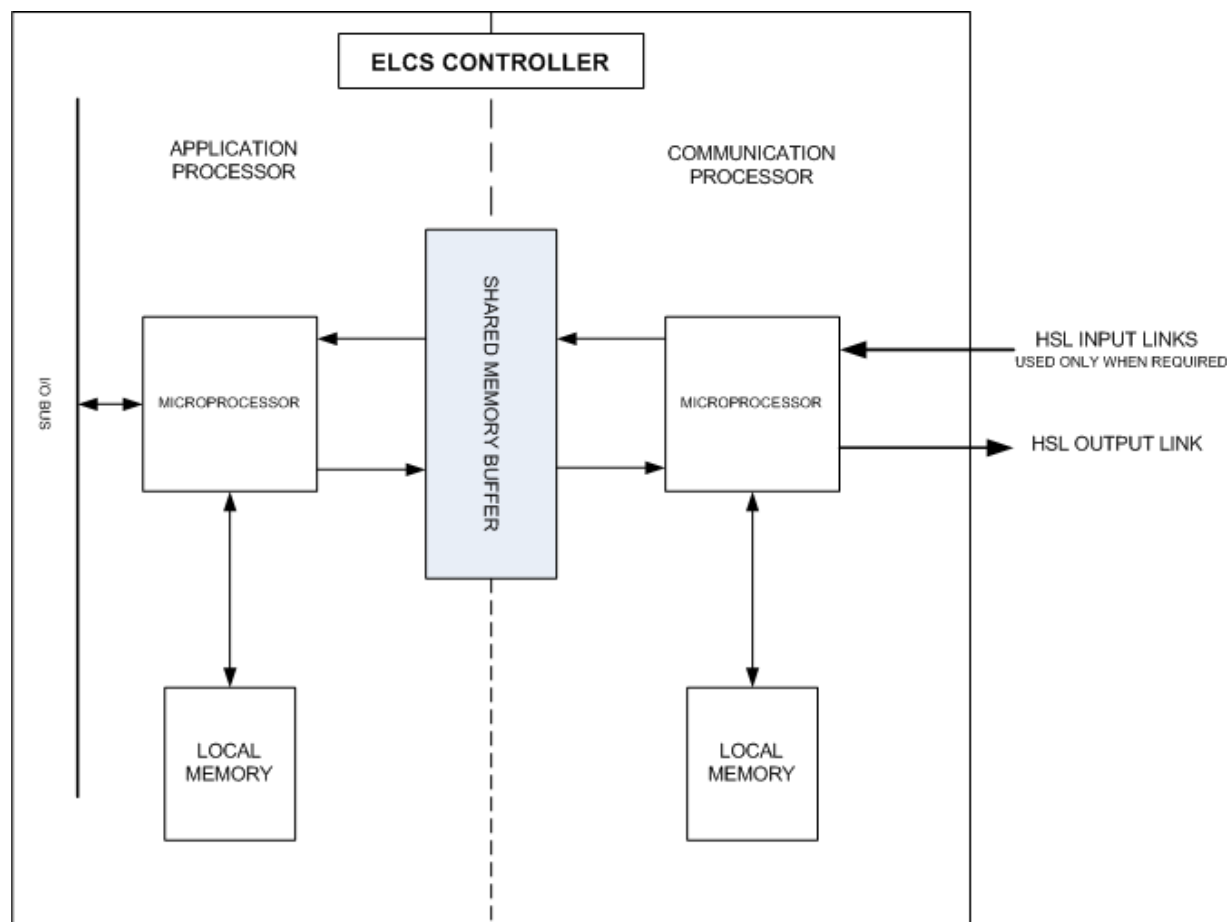
- Four independent & redundant sensor divisions
- Three independent & redundant ESF Safety Function Actuation divisions
  - ESF safety function system level initiation
  - ESF component actuation and control
- Four independent & redundant divisional power sources



# ELCS Independence

- Four independent power sources
- Independence from non-safety systems
  - Electrical isolation and physical separation
- Four independent ESF sensor divisions
- Three independent ESF Safety Function Actuation divisions
  - Electrical isolation and physical separation
- Communications Independence
  - Safety related communications are isolated and independent
  - Non-safety related communications are isolated and independent

# ELCS Controller Simplified Diagram



NON-PROPRIETARY VERSION OF FUNCTIONAL ARCHITECTURE FIGURE,  
SECTION 6.2.1.2.1.2 OF COMMON Q TOPICAL REPORT WCAP-16097-P-A

# ELCS Independence

## Inter-division Communication

- DTF to SLF Communication
  - DTF transmits trip status to SLFs
    - Unidirectional Serial Link with fiber optic isolation
    - Fixed periodicity of transmission
    - All data transmitted, even if none has changed
    - Fixed length, fixed format message
      - Fixed data mapping – same data point in same position
      - Data redundancy provided in message
      - Cyclic redundancy check (CRC) data provided in message
  - Supports detection of corrupt data

# ELCS Independence

## Inter-division Communication (cont'd)

### ■ DTF to SLF Communication (cont'd)

- SLF receives DTF communication
  - SLF has a communication processor and an application processor that communicate through shared memory
  - Communication processor receives message
    - Link failure diagnostic detects failed link
      - Provides error status for bad message
    - CRC diagnostic provides error status for bad message
    - Data redundancy diagnostic provides error status for bad message
    - Stores message in a unique location in shared memory
  - Application processor reads message
    - Bad message status causes the message data to be replaced with predetermined value
    - Alarm message sent to operator

# ELCS Determinism

- ELCS Application Processor
  - No external interrupts
  - Internal clock uses precision interval timer
    - Cyclic execution of application software modules based on precision interval timer
    - Predetermined fixed execution cycle
    - Maximum processor load of 70% – enforced by self-diagnostic
    - Buffered from external communication – read and write data from buffered memory on a fixed cycle, independent of communication interface status
    - Communication interfaces – flag corrupt data as bad message
    - Application uses predetermined values in place of bad message
  - Diagnostics provide annunciation to operator
    - Watchdog timer hardware output monitored by independent controller
    - Over-run of cyclic execution time monitored by self-diagnostic
    - Communication self-diagnostics monitored by application

# ELCS Determinism

## ■ ELCS Communication Processor

- Deterministic Protocol
- All data transmitted, even if none has changed
- Fixed length, fixed format message
  - Fixed data mapping – same data point in same position
  - Data redundancy provided in message
  - Cyclic redundancy check (CRC) data provided in message
- Deterministic Transmission Intervals
  - Based on fixed intervals of application processor requests to send messages
- Deterministic Reception Intervals
  - Based on fixed message reception intervals from transmitting controllers
- Communication process is buffered from application processor by shared memory
- Diagnostics provide annunciation to operator
  - Watchdog timer hardware output monitored by independent controller
  - Loss of communication monitored by controller receiving the communication
  - Message Diagnostics – CRC and data redundancy monitored by the controller receiving the transmission

# ELCS Determinism

## ■ Response Time Analysis

- ☐ Criteria based on Safety Analysis requirements
- ☐ Includes all delay elements
- ☐ Determines minimum and maximum acceptance criteria for response time validation testing
- ☐ Documented in a report

## ■ Validation Testing

- ☐ Validates analysis
- ☐ Documented in a report

# ELCS Diversity

- Diverse from equipment credited to mitigate ELCS failure
  - Diverse equipment is hard wired
- Diverse from RTIS and NMS
  - ELCS is microprocessor based
  - RTIS and NMS are FPGA based
- Diverse from non-safety control systems
  - Different microprocessor and software
  - Different communications technology and equipment



# ELCS Simplicity

- Separation of Safety and Non-Safety
  - ELCS control is performed within ELCS
  - No non-safety digital control communication links with priority modules
- Simplicity of Communication
  - Unidirectional serial links for automatic and manual initiation of ESF safety functions simplify architecture
- Minimization of Interdivision Digital Communication
  - Only system level coincidence logic function uses interdivisional digital communication links

# Mapping of Design Principles to Applicable ITAAC

## ■ Example Supporting Information provided in Appendix 7DS

- Tier 1 Table 2.7.5 ITAAC 2 requires deterministic communications protocols

Table 2.7.5 Data Communication

Inspections, Tests, Analysis and Acceptance Criteria		
Design Commitment	Inspections, Tests, Analysis	Acceptance Criteria
2. The ECFs use deterministic communication protocols	Tests of the ECFs communications protocols will be conducted in a test facility	The ECFs use deterministic communications protocols

- Section 7DS.2.3.2.2 describes all steps in ESF communication timing
- Section 7DS.2.3.2.2 statement “{Each step in the process is predictable and repeatable. This is the time response that is designed to meet the Safety Analysis requirements.}<sup>16</sup>” points to Note 16 in Table 7DS-1
- Table 7DS-1 Note 16 links the bracketed description back to Tier 1 Table 2.7.5 ITAAC 2.

# ACRS Action Item Summary

## Action Item 7 from May 20, 2010 ACRS Meeting

- Further discussion was needed on the application of Common-Q platform, independence and determinism

## Response to Action Item 7

- Explanation in FSAR Tier 2 Appendix 7DS and ELCS Presentation Information
  - Explains that data corruption does not compromise communication independence
  - Explains inter-division communication compliance to independence and determinism requirements
  - Explains the compliance to determinism requirements

# Chapter 7

## Questions and Comments



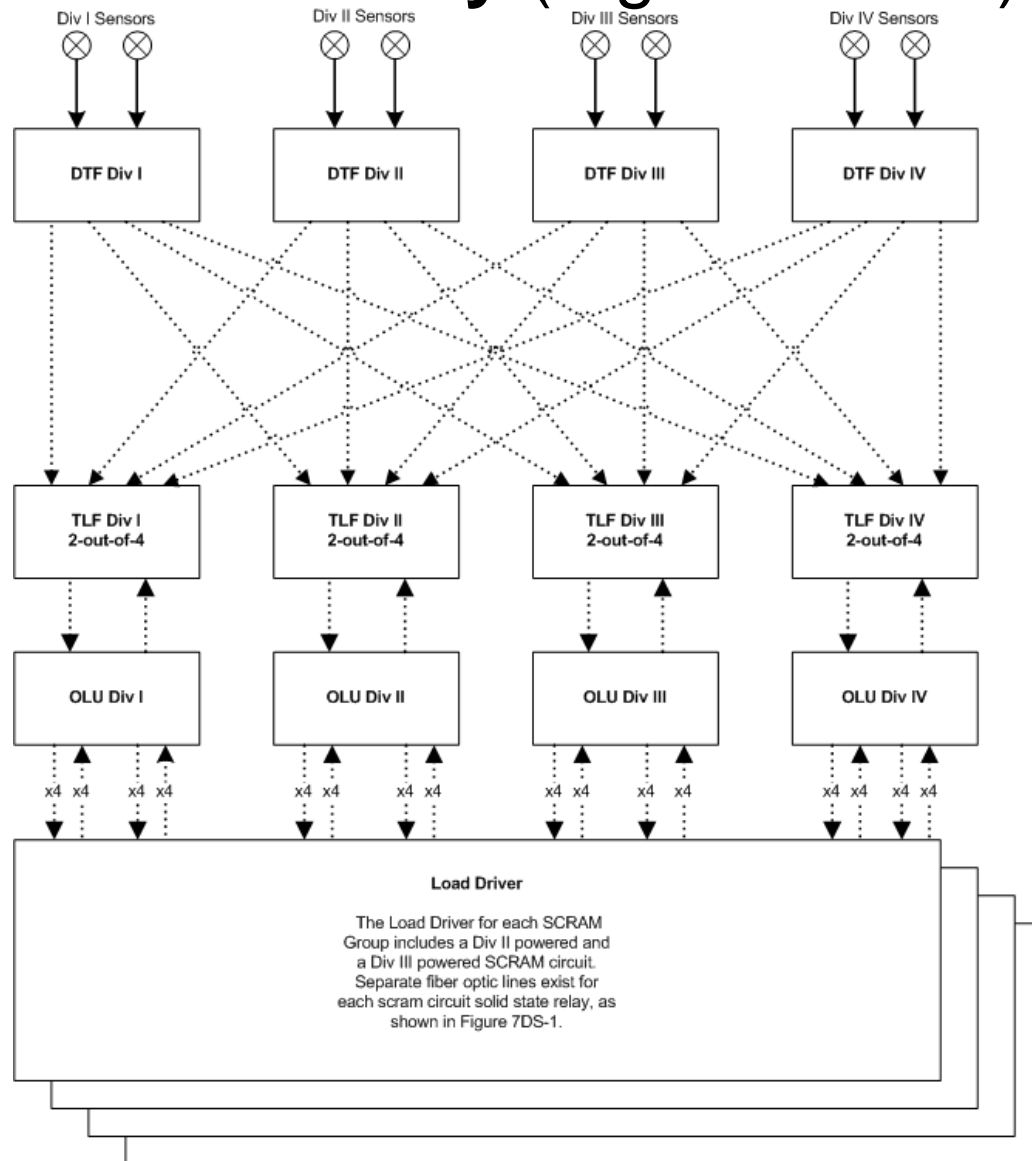
# Acronyms

ABWR	Advanced Boiling Water Reactor
APRM	Average Power Range Monitor
COLA	Combined License Application
CRC	Cyclic Redundancy Check
DAC	Design Acceptance Criteria
DI&C	Digital Instrumentation and Controls
DIV	Division
DTF	Digital Trip Function
ECCS	Emergency Core Cooling System
ELCS	Engineered Safety Features Logic and Control System
ESF	Engineered Safety Features
FPGA	Field Programmable Gate Array
FSAR	Final Safety Analysis Report
HSL	High Speed Link
I&C	Instrumentation and Controls
I/O	Input / Output
ICRC	ITAAC Closure Requirements Checklist
ITAAC	Inspections, Tests, Analyses, and Acceptance Criteria
LD	Load Driver
LDS	Leak Detection and Isolation System

# Acronyms (cont'd)

LPRM	Local Power Range Monitor
MCR	Main Control Room
MSIV	Main Steam Isolation Valve
NINA	Nuclear Innovation North America
NRW	Non-rewritable
NMS	Neutron Monitoring System
OLU	Output Logic Unit
OPRM	Oscillation Power Range Monitor
RAI	Request for Additional Information
RDLC	Remote Digital Logic Controller
RG	Regulatory Guide
RPS	Reactor Protection System
RTIS	Reactor Trip and Isolation System
SLF	Safety System Logic Function
SRNM	Startup Range Neutron Monitor
SSLC	Safety System Logic and Control
TANE	Toshiba America Nuclear Energy
TLF	Trip Logic Function
WEC	Westinghouse Electric Corporation

# RTIS/NMS Redundancy (Figure 7DS-2)





# **Presentation to the ACRS Subcommittee**

**South Texas Project Units 3 and 4 COL Application Review**

**Chapter 7 Advance SER (with no Open Items)  
“Instrumentation and Controls”**

February 8, 2010



## **STP 3 & 4 COL Chapter 7 Staff Review Team**

- **Project Managers**

- George Wunder, Lead PM, DNRL/NGE2
- Adrian Muñiz, Chapter PM, DNRL/NGE2

- **Technical Staff**

- Dinesh Taneja, Reviewer, DE/ICE2
- Jack Zhao, Reviewer, DE/ICE1
- Eugene Eagle, Reviewer, DE/ICE2
- Sang Rhow, Reviewer, DE/ICE2

## **Summary of Technical Discussion Points for STP 3 & 4 COL Chapter 7 Review**

<b>SER Open Item 07.01-16</b>	Open item 07.01-16 in the SER with OI (Phase 2)
<b>RAI 07.01-14</b>	2 <sup>nd</sup> revised response related to applicability of NRC Regulatory Guides and Industry Standards to Common Q platform used for ELCS
<b>ACRS ABWR Subcommittee Action</b>	Application of Common Q platform, independence and deterministic implementation
<b>Appendix 7DS</b>	Staff evaluation of Appendix 7DS, “Digital Instrumentation and Control Design Verification for Safety-Related Systems”

## SER Open Item 07.01-16

- Reference to post-COL document in COLA
  - In the setpoint methodology report (WCAP-17119-P, Rev. 1), a reference was made to WCAP-17137-P, “Westinghouse Stability Methodology for the ABWR,” for OPRM setpoints. This topical report is a part of the planned post COL fuel amendment activity, and can’t be referenced in the COL application.
  - In response to RAI 07.01-16, the applicant has agreed to remove the reference to WCAP-17137-P from the setpoint methodology report, and include typical setpoint values and associated uncertainties for the OPRM.
  - The staff finds this RAI response acceptable.
  - Proposed changes to the FSAR and WCAP-17119-P are being tracked as **Confirmatory Item 07.01-16**.

## **RAI 07.01-14 2<sup>nd</sup> Revised Response**

- Applicability of regulatory guides and industry standards to Common-Q platform used for ELCS
  - On September 23, 2010, the applicant provided 2<sup>nd</sup> revised response to RAI 07.01-14, which commits to meeting current NRC Regulatory Guides and industry standards for the Common-Q platform used for ELCS
  - This RAI response includes proposed changes to the FSAR Table 1.8-20, “NRC Regulatory Guides Applicable to ABWR,” and Table 1.8-21, “Industry Code and Standards Applicable to ABWR”
  - The staff finds this 2<sup>nd</sup> revised RAI response acceptable
  - Proposed changes to the FSAR are being tracked as **Confirmatory Item 07.01-14**

## **ACRS ABWR Subcommittee Action Item**

- Application of Common Q platform, independence and deterministic implementation
  - Microprocessor-based Common Q platform is used for Engineered Safety Features (ESF) Logic and Control System (ELCS)
  - The following ELCS data communication design features described in the FSAR demonstrate **independence**:
    - Unidirectional serial point-to-point fiber optic isolated data links utilizing deterministic protocol are used to communicate ESF safety function information
    - Communication is buffered by the communication processor, which is independent from the application processor (sending and receiving end)
    - Separate communication equipment is used for interdivisional communication
    - Predefined formatting and data redundancy within the message minimize the possibility of malformed message from being used by the receiving controller

## **ACRS ABWR Subcommittee Action Item (continued)**

- Each ELCS division includes an intra-division network that performs the following functions:
  - This network is separate from the ESF safety function communication
  - Loss of intra-division network does not affect the division's ability to perform ESF safety function
  - Communication with dedicated safety flat panel displays in the control room for ESF components control and status information
  - Communicate self-diagnostic information for display and alarm in the main control room
  - Provides detailed diagnostic information and the capability to conduct surveillance testing at the Maintenance and Test Panel (MTP)
- Each ELCS division has a unidirectional communications interface to non-safety Plant Information and Control System (PICS)

## **ACRS ABWR Subcommittee Action Item (continued)**

- A division of ELCS will accomplish its safety functions regardless of the operation or failures of other safety divisions, or non-safety systems
- Tier 1 Table 2.7.5 Item 3 **ITAAC** requires **testing** to verify, in part, that only one way data transfer from SR to NSR system or devices is permitted
- Tier 1 Table 2.7.5 Item 5 **ITAAC** requires **testing** to verify that loss of data communication in one division does not result in generation of transient or erroneous signals
- In response to RAI 07.01-2, the applicant confirmed that the DI&C-ISG-04 is applicable, and the SSLC design conforms to the ISG-04 guidance

## **ACRS ABWR Subcommittee Action Item (*continued*)**

The following ELCS data communication design features described in the FSAR demonstrate **deterministic performance**:

- ELCS response time for all ESF safety functions is predictable and repeatable, therefore it is deterministic
- Formal timing analysis documents the response times, which is validated by formal test
- Communications processor supports deterministic performance of the unidirectional serial data link communications
- Input communications are sent by a cyclic deterministic process from the transmitting processors



## **ACRS ABWR Subcommittee Action Item (*continued*)**

- Scheduling of the execution of the application software is based on internal clock and is fixed by design
- There are no application processor interrupts that are driven by external process signals
- Output communications are initiated by the cyclic and deterministic application processor
- Each step in the process (input – application processing – output) is predicable and repeatable
- Tier 1 Table 2.7.5 Item 3 **ITAAC** requires **testing** to verify that the essential communication functions are implemented with a deterministic communications protocol

## **ACRS ABWR Subcommittee Action Item (*continued*)**

- Westinghouse Common Q platform design has already been evaluated by the NRC and found suitable for use in safety-related applications (ADAMS Accession No. ML003740165). In the Common Q SER:
  - The staff concluded that design features, operation of the AC160 PLC system, and Westinghouse's commitments to perform timing analyses and tests provide sufficient confidence that the AC160 will operate deterministically to meet guidance in BTP 7-21
  - The plant-specific action item 6.6 requires the licensee to review Westinghouse's timing analyses and validation tests in order to verify that it satisfies its plant-specific requirements for system response and display response time presented in the Chapter 15 accident analysis

## **STP 3 & 4 FSAR Appendix 7DS**

- **STP 3 & 4 FSAR Appendix 7DS, “Digital Instrumentation and Control Design Verification for Safety-Related Systems”**
  - On January 19, 2011, the applicant provided a site-specific FSAR appendix 7DS, which:
    - Consolidates information regarding key design features of safety-related digital I&C platforms
    - Facilitates mapping of applicable DAC and ITAAC that would verify implementation of these key design features
    - Does not change the SSLC design as already described in the STP 3 & 4 COLA
  - Information provided in appendix 7DS does not have any impact on Staff’s safety findings documented in the Chapter 7 Advance SER

## **Overview of STP RCOL Chapter 7**

### **Discussion/Committee Questions**

# Backup Slides

# **Independence of Data Communication Functions**

- Brief description
  - Data communication functions are inherent to each of the SSLC digital I&C platforms and therefore separate and independent from each digital I&C system and division within the systems. These data communication functions are designated as ECF (essential communication Function).
- Specific items of interest
  - The following data communication design features that demonstrate independence are described in the STP 3 & 4 FSAR that will be inspected and/or tested by ITAAC in Tier 1 Table 2.7.5:
    - ECFs are implemented through dedicated equipment in each of the divisions, with no direct electrical interconnections among divisions.

# **Independence of Data Communication Functions (continued)**

- Specific items of interest (*continued*)
  - Data communication design features (*continued*):
    - Data communication is provided between redundant safety-related divisions to support coincident logic functions.
    - Data communication is implemented through fiber optic based data links to ensure interdivisional isolation.
    - All communication is checked to prevent a division from impacting the performance of other divisions.
    - Each division has independent control of data acquisition & transmission.
    - System timing is asynchronous among divisions.
    - Loss of data communication in a division of equipment implementing the ECFs does not cause transient or erroneous data to occur at system outputs.

# **Independence of Data Communication Functions (continued)**

- Specific items of interest (*continued*)
  - Data communication design features (continued):
    - Communication between safety-related (SR) and non safety-related (NSR) systems use isolating transmission medium and buffering devices. When the equipment is in service, data cannot be transmitted from NSR side to SR side.
    - Each division of ECF equipment is powered from its respective division's Class 1E UPS.
    - All equipment within Reactor Protection System (RPS) and Leak Detection and Isolation System (LDS) is designed to fail-safe, i.e., fail into a trip initiating state on loss of power or input signal.
    - All equipment within Engineered Safety Feature (ESF) Systems is designed to fail as-is, i.e., system controllers continue to operate based on the last command.



## Independence of Data Communication Functions (continued)

- Specific items of interest (continued)
  - Tier 1 Table 2.7.5 Item 3 requires **testing of equipment** implementing ECFs to verify that only one way data transfer from SR to NSR system or devices is permitted, and no control and timing signal are exchanged between SR and NSR systems or components.
  - Tier 1 Table 2.7.5 Item 5 requires testing to verify that loss of data communication in one division of equipment implementing ECFs does not result in generation of transient or erroneous signals.
  - In response to RAI 07.01-2, the applicant confirmed that the DI&C-ISG-04 is directly applicable, and the STP 3 & 4 SSLC design is in accordance with the guidance provided in this ISG.

## **Independence of Data Communication Functions (continued)**

- Conclusion
  - The staff found reasonable assurance that the STP 3 & 4 data communication functions conform to all applicable regulations and guidelines, specifically, IEEE Std 603-1991 and IEEE Std 7-4.3.2-2003.

# **Deterministic Features of Data Communication Functions**

- Brief description
  - A deterministic algorithm is an algorithm which behaves predictably. Given a particular input, it will always produce the same output, and the underlying machine will always pass through the same sequence of states.
  - In STP 3 & 4 I&C design, RTIS and NMS platforms are based on the FPGA technology with hardwired I/O. Interdivision communication uses isolated optical data links with deterministic communication protocol.
  - In STP 3 & 4, ELCS is designed with Westinghouse Common Q Platform based on deterministic communication protocol.

## **Deterministic Features of Data Communication Functions (continued)**

- Specific items of interest
  - In response to RAI 14.03.05-4, the applicant confirmed the following I&C design elements:
    - Safety-related I&C systems are deterministic.
    - Response times for the system elements, including architecture, communications (including timing and loading) and processing elements will be analyzed in accordance with BTP 7-21 to verify that the systems' performance characteristics are consistent with the safety requirements established in the design basis for these systems.
  - Tier 1 Table 2.7.5 ITAAC Item 3 requires testing to verify that the essential communication functions are implemented with a deterministic communications protocol.

## **Deterministic Features of Data Communication Functions (continued)**

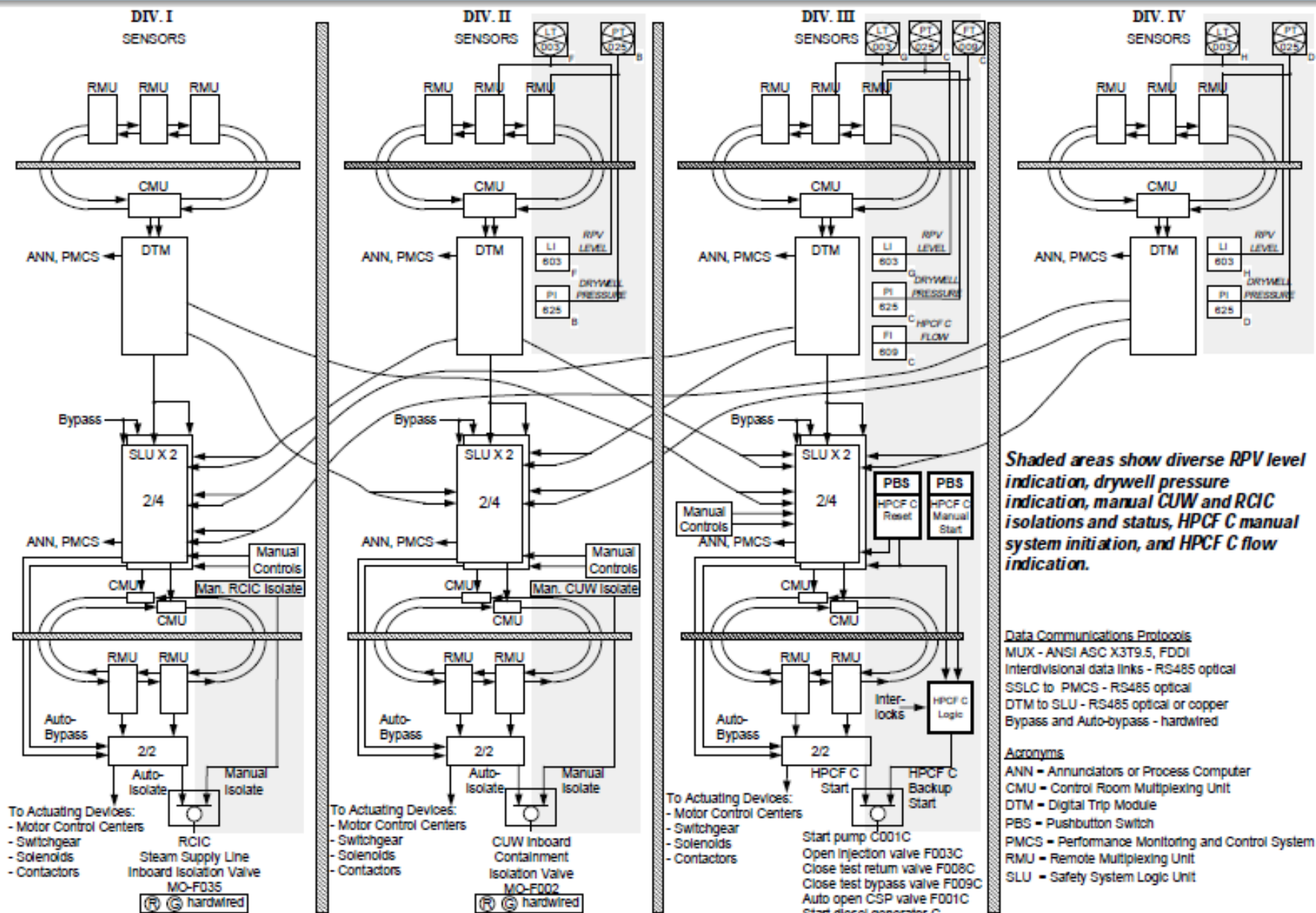
- Specific items of interest (continued)
  - In the Common Q SER, the staff concluded that the design features, the operation of the AC160 programmable logic controller (PLC) system, and Westinghouse's commitments to perform timing analyses and tests provide sufficient confidence that the AC160 will operate deterministically to meet guidance in BTP 7-21 and is, therefore, acceptable.
  - In the Common Q SER, the plant-specific action item 6.6 requires the licensee to review Westinghouse's timing analyses and validation tests in order to verify that it satisfies its plant-specific requirements for system response and display response time presented in the Chapter 15 accident analysis.

## **Deterministic Features of Data Communication Functions (continued)**

- Conclusion
  - The essential communication functions of the STP 3 & 4 SSLC are implemented with a deterministic communications protocol.
  - Response times for the system elements, including architecture, communications (including timing and loading) and processing elements will be analyzed by STPNOC in accordance with BTP 7-21 to verify that the systems' performance characteristics are consistent with the safety requirements established in the design basis for these systems.
  - An ITAAC in the COLA requires testing to verify that the essential communication functions are implemented with a deterministic communications protocol.

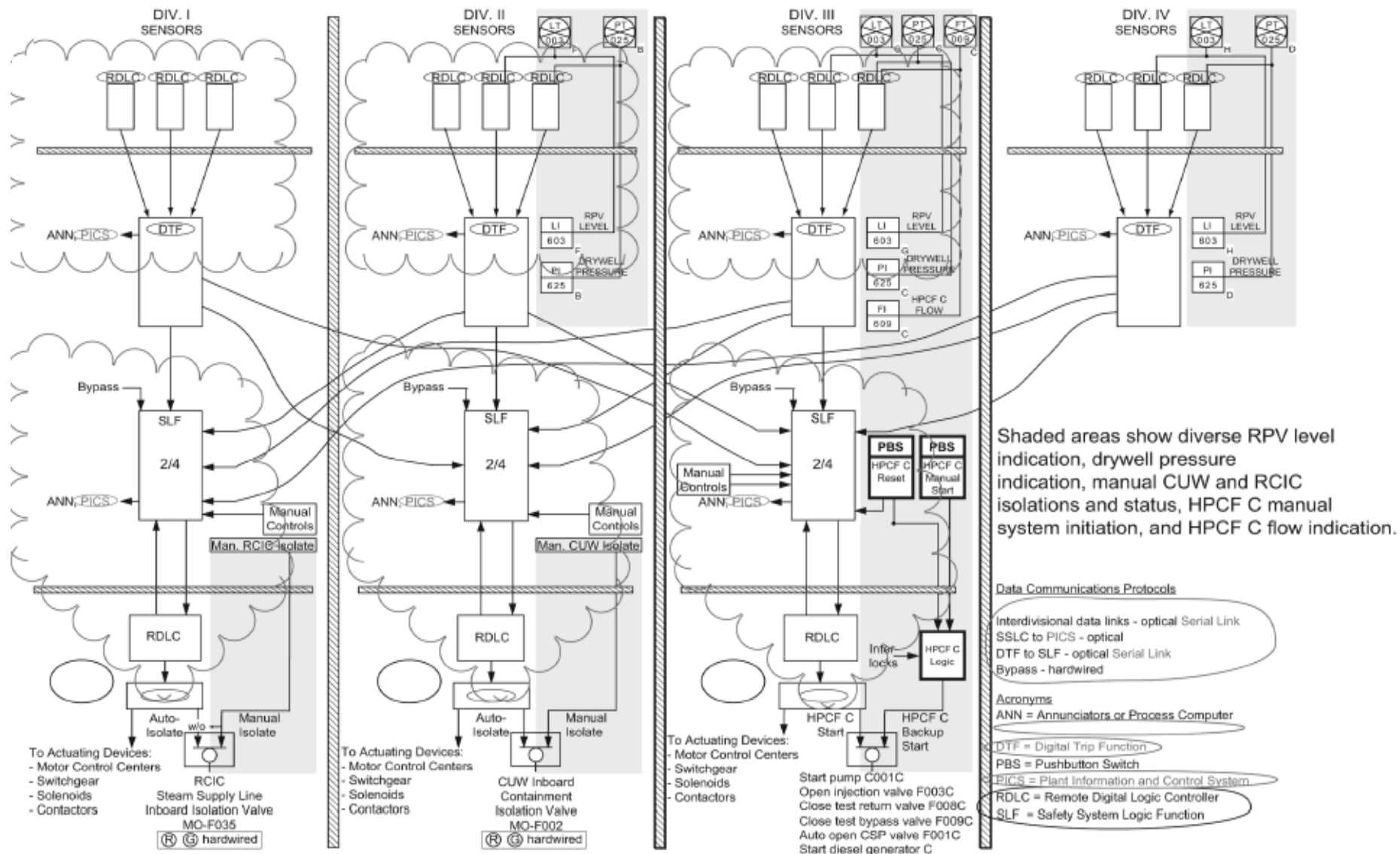
## Diversity and Defense-in-Depth

- Brief description
  - The certified U.S. ABWR design provides for diverse backup hardwired capabilities for reactivity control (reactor trip), core cooling (ESF actuation), containment isolation, and supporting diverse displays to cope with a postulated worst-case event, i.e., undetected 4-division common mode failure of all communications or logic processing functions in conjunction with a large break LOCA.
  - STP 3 & 4 COLA incorporates by reference (**IBR**) the diversity and defense-in-depth consideration and resulting diverse backup design features of the certified ABWR design **with no departures**.



ABWR DCD Figure 7C-1 Implementation of Additional Diversity in SSLC to Mitigate Effects of CMF





COLA Figure 7C-1 Implementation of Additional Diversity in SSLC to Mitigate Effects of CMF

## **Diversity and Defense-in-Depth (continued)**

- **Specific items of interest**

–For the purpose of ABWR I&C design diversity analysis, design basis events (DBE) described in Chapter 15 were analyzed with the following modeling assumptions:

- A worst-case postulated common mode failures (CMF) of the digital safety systems was considered concurrently with each of the design basis events.
- The analyses were done using “realistic” modeling as opposed to standard “licensing basis” modeling.
- The analyses took credit for operator actions at the Remote Shutdown System (RSS) after one hour, but prior to that one hour period, all operator actions were limited to those which could be performed in the main control room, using equipment that was independent of the postulated CMF.

## **Diversity and Defense-in-Depth (continued)**

- Specific items of interest (continued)
  - In the certified ABWR design, EMS is common to all digital I&C systems within a division.
  - Loss of EMS (A worst-case postulated CMF of the digital safety systems) adversely impacts the entire division of safety-related I&C systems (SSLC), thereby potentially rendering both RPS and ESFAS inoperable. Note that RPS is a fail-safe design, therefore any failure in the RPS (including EMS) would result in a division trip signal.
  - STP 3 & 4 I&C design provides for independent and diverse RTIS and ELCS with inherent communications capabilities. Therefore, this I&C design is not subject to total loss of a safety division (i.e., both RTIS and ELCS) due to any postulated CCF of digital I&C systems.

## **Diversity and Defense-in-Depth (continued)**

- Specific items of interest (continued)
  - In STP 3 & 4 I&C design, the hard wired diverse features are independent of all digital I&C systems as illustrated in STP 3 & 4 FSAR Figure 7C-1.
  
- Conclusion
  - Although STP 3 & 4 I&C design has reduced concerns with CMF in digital I&C systems, it incorporates diverse backup design features of the certified ABWR design with no departures.

## Simplicity of I&C Design

- Brief description
  - Safety system logic in the certified ABWR:
    - Uses only simple gating and interlock functions and does not require processing of complex algorithms.
    - Uses state-of-the-art program design methods to achieve highly reliable software.
    - These program design methods use simple data structures and modular, top-down programming to produce easily verifiable and testable programs that provide predictable performance.
  - STP 3 & 4 COLA incorporates by reference (IBR) this simplicity of I&C design concepts.

## **Simplicity of I&C Design (continued)**

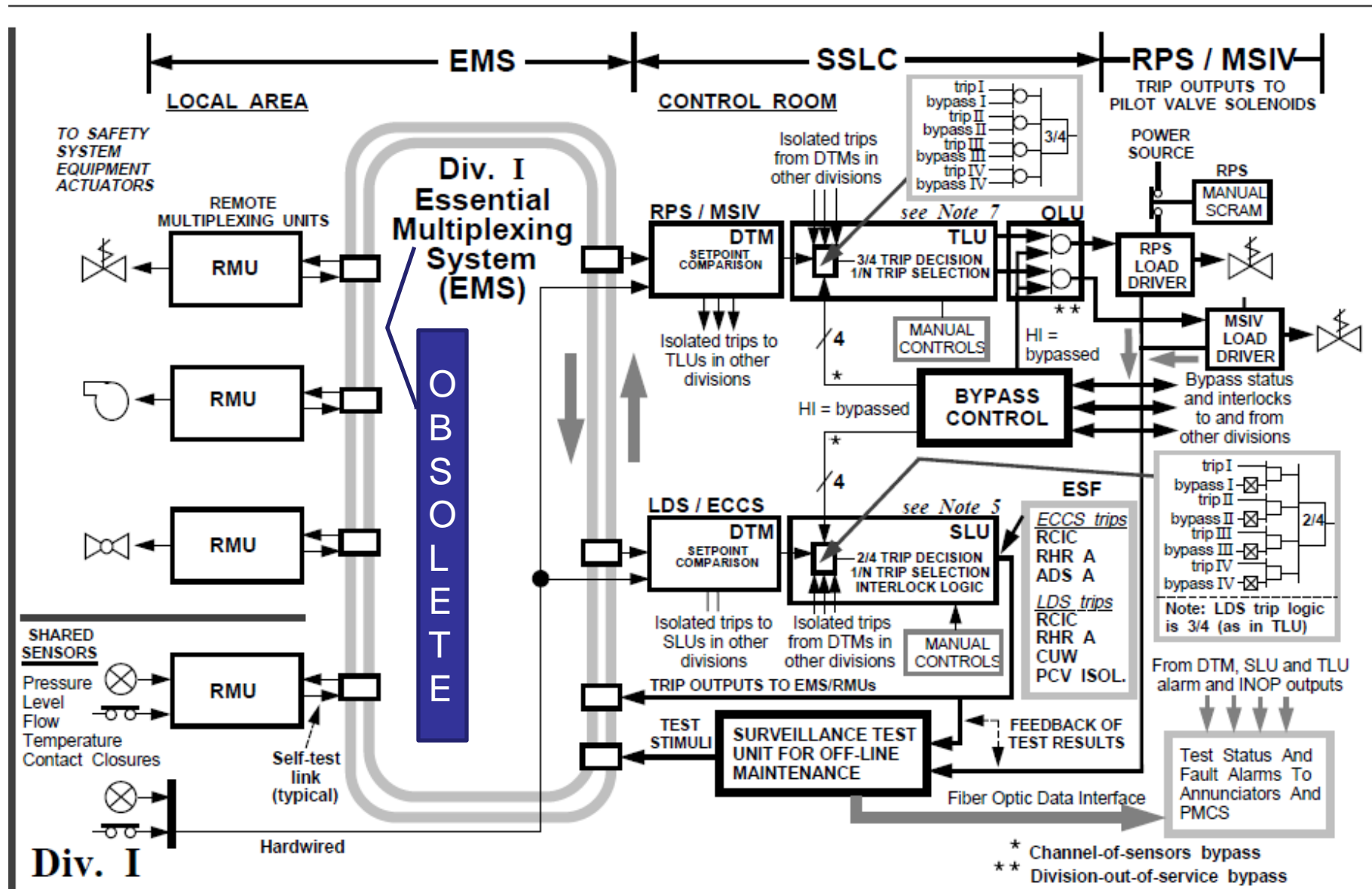
- **Specific items of interest**

- Examples of simple safety system I&C design features:

- Each SSLC division is independently controlled from a set of dedicated safety FPD (flat panel displays) in the main control room.
    - Only one-way communication is allowed from SR to NSR components.
    - Microprocessors are used for making “simple” logic decisions.
    - Software is developed as a structured set of simple modules.
    - Each module performs a prescribed task that can be independently verified and tested.

- **Conclusion**

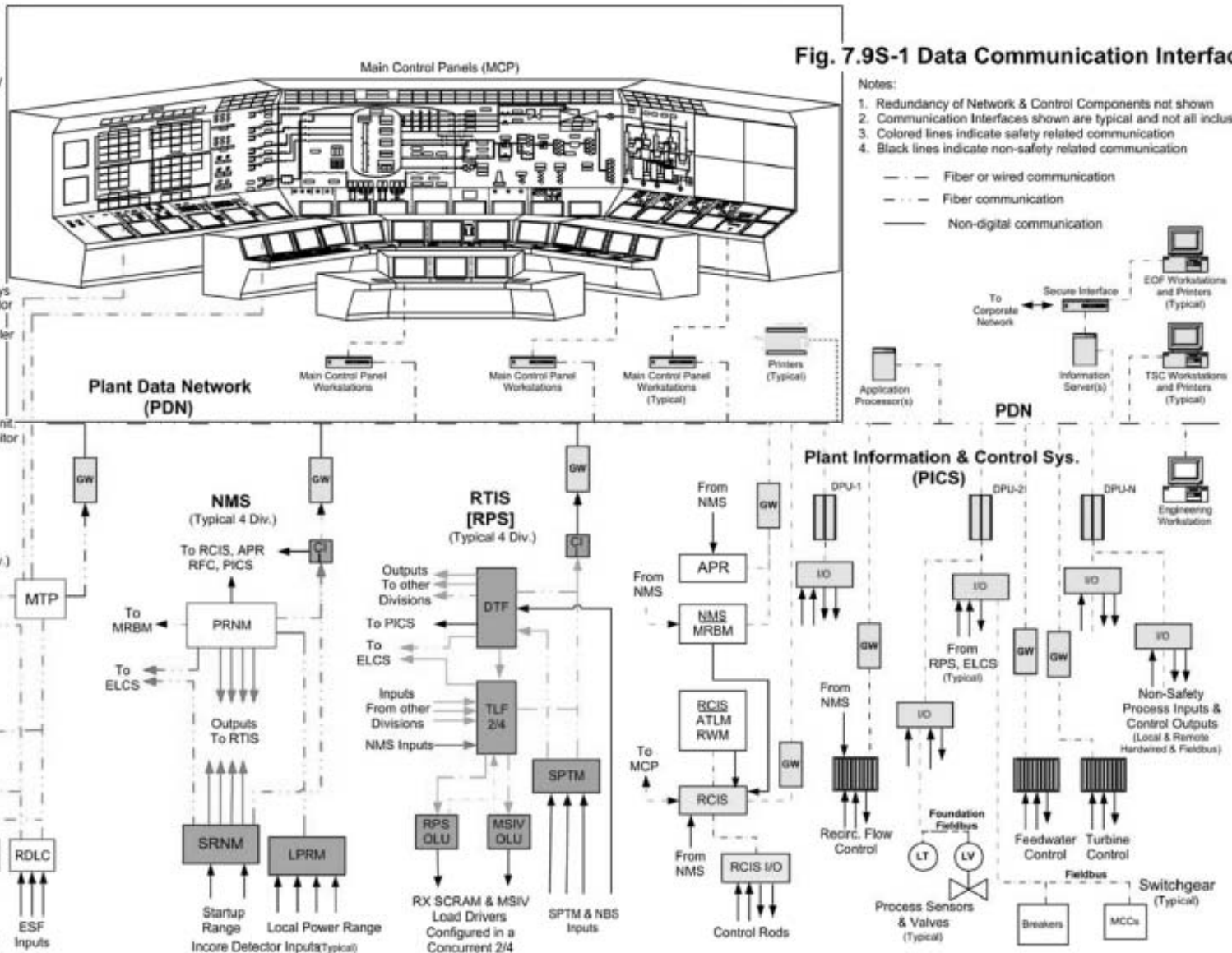
- STP 3 & 4 digital I&C design follows the philosophy of simple design employed in the certified ABWR design.



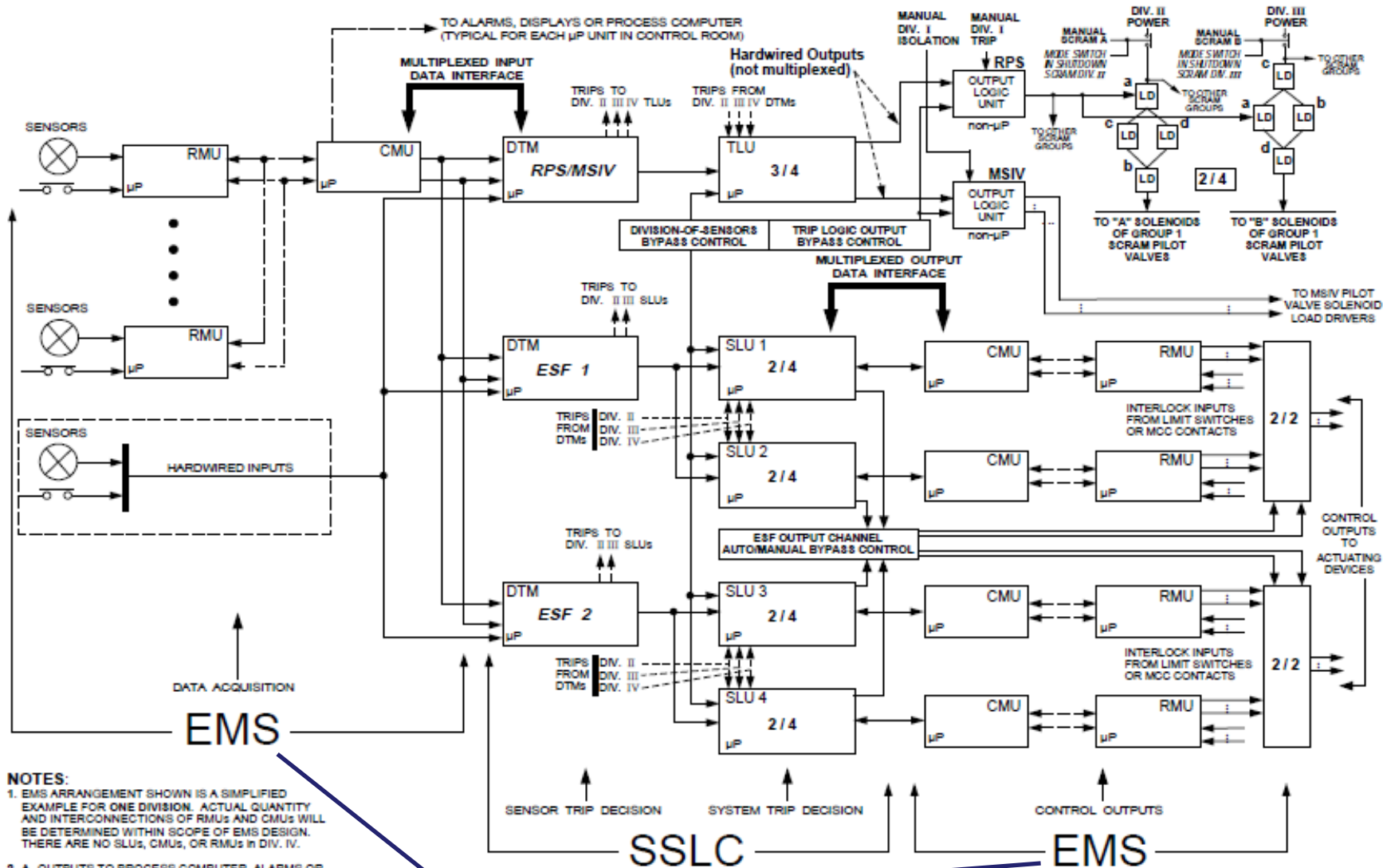
ABWR DCD Figure 7A-1 SSLC

**Legend:**

APR – Auto Power Regulator  
 ATLM – Auto. Thermal Limit Monitor  
 CI – Communications Interface  
 DPU – Digital Processing Unit  
 DTF – Digital Trip Function  
 ELCS – ESF Logic & Control System  
 EOF – Emergency Operations Facility  
 ESF – Engineered Safety Functions  
 GW – Gateway  
 I/O – Plant Input & Output Units  
 LV – Level Transmitter  
 LT – Level Control Valve  
 MCC – Motor Control Centers  
 MCP – Main Control Panel  
 MRBM – Multichannel Rod Block  
 MTP – Maintenance & Test Panel  
 NMS – Neutron Monitoring System  
 NBS – Nuclear Boiler System  
 OLU – Output Logic Unit  
 PDN – Plant Data Network  
 PICS – Plant Information & Control Sys.  
 PRNM – Power Range Neutron Monitor  
 RCIS – Rod Control & Info. Sys.  
 RDLC – Remote Digital Logic Controller  
 RFC – Recirculation Flow Control  
 RPS – Reactor Protection System  
 RTIS – Reactor Trip & Isolation Sys.  
 RWM – Rod Worth Minimizer  
 SLF – Safety Logic Functions  
 SPTM – Suppression Pool Temp. Monit.  
 SRNM – Startup Range Neutron Monitor  
 TLF – Trip Logic Function  
 TSC – Technical Support Center





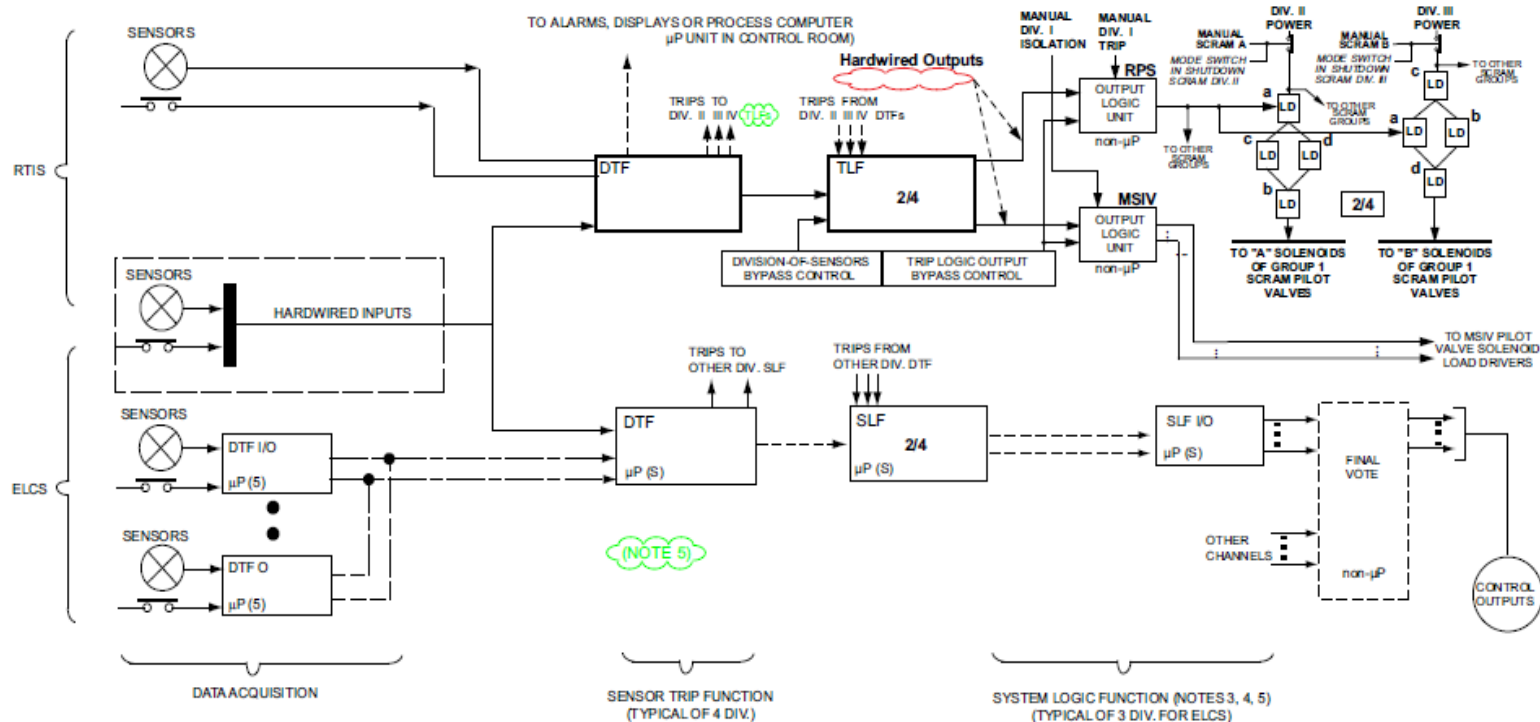


#### NOTES:

1. EMS ARRANGEMENT SHOWN IS A SIMPLIFIED EXAMPLE FOR ONE DIVISION. ACTUAL QUANTITY AND INTERCONNECTIONS OF RMUs AND CMUs WILL BE DETERMINED WITHIN SCOPE OF EMS DESIGN. THERE ARE NO SLUs, CMUs, OR RMUs IN DIV. IV.
2. A. OUTPUTS TO PROCESS COMPUTER, ALARMS OR DISPLAYS ON DEDICATED FIBER OPTIC DATA LINKS.  
B. CONTROL SWITCH INPUTS TO SSLC NOT SHOWN.  
C. INPUTS FROM NMS AND PRM NOT SHOWN.  
D. INTERDIVISIONAL COMMUNICATIONS USE FIBER OPTIC DATA LINKS.

**OBSOLETE**

ABWR DCD Figure 3.4b SSLC Block Diagram



## NOTES

1. ARRANGMENT SHOWN IS A SIMPLIFIED EXAMPLE FOR ONE DIVISION
2. A. NOT ALL CONTROL SWITCH INPUTS SHOWN.  
B. INPUTS FROM NMS AND PRM NOT SHOWN.  
C. INTERDIVISIONAL COMMUNICATIONS USE FIBER OPTIC DATA LINKS.

3. **SAFETY SYSTEM LOGIC FUNCTION (SLF)** FOR ECCS FUNCTIONS IS IMPLEMENTED WITH REDUNDANT CHANNELS WITH A MINIMUM 2/2 VOTE OF THE OUTPUT SIGNALS TO PREVENT INADVERTENT COOLANT INJECTION OR DEPRESSURIZATION DUE TO SINGLE SLF ELECTRONICS FAILURE. THE OUTPUT VOTE MAY BE ACCOMPLISHED EITHER BY DIRECT VOTE OF SLF OUTPUT SIGNALS OR BY A SYSTEM VOTE WHERE BOTH VALVE AND PUMP ACTUATION IS REQUIRED TO INITIATE SYSTEM ACTION. BYPASS OF A FAILED SLF CHANNEL MAY BE PROVIDED AS LONG AS THE REMAINING OPERATIONAL CHANNELS PROVIDE A MINIMUM OF TWO SLF CHANNELS FOR ECCS FUNCTIONS.

4. **SAFETY SYSTEM LOGIC FUNCTION (SLF)** FOR SOME ISOLATION AND SUPPORTING ESF FUNCTIONS MAY BE IMPLEMENTED WITH REDUNDANT CHANNELS WITH A NORMAL MINIMUM 2/2 VOTE OF THE OUTPUT SIGNALS WHERE INADVERTENT ACTUATION OF THE FUNCTION MIGHT REQUIRE **UNREASONABLY** SHORT REPAIR TIMES TO ELIMINATE OPERATIONAL IMPACT. FOR THESE FUNCTIONS, OPERATIONAL CONTROLLED BYPASS TO ALLOW OPERATION WITH A FINAL 1/1 VOTE IS PERMITTED.

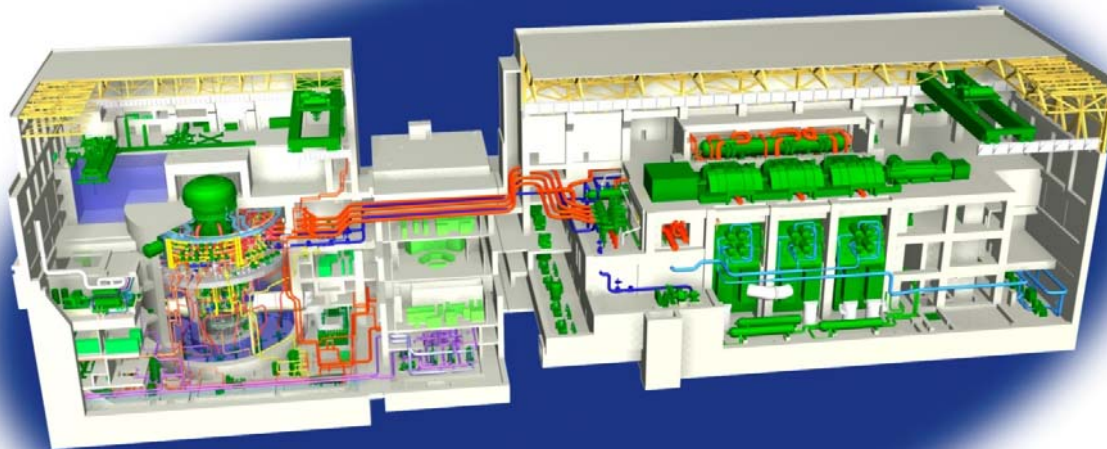
5. EACH FUNCTION MAY BE ACCOMPLISHED BY MULTIPLE PROCESSORS TO MINIMIZE THE HARDWARE AND SOFTWARE COMPLEXITY OR OPERATIONAL IMPACT OF HARDWARE FAILURES, PROVIDED THE MINIMUM REDUNDANCY OF NOTES 3 AND 4 IS MAINTAINED.

STP COLA Figure 3.4b SSLC Block Diagram

# South Texas Project Units 3 & 4

## ACRS ABWR Subcommittee Presentation

### ACRS Action Items



# Attendees

Scott Head	Regulatory Affairs Manager, NINA
Mike Murray	I&C Manager, NINA
Coley Chappell	Regulatory Affairs, NINA

# Agenda: Action Items for Discussion

- (#7) Inter-channel communication and determinism for FPGA and Common-Q platform (Recap)
- (#45) Provide RAI responses regarding redundancy and diversity of turbine overspeed sensors including power supply – ITAAC very general in scope (Update)

## Action Item #7 (Recap)

Address FPGA (field-programmable gate array) in more detail, e.g., inter-channel communication and determinancy. Consider application of Common Q platform, e.g., independence and determinancy.

**Response:** Based on 5/20/10 meeting, action item as related to FPGA is closed.

Application of Common-Q platform including independence and determinancy, and protection from corruption via data communication between divisions, were discussed with the preceding Chapter 7 presentation.

## Action Item #45 (Update)

Provide RAI responses regarding redundancy and diversity of turbine overspeed sensors including power supply – ITAAC very general in scope. (Also addressed in ACRS letter 8/9/10.)

**Response:** On 2/2/11 NINA met with NRO staff to discuss issues related to redundancy and diversity of the turbine overspeed system. As a result, RAI responses related to SRP 10.2 will be revised, and will supersede those provided in STPNOC letter 10/15/10 (U7-C-STP-NRC-100231).

NINA will submit additional details for the STP 3 & 4 departure to use two electrical overspeed systems, to be included in the FSAR as needed to further explain how the redundancy and diversity of the overspeed systems meet the SRP acceptance criteria, and how the design will meet the ITAAC inspections and acceptance criteria.

Based on EDO letter 9/10/10, resolution will be presented with final SE with no OI.



# ACRS Action Items

## Questions and Comments

