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

March 1, 2011

MEMORANDUM TO: ACRS Members

FROM: Weidong Wang, Senior Staff Engineer /RA/
Reactor Safety Branch B, ACRS

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS SUBCOMMITTEE ON THE AP1000 REACTOR, NOVEMBER 2-3, 2010, ROCKVILLE, MARYLAND

The minutes of the subject meeting were certified on February 24, 2011, as the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Attachment: As Stated

Cc w/o Attachment: E. Hackett
Y. Dias-Sanabria
C. Santos

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

MEMORANDUM TO: Weidong Wang, Senior Staff Engineer
Reactor Safety Branch - B
ACRS

FROM: Harold B. Ray, Chairman
AP1000 Subcommittee
ACRS

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS SUBCOMMITTEE ON THE AP1000 REACTOR, NOVEMBER 2-3, 2010, ROCKVILLE, MARYLAND

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting held on November 2-3, 2010, are an accurate record of the proceedings.

/RA/ ***February 24, 2011***

Harold B. Ray, Chairman *Date*
ACRS AP1000 Subcommittee

Certified on: February 24, 2010
Certifed by: Harold Ray

REVISION 17 TO AP1000 DESIGN CONTROL DOCUMENT APPLICATION

November 2-3, 2010
ROCKVILLE, MARYLAND

INTRODUCTION

The Advisory Committee on Reactor Safeguards (ACRS) Subcommittee on the Westinghouse Electric Company's AP1000 advanced pressurized water reactor (PWR) design met in Room T-2B1 at the Headquarters of the U.S. Nuclear Regulatory Commission (NRC), located at 11545 Rockville Pike, Rockville, Maryland, on November 2-3, 2010. The purpose of this meeting was to review select chapters of the Revision 17 to AP1000 DCD and its associated Advanced Final Safety Evaluation Report (FSER). The Subcommittee was briefed by, and held discussions with representatives of Westinghouse Electric Company (WEC) on the AP1000 DCD Amendment and the U.S. Nuclear Regulatory Commission (NRC) on the Advanced FSER. As part of the review process, NRC's regulations under 10 CFR Part 52 direct the staff to consult with the ACRS on safety issues before any reactor design can be certified or any NRC operating license can be approved.

The staff's Advanced FSER was organized based on the various chapters found in NUREG-0800 – NRC's "Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition." To this end, the Subcommittee planned to gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee of the ACRS at a later date. This was the tenth Subcommittee meeting on the AP1000 design.

The Chairman for this ACRS Subcommittee was Mr. Harold Ray. Mr. Weidong Wang was the cognizant ACRS staff engineer for this topic and served as the Designated Federal Official for this meeting. Peter Wen, an ACRS staff engineer, supported this meeting as well. Part of the meeting was closed to public attendance and part of the meeting was open.

ATTENDEES

ACRS

H. Ray, Subcommittee Chairman	S. Abdel-Khalik, Member	J. Sam Armijo, Member

D. Bley, Member	M. Bonaca, Member	J. Rempe, Member
M. Ryan, Member	B. Shack, Member	J. Sieber, Member
T. Kress, Invited ACRS Consultant	G. Wallis, Invited ACRS Consultant	W. Wang, ACRS Staff
P. Wen, ACRS Staff		

The NRC Staff

E. McKenna	N. Gilles	B. Thomas
T. Dinh	M. Lombard	S. Lee
M. Kowal	M. Patterson	P. Buckburg
P. Patel	A. Stubbs	C. Van Wert
L. Wheeler	E. Sastre	M. Noraro
G. Makar	D. Zhang	J. Zhao
K. Mott		

Others

B. Sisk, WEC	J. Kostelnik, WEC	T. Ray, WEC
M. Melton, WEC	J. Gillespie, SCANA	N. Haggerty, NuStart
W. Sparkman, SNC	R. Morante, BNL	J. Rraverman, BNL
M. Lucci, WEC	Y. Masset, WEC	R. Anderson, WEC
R Burger, WEC	B. Carpenter, WEC	R. Morrow, WEC
B. Seelman, WEC	J. Ewald, WEC	M. Stofku, WEC
M. Murray, STPNOC	E. Cummins, WEC	

Other Individuals and their affiliations attending this meeting are listed in the sign-in sheets in Attachment 1.

SCHEDULED PRESENTATIONS

The detailed agenda identifying the specific presentation topics comprising this meeting can be found in Attachment 2. Both during and following the scheduled presentations, the speakers responded to specific questions and comments from the ACRS Subcommittee members. The scope of the questions, comments, and the speaker's responses had been captured in the verbatim meeting transcripts. As a result of questions and comments from the Members and responses from the speakers, follow-up actions were identified for further discussion at subsequent Subcommittee meetings. These follow-up actions were tracked by the ACRS staff. The topics presented were:

1. Chapter 9 Auxiliary Systems
2. Chapter 19 Probabilistic Risk Assessment and Aircraft Impact Assessment
3. Action Items from previous Subcommittee meetings

The Aircraft Impact Assessment presentation involved security related information and need-to-know audience was verified before the presentation.

ACRS Subcommittee meeting transcripts can be found at the following NRC Internet website location: http://www.nrc.gov/ reading-rm/doc-collections/acrs/tr/subcommittee/.

Opening Remarks

Subcommittee Chairman Ray made the opening remarks. He stated that this AP1000 Subcommittee meeting would continue to review the Safety Evaluation Report on Revision 17 to the AP1000 DCD. The review topics included Chapter 9 Auxiliary Systems, Chapter 19 Probabilistic Risk Assessment and Aircraft Impact Assessment, and Action Items from the previous ACRS meetings. Presentations for Aircraft Impact Assessment and other proprietary information would be closed to the public in order to discuss information that is proprietary to the applicant and its contractors pursuant to 5 U.S.C. 552(b), (c), (3), and (4).

Following the opening statement by the Subcommittee chairman, the applicant and the NRC staff made presentations. The briefing slides with non-proprietary and non-security related information can be found in Attachment 3.

Key points and Follow-Up Actions

Passive Containment Cooling

WEC addressed on open item on passive containment cooling. WEC discussed areas in monitoring / testing of the containment vessel (CV) shell coating, CV shell coating test specimen weathering, conservatisms in safety analyses heat transfer, CV shell thermal stress considerations, and high-energy line break considerations. An issue, with respect to whether or not the external containment cooling water will meet the required "wetting" fraction of the

containment surface, was discussed. It was noted by Members that surface tension forces create what is called the “Maragoni” instability which results in such water films becoming rivulets with dry spaces in between. This thermal hydraulic effect, if present, could result in not meeting the wettability criterion. The committee spent a great amount of time discussing the issue and commented that this is a significant unresolved issue. Action Item 60 tracked this issue and it remained open.

Action Items Closed

Three Action Items were closed after the presentations on the topics by the applicant and the staff. The closed action items were:

Item # 2, Can Non-condensible gases affect flow from IRWST; a) what ITAAC will be included and b) heatup analysis.

The applicant made a presentation on the Impact of Gas Intrusion on IRWST Makeup Water Injection in the AP1000. In their simulation, with accounting for gas intrusion, results showed partial core uncovery. But the peak cladding temperatures are well below 10 CFR 50.46 limit with maximum IRWST line void considered. The applicant stated that no new ITACC is required for this issue.

Item # 41, Reactor Trip Circuit Breaker (RTCB) test frequency and operating experience.

The applicant made a presentation on RTCB Testing. They answered questions on RTCB test frequency and provided RTCB operating experience in Westinghouse plants from Year 2000 to the present.

Item # 66, requested the staff to present the safety concerns and considerations associated with what the staff learned from the United Kingdom (UK).

The staff made a presentation on Technical Issues associated with the UK-AP1000 Instrumentation and Control review. The issues discussed: Diverse Actuation System (DAS), Protection and Safety Monitoring System (PMS) Common Cause Failure (CCF), and Component Interface Module (CIM)/DAS Diversity.

New Action Items Created

72. Members were concerned that the spurious actuation of ADS valves, due to a CCF of the PMS, was not addressed in the design. Under this situation, can the safety function rely on the rest of the system to mitigate the scenario?

Members were also concerned that the manual DAS out of service for 30 day is too long.

73. Replace Action Item 56 with the following comments from Member Brown:

"The response of the overall overspeed trip system is supposed to ensure that the turbine generator speed will not exceed 120% of rated speed as stated in the Tier 2 DCD Chapter 10 note following Table 10.2-2 Turbine Overspeed Protection. The Note follows:
Following the above sequence of events, the turbine may approach but not exceed 120 percent of rated speed.

There is no acceptance criterion for Tier 1 Chapter 10 ITAAC/DAC for the Main Turbine System requiring an analysis that demonstrates that the sample time and processing architecture for each of the trip functions will be bounded such that this criterion will be met."

Updated Follow-up Action Items Table

Action Items 68, 69, 70, and 71, were modified for their clarity. The updated follow-up Action Item Table was attached in Attachment 4.

Attachments

1. Sign-In Sheets
2. Meeting Agenda
3. Presentation Slides from Open Sessions
4. ACRS AP1000 Subcommittee Action Items Table

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON AP1000

November 2, 2010
Date

NRC STAFF SIGN IN FOR ACRS MEETING

PLEASE PRINT

	NAME	NRC ORGANIZATION
1	Eileen McKenna	NRC/NRO/DNRL
2	Nanette Gilles	NRO/DNRL
3	Brian Thomas	NRO/DE/SEB1
4	Mark Lombard	NRO/DSRA
5	Thinh Dinh	NRO/DSRA
6	Samuel Lee	NRO/DSRA/SBPB
7	Mark Kowal	NRO/DCIP/CTSB
8	Malcolm Patterson	NRO/DSRA/SPRA
9	Perry Buckberg	NRO/DNRL/NWE2
10	Pravin Patel	NRO/DE/SEB1
11	Angelo Stubbs	NRO/DSRA/SPSA
12	Gordon Curran	NRO/DSRA/SBPB
13	Chris Van Wert	NRO/DSRA/SRSB
14	Larry Wheeler	NRO/DSRA/SBP
15	Edvardo Sastre	NRO/DE/CIB2
16	Michael Norato	NRO/DE/CIB2
17	Greg Makar	NRO/DE/CIB1
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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON AP1000

November 2, 2010
Date

PLEASE PRINT

	NAME	AFFILIATION
1	Rob Sisk	Westinghouse
2	Khanh Dq	Westinghouse
3	James W Winters	Westinghouse
4	JOHN KOSTELNIK	WESTINGHOUSE
5	Thom Ray	Westinghouse
6	Mike Melton	W EC
7	Joe Gillespie	SCANA
8	Neil Haggerty	NuStart
9	Wes Sparkman	SNC
10	Rich Morante	BNL
11	Paul Lotz	W EC
12	JOSEPH BRAVERMAN	BNL
13	Melissa Lucai	Westinghouse
14	Yves MASSET	WESTINGHOUSE
15	ANDREA MAIOLI	WESTINGHOUSE
16	Richard G Anderson	Westinghouse
17	Rustin Burger	Westinghouse
18	BRAD CARPENTER	Westinghouse
19	Rob Morrow	Westinghouse
20	Mitch Sanders	Westinghouse
21	Bob Hirmanpour	NuStart
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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON AP1000

November 3, 2010
Date

NRC STAFF SIGN IN FOR ACRS MEETING

PLEASE PRINT

	NAME	NRC ORGANIZATION-
1	Dennis Threats	NRO/DE/ICE1
2	Malcolm Patterson	NRO/DSRA/SPRA
3	Jack Zhao	NRO/DE/ICE1
4	Ken Mott	NRO/DE/ICE1
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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON AP1000

November 3, 2010
Date

PLEASE PRINT

	NAME	AFFILIATION
1	BOB SEELMAN	WESTINGHOUSE
2	Rob Sisk	WEC
3	John Ewald	WEC
4	Joe Gillespie	SCANA
5	WARREN ODESS-GILLETT	WEC
6	MARK STOFKO	WEC
7	Mike Murray	STPNOC
8	ED CUMMINS	WEC
9	Kyle Dittman	STPNOC
10	Bob Hirmanpour	NuStart
11	Wes Sparkman	SNC
12	~~Deanna Zhang~~	~~NRC~~
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Advisory Committee on Reactor Safeguards
Meeting of the Subcommittee on the
Westinghouse AP1000 DCD
Rockville, MD
November 2 -3, 2010

- Agenda -

Cognizant Staff Engineers: Weidong Wang (301-415-6279, Weidong.Wang@nrc.gov)
Peter C Wen (301-415-2832, Peter.Wen@nrc.gov)

November 2, 2010

Item	Topic	Presenter(s)	Time
1	Opening Remarks and Objectives	Harold B. Ray, ACRS	8:30a.m. – 8:35 a.m.
2	Aircraft Impact Assessment (Applicant) (CLOSED - SGI)		8:35 a.m. – 10:00 a.m.
	Break		10:00 a.m. – 10:15 a.m.
3	AIA App 19F (Staff) (CLOSED)	Caruso, Tegeler, Dreisbach, Buckberg	10:15 a.m. – 11 am.
4	AIA Inspection (Staff) (CLOSED)	Prato, Tegeler, Dieh	11:00 a.m.-11:45 a.m.
	Lunch		11:45a.m.-12:45 pm
5	Other chapter 19 (e.g., margins) – applicant (OPEN)		12:45pm-1:15p.m.
6	Other Chapter 19 – Staff (open)	Malcolm, Bret, Goutam,	1:15-1:45p.m
7	Chapter 7 I&C Followup discussion – applicant/staff (CLOSED)	Westinghouse – Seelman, Odess-Gillette, Ewald, NRO-Jackson, Roggenbrodt	1:45 p.m. – 2:45 p.m.
	Break		2:45-3:00 p.m.
8	UK Issues discussion (Staff) (CLOSED)	Jackson, Roggenbrodt	3:00 p.m. – 3:45 p.m.
9	Action item presentations (all)		3:45pm – 4:45 p.m.
10	Closing remarks	Harold Ray	4:45-5:00pm

Advisory Committee on Reactor Safeguards
Meeting of the Subcommittee on the
Westinghouse AP1000 DCD
Rockville, MD
November 2-3, 2010

- Agenda -

Cognizant Staff Engineers: Weidong Wang (301-415-6279, Weidong.Wang@nrc.gov)
Peter C Wen (301-415-2832, Peter.Wen@nrc.gov)

November 3, 2010 (A.M.)

Item	Topic	Presenter(s)	Time
1	Opening Remarks and Objectives	Harold B. Ray, ACRS	8:30 a.m. – 8:35 a.m.
2	Chapter 9 Applicant (OPEN, with possible part CLOSED)		8:35 a.m. – 9:45 a.m.
3	Chapter 9 Staff (OPEN)	VanWert, Curran, Patel, Wheeler, Buckberg	9:45 a.m -10:30 am.
	Break		10:30 a.m. – 10:45 a.m.
4	Complete chapter 9 discussion		10:45 a.m.-11:15 a.m.
5	Action item discussion		11:15 a.m.-12:15 pm
6	Closing Remarks		12:15p.m.-12:30 pm

AP1000 Design Control Document Amended Design

Chapter 19
11/02/10

Westinghouse

Chapter 19 Overview

- Probabilistic Risk Assessment
  - Internal Events
  - External Events
- Ex-Vessel Severe Accident Phenomena
- Additional Assessment of AP1000 Design Features
- Equipment Survivability Assessment
- Shutdown Evaluation
- Malevolent Aircraft Impact

- Licensing Lead: Thom Ray
- Technical Lead: Rick Anderson and Andrea Maioli

Chapter 19 Open Items

Five Open Items were identified and subsequently closed:

- OI-SRP19.0-SPLA-07 – More detail of resolved and requantified PRA model and any DCD updates that may be necessary.
- OI-SRP-19.0-SPLA-12 – Maintain acceptable seismic margin for Hard Rock High Frequency sites.
- OI-SRP19.0-SPLA-13 – More detail of the shutdown PRA risk and any DCD updates that may be necessary.
- OI-SRP19.0-SPLA-14 – More information on the containment inventory of radionuclides used for survivability evaluation.
- OI-SRP19F-SPLA-01 – Open Item for review of Appendix 19F, “Malevolent Aircraft Impact.” Staff was Awaiting Regulator Guidance for review of Section.

Chapter 19 - OI-SRP19.0-SPLA-07

- **Issue:**
  - More detail of resolved and requantified PRA model and any DCD updates that may be necessary
- Final Resolution
  - DCD Rev. 17 did not reflect the new instrumentation and control (I&C) modeling provided in the PRA model. The PRA was requantified and the results for the at power PRA indicated that the at power CDF and LRF values and top cutsets closely compare with these items documented in the DCD. No further DCD updates were necessary for the at power PRA.

Chapter 19 - OI-SRP-19.0-SPLA-12

- **Issue:**
  - Maintain acceptable seismic margin for Hard Rock High Frequency sites
- Final Resolution
  - The response provided more information for the Seismic Margin Analysis based on guidance provided in ISG-20. Chapter 19.55 of the DCD (PRA-based Seismic Margin Analysis) was revised to reflect the current site parameters for the standard design of AP1000 and design modifications from DCD Rev. 17 and 18.

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Chapter 19 - OI-SRP19.0-SPLA-13

- **Issue:**
  - More detail of the shutdown PRA risk and any DCD updates that may be necessary
- Final Resolution
  - More detail was provided in DCD Chapter 19.59.5 to reflect the results and insights of the requantified low-power/shutdown PRA.

Chapter 19 - OI-SRP19.0-SPLA-14

- **Issue:**
  - More information on the containment inventory of radionuclides used for equipment survivability evaluation.
- Final Resolution
  - Information was provided to give more details on the containment inventory of radionuclides used for the equipment survivability evaluation, inclusion of mechanical hatches and gaskets into the environmental assessment, and additional information by which the licensee COL information item is addressed. The DCD Section 19D.8.2.4 was revised to clarify how the hydrogen monitors are used in severe accident conditions.

Chapter 19 - OI-SRP19F-SPLA-01

- **Issue:**
  - Open Item for review of Appendix 19F, “Malevolent Aircraft Impact.”
- Final Resolution
  - NRC performed review in accordance with new guidance provided in DG1176, “Guidance for the Assessment of Beyond-Design-Basis Aircraft Impacts.” In response to NRC requests, DCD Section 19F was updated to provide more information on the descriptions of the design features and functional capabilities required by NEI 07-13 “Methodology for Performing Aircraft Impact Assessments for New Plant Designs”.

Questions?

AP1000 Design Control Document
Amended Design
Review of Chapter 9 AFSER

November 2-3, 2010

1

Westinghouse

Chapter 9 - Auxiliary Systems

- Subject Matter Experts
  - Rob Morrow - Components and Materials
  - Chuck Bullard – HOLTEC International
  - Jeff Secker - Core Technologies
  - Phil Mathewson - Turbine Building Layout
  - Mitch Sanders - Auxiliary Equipment
- Licensing – Paul Loza

2

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Chapter 9 - Auxiliary Systems

- Chapter 9 describes Auxiliary Systems, including
  - **Fuel Storage and Handling**
  - **Water Systems**
  - **Process Auxiliaries**
  - **Air-Conditioning, Heating, Cooling, and Ventilation System**
  - **Fire Protection Analysis**

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Chapter 9 – Open Items

- Open Items:
  - Eleven OIs identified in the SER with OIs
  - All are closed
  - Additional RAIs on Fuel Rack Seismic Analysis are closed

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Chapter 9 - Discussion Issues

- SFP Criticality (OI-SRP9.1.1-SRSB-08)
- Fuel Racks Seismic Analysis
- Zinc Addition (OI-SRP9.3.6-SRSB-01)

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Chapter 9 - SFP Criticality

- AP1000 issue:
  - Increased capacity from 619 storage locations to 889
  - Staff concern with the industry issue on treatment of depletion calculation uncertainties in SFP criticality analysis

Westinghouse

Chapter 9 - SFP Criticality

- **Resolved:**
  - SFP criticality reanalyzed using methods of recent similar fuel pools SERs
  - No burnup credit needed for Region 2 (High density)
  - Staff concluded methodology and analysis are acceptable
  - **OI-SRP9.1.1-SRSB-08** is closed

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Chapter 9 - Fuel Rack Seismic Analysis

- **AP1000 issue:**
  - Update structural dynamic and stress analyses from DCD R15
    - higher SFP capacity
    - new rack designs
    - new SSE spectra
  - Two COL Information Items desired closed – WEC to perform these analyses for the new and spent fuel racks

Westinghouse

Chapter 9 - Fuel Rack Seismic Analysis

- **Resolved:**
  - Multiple structural evaluations performed
    - 3D seismic, fuel drop, stuck assembly, rack/wall impact
    - HOLTEC performed WEC analyses
    - TR-44 and TR-54 were updated to include revised and additional analyses
  - Staff concluded fuel racks are acceptable
  - Two COL Information Items closed

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Chapter 9 – Zinc Injection to RCS

- **AP1000 issue:**
  - Zinc Addition is shown to reduce personnel exposure, surface corrosion, and potential for crud induced power shifts (CIPS)
  - Resolve staff concerns:
    - AP1000 core considered High Duty per EPRI
    - Small High Duty core operating experience
    - Potential for excessive crud/CIPS when zinc addition is started later in core/fuel life

Westinghouse

Chapter 9 – Zinc Injection to RCS

- **Resolved:**
  - Staff concludes AP1000 Zinc injection acceptable:
    - Cycle reload analyses will coordinate zinc addition strategy to minimize crud thickness
    - Addition starts during hot functional testing to reduce corrosion on the RCS and primary side steam generator surfaces.
    - Operating levels similar to operating plants, and inspection to be per EPRI fuel reliability guidelines
    - **OI-SRP9.3.6-SRSB-01** is closed

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Questions?

Westinghouse

(backup slides)

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Chapter 9 - Open Items

OI-SRP9.1.1-SRSB-08 - Criticality analysis consistent with current burnup credit methodology

OI-SRP9.1.2-SBPA-09 - SFP minimum water shield height

OI-SRP9.1.2-SBPA-14 - SFP storage rack density

OI-SRP9.1.3-SBPA-04 - SFP decay heat levels vs. critical time values

OI-SRP9.1.3-SBPA-08(b) - SFP thermal analysis - suction line elevation

OI-SRP9.1.3-SBPA-10 - SFP piping diagram changes

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Chapter 9 - Open Items (cont.)

OI-SRP9.1.3-SBPA-11 - SFP level alarm changes

OI-SRP9.1.3-SBPA-13 - SFP saturation and required operator actions

OI-SRP9.1.4-SBPA-03 - Fuel Move Components

OI-SRP9.1.5-SBPB-01 - Heavy loads handling program

OI-SRP9.3.6-SRSB-01 - Zinc Addition to RCS during operation

Westinghouse

Chapter 9 - OI-SRP9.1.1-SRSB-08

- **Issue:**
  - Potential restricted SFP loading pattern due to Fission Product and Actinide Inventory Uncertainties
- **Final Resolution: Issue closed**
  - Burnup credit methodology revised to match currently operating reactors / Kopp memo
  - No burnup credit needed for Region 2 (High density)
  - Meets the requirements of GDC 62 / 10 CFR 50.68

Westinghouse

Chapter 9 - OI-SRP9.1.2-SBPA-09

- **Issue:**
  - SFP minimum water shield height
- **Final Resolution: Issue closed**
  - Adjustments made to maximum lift height and SFP water level maintain the dose rate to the bridge operator within safe limits

Westinghouse

Chapter 9 - OI-SRP9.1.2-SBPA-14

- **Issue:**
  - SFP cooling with high density storage racks
- **Final Resolution: Issue closed**
  - AP1000 SFP cooling removes decay heat during all plant operation modes, regardless of location
  - Satisfies GDC 61 requirements

Westinghouse

Chapter 9 - OI-SRP9.1.3-SBPA-04

- **Issue:**
  - SFP decay heat levels vs. critical time values
- **Final Resolution: Issue closed**
  - Clarified conditions and assumptions of each calculated range of decay heat levels
  - Specified each refueling off-load condition as representative or limiting
  - Now a Confirmatory Item

Westinghouse

Chapter 9 - OI-SRP9.1.3-SBPA-08(b)

- **Issue:**
  - SFP Thermal Analysis – Suction Line Elevation
- **Final Resolution: Issue closed**
  - SFP boiloff calculation revised to correct the draindown height
  - SFP level is changed to a normal operation band
  - Now a Confirmatory Item

Westinghouse

Chapter 9 - OI-SRP9.1.3-SBPA-10

- **Issue:**
  - SFP piping diagram changes
- **Final Resolution: Issue closed**
  - Several corrections were made to represent the actual SFS on DCD Figure 9.1-5
  - None of these corrections change the safety conclusions

Westinghouse

Chapter 9 - OI-SRP9.1.3-SBPA-11

- **Issue:**
  - SFP level alarm changes re: level is changed to a normal operation band
- **Final Resolution: Issue closed**
  - High and Low SF Pool level alarms are moved from safety related sensors to a non-safety related level transmitter, allowing accurate level maintenance
  - The Low-Low safety-related setpoint remains on the safety-related sensors. No safety evaluation are affected.

Westinghouse

Chapter 9 - OI-SRP9.1.3-SBPA-13

- **Issue:**
  - SFP saturation and required operator actions
- **Final Resolution: Issue closed**
  - Description and TS reflect assumed water sources and operator actions for several offload scenarios
  - Maximum 140F temperature clarified regarding available equipment and ambient wet bulb temperatures

Westinghouse

Chapter 9 - OI-SRP9.3.6-SRSB-01

- **Issue:**
  - Zinc Addition to RCS during operation
- **Final Resolution: Issue closed**
  - Cycle specific reload analyses will coordinate zinc addition strategy with the plant and core design to minimize crud thickness
  - Zinc to be added during hot functional testing to reduce corrosion on the RCS and steam generator surfaces. Zinc levels are lowered on fuel load similar to operating plants
  - Fuel inspection to be per EPRI fuel reliability guidelines

Westinghouse

Chapter 9 - OI-SRP9.1.4-SBPA-03

- **Issue:**
  - Fuel Move Components
- **Final Resolution: Issue closed**
  - Clarified the use of and the restrictions on each Fuel Handling Machine (FHM) hoist
  - FHM hoists have mechanical stops to limit height of fuel lift within safe bounds
  - Add New Fuel Elevator to Figure 9.1-4

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Chapter 9 - OI-SRP9.1.5-SBPB-01

- **Issue:**
  - Evaluate Equipment Hatch Hoist Loads on Containment Vessel
- **Final Resolution: Issue closed**
  - The analyzed load set on Containment Vessel is acceptable for all conditions and service levels, including seismic

Westinghouse

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Presentation to the ACRS Subcommittee

AFSER Chapter 9
Auxiliary Systems

Westinghouse AP1000 Design Certification Amendment Application Review

November 3, 2010

Staff Review Team

- Technical Staff
  - Pravin Patel—Structural Engineering
  - Chris Van Wert—Reactor Systems
  - Raul Hernandez—Balance of Plant
  - Gordon Curran—Balance of Plant
  - Larry Wheeler—Balance of Plant
  - Thinh Dinh—Balance of Plant
  - Brookhaven National Laboratory
    - (R. Morante, J. Braverman)
- Project Management
  - Perry Buckberg

Overview

- Chapter 9 of the SER with Open Items (OIs) included 11 Open Items
- Fuel Rack Seismic Analyses Sections Were Not Issued Until the AFSER
  - Several RAIs were Resolved Summer 2010
- All Open Items & RAIs are now Resolved
- OI Resolutions Being Presented
  - OI-SRP9.1.1-SRSB-01
  - OI-SRP9.3.6-SRSB-01
- Fuel Rack Seismic topics will be presented

OI-SRP9.1.1-SRSB-01

- OI-SRP9.1.1-SRSB-01 tracks an issue related to the use of burnup credit in the spent fuel pool criticality analysis.
  - Original analysis assumed full rack loading and included burnup credit for Region 2 storage.
  - Staff questioned the handling of uncertainties related to depletion calculations.
  - To resolve the issue, the applicant proposed a checkerboard pattern limitation so that burnup credit was not necessary.

OI-SRP9.1.1-SRSB-01 (cont.)

- The applicant subsequently returned to the original fully loaded analysis.
  - Recent LAR approvals of similar designs/methods.
- Based on the staff's technical review and recent precedents, the staff finds that the applicant meets all current regulations regarding spent fuel pool criticality.

OI-SRP9.3.6-SRSB-01

- Option to Inject Zinc Added to DCD
  - For Dose Reduction; Not Credited For PWSCC Mitigation
  - No Adverse Effects on RCS Pressure Boundary Materials or Chemistry (Operating or Post- Accident)
- Insufficient High Duty Core Industry Experience
  - To Rule Out Excessive Crud, or Crud Induced Power Shift (CIPS)
  - OI-SRP 9.3.6-SRSB-01 Related to Effects on Fuel

OI-SRP9.3.6-SRSB-01

- OI Related to Effects on Fuel
  - AP1000 core design classified as a low to medium duty plant.
    - Confirmed by staff calculation
  - High duty plants have successfully operated with zinc addition
  - CIPS risk analysis is performed using EPRI guidelines(VIPRE BOA)
  - Fuel inspection program will look at crud build-up
- Staff finds the Response Acceptable
  - AP1000 CIPS risk is bounded by current OE
  - Modeling plus fuel inspection provides additional assurance CIPS risk is minimized

Spent Fuel Storage Racks

- Westinghouse Technical Report TR-54 (APP-GW-GLR-033), “Spent Fuel Storage Racks Structural/Seismic Analysis”, addresses DCD Revision 15 COL Information Item 9.1-3:

  Perform a confirmatory structural dynamic and stress analysis for the spent fuel rack, as described in subsection 9.1.2.2.1. This includes reconciliation of loads imposed by the spent fuel rack on the spent fuel pool structure described in subsection 3.8.4.

- TR-54, Revision 0, was submitted in July 2006.
- TR-54, Revision 4, was submitted in May 2010.
- Based on its technical evaluation, the staff concludes that the substance of the COL Information Item is completely addressed by TR-54, Revision 4.
- DCD Revision 15 COL Information Item 9.1-3 is no longer needed.

New Fuel Storage Racks

- Westinghouse Technical Report TR-44 , (APP-GW-GLR-026) “New Fuel Storage Rack Structural/Seismic Analysis”, addresses DCD Revision 15 COL Information Item 9.1-1:

  Perform a confirmatory structural dynamic and stress analysis for the new fuel rack, as described in AP 1000 DCD subsection 9.1.1.2.1. This includes the structural adequacy of the proposed AP 1000 New Fuel Storage Rack under postulated loading conditions and effects on the structure described in subsection 3.8.4.

- TR-44, Revision 0, was submitted in May 2006.
- TR-44, Revision 5, was submitted in August 2010.
- Based on its technical evaluation, the staff concludes that the substance of the COL Information Item is completely addressed by TR-44, Revision 5
- DCD Revision 15 COL Information Item 9.1-1 is no longer needed.

Fuel Racks Structural Evaluation

- Loading Conditions Analyzed
  - 3 Directions of Seismic Excitation + Dead Weight
  - Fuel Assembly Accidental Drop over the Spent Fuel Pool
  - Stuck Fuel Assembly, during removal from rack
  - Impact Load on the Spent Fuel Pool Steel Liner/Concrete Wall

Fuel Racks Structural Evaluation

- Primary Analysis Methods
  - HOLTEC proprietary computer code DYNARACK, for nonlinear dynamic analysis of free-standing fuel racks subject to seismic plus deadweight loading
  - LS-DYNA nonlinear dynamic analysis, for accidental drop of a fuel assembly over the spent fuel pool. Two scenarios: drop on top of a fuel rack and drop through a cell to the rack bottom plate.
  - LS-DYNA nonlinear analysis, for worst-case rack-to-rack impact loading at the top of a spent fuel rack
  - ANSYS nonlinear analysis, for cell wall compressive loading at the bottom of the new and spent fuel racks.

Fuel Racks Structural Evaluation

- The staff issued forty-four (44) RAIs for TR-54, and thirty-one (31) RAIs for TR-44.

- For the seismic analysis, the applicant's contractor (HOLTEC) conducted the following sensitivity studies, several in response to staff RAIs:
    - friction coefficient between the bottom of the fuel racks and the supporting surface; 0.2, 0.5, 0.8 analyzed.
    - number of fuel assemblies in the fuel racks at the time of a seismic event; three cases analyzed.
    - in-situ gaps between adjacent spent fuel racks; two cases analyzed.
    - impact spring value due to local flexibility of the fuel assembly cell wall; three values analyzed.
    - sensitivity of the DYNARACK solution to reduction of the integration time step, by a factor of 4.

Fuel Racks Structural Evaluation

- Seismic loading on the new and spent fuel racks was re-defined two (2) times during the course of the staff's review; re-analysis each time.

- The staff confirmed that final seismic loading is consistent with the Auxiliary and Shield Building (ASB) re-analysis (SASSI modeling errors and SB design changes).

- Applicant made several design changes, to strengthen for rack-to-rack impact loading, due to seismic excitation of the spent fuel racks.

- The staff determined that the applicant applied methods and procedures contained in NRC regulatory guidance documents, and previously accepted by the staff for qualification of fuel racks.

- Based on the staff's in-depth review of the applicant's detailed calculations, during a series of audits, and the results of the applicant's sensitivity studies, the staff concluded that the spent and new fuel rack designs are adequate to withstand the postulated loading

Fuel Racks Structural Evaluation

- SER Section 9.1.2.2.1 "Spent Fuel Rack Design Change" documents the staff's evaluation of TR-54.
  - All Technical Issues are Resolved.
  - Two (2) Confirmatory Items require revision of the DCD.
  - One (1) Confirmatory Item requires revision of TR-54 and the DCD, to show the final gap and tolerance dimensions between the racks and between the racks and the spent fuel pool wall.

- SER Section 9.1.1.2.1 "New Fuel Rack Design Change" documents the staff's evaluation of TR-44.
  - All Technical Issues are Resolved.
  - Five (5) Confirmatory Items require revision of the DCD.

ACRS Meeting

Impact of Gas Intrusion on IRWST Makeup Water Injection in the AP1000

November 2010

Chuck Brockhoff — Nuclear Systems Design
David McDevitt — Nuclear Safety Analyses

AP1000 Gas Intrusion Assessment

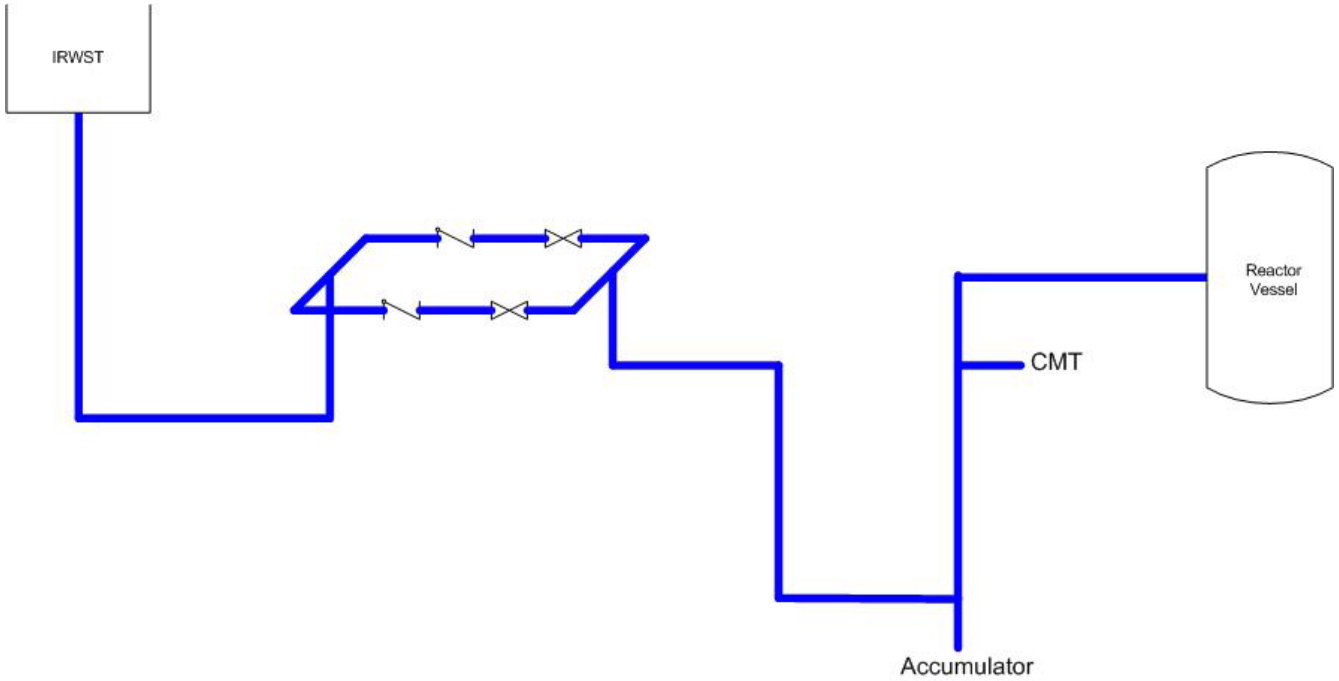
- A question on the potential for gas intrusion during In-Containment Refueling Water Storage Tank (IRWST) passive injection was asked during the July 2009 ACRS Meeting discussion on Chapter 14 (Initial Test Program)

- Westinghouse provided an update to the ACRS in February 2010 on the AP1000 gas intrusion assessment following the operating plant guidance in NEI 09-10 to address GL 2008-01 considerations (now required for advanced plants per draft ISG-019)

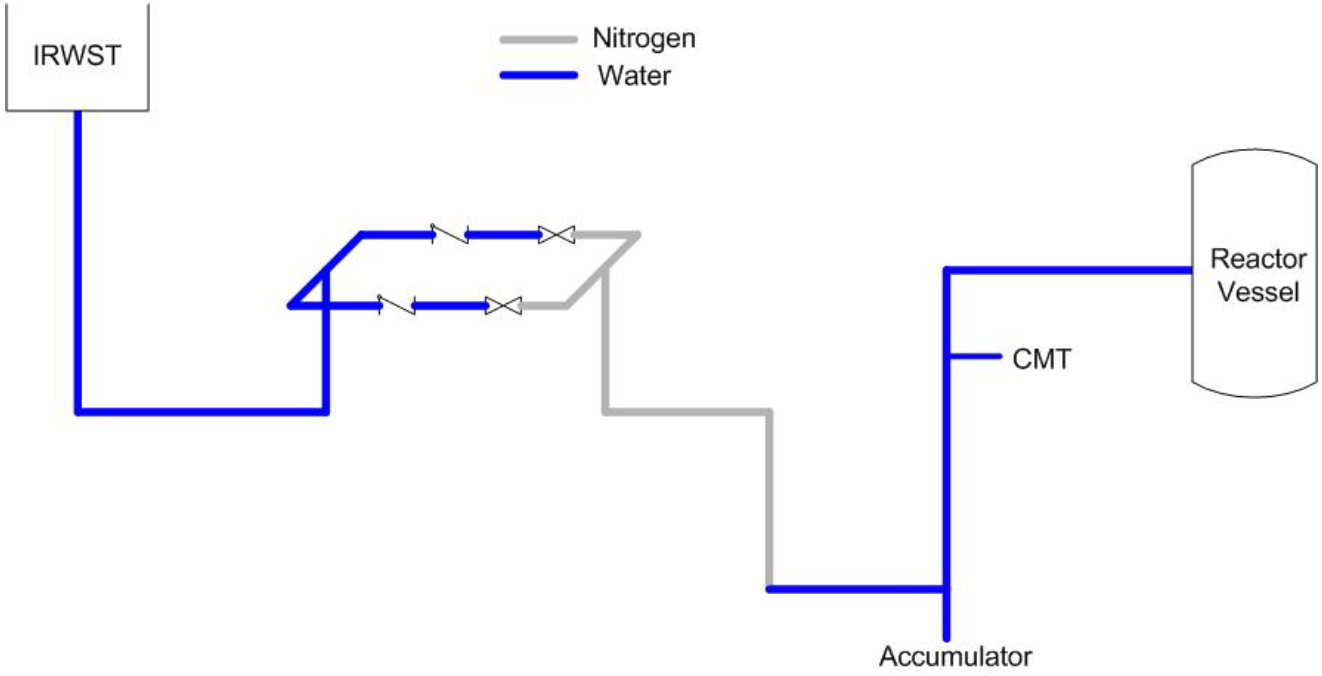
- Resulted in three design changes initiated by CN66
  - Added 4 high point pipe stub locations / redundant level indications / hard piped vents
  - Added 8 other high-point vent valves (and used existing test connections at 9 other locations)
  - Moved the accumulator discharge line connection to the direct vessel injection line

- One Open Item (2b) from the February 2010 ACRS meeting was to supplement the sensitivity analysis (core mixture level) provided with a core heatup calculation

IRWST Injection Path - No Void Present



IRWST Injection Path - Void Present



[NOTE: (IRWST Valve Elevation – IRWST Injection Tee Elevation) * Density of IRWST Fluid ≈3.4 psi]

SBLOCA Gas Intrusion Simulations

- Current Safety Analysis NOTRUMP Small Break LOCA Evaluation Model (EM) does not explicitly consider gas intrusion
  - Potential delay in onset of IRWST injection

- During February meeting preliminary NOTRUMP simulations were discussed
  - IRWST injection delayed to simulate non-condensable gas accumulation
  - Impact is most significant for smaller breaks and no-break simulations (Inadvertent ADS, INADS)
    - Break in RCS assists in depressurization characteristics
    - 2 inch cold leg break and INADS examined
  - Core uncovery predicted

- Peak Cladding Temperature (PCT) response requested
    - SBLOCTA code utilized

NOTRUMP Simulation Results

- Simulations indicate base model IRWST injection begins with a DVI line pressure of approximately 28 psia
  - 2-inch indicates IRWST Injection at ~3197 seconds
  - INADS indicates IRWST Injection at ~2474 seconds
- Accounting for gas intrusion requires additional depressurization to achieve IRWST injection
  - With maximum IRWST line void (~7.9 ft) assumed an additional ~3.4 psia depressurization required
    - 2-inch indicates ~2.9 ft uncovery over ~115 seconds
      - 654°F PCT
    - INADS indicates ~4.3 ft uncovery over ~346 seconds
      - 1305°F PCT
- Accounting for gas void with DCD modeling assumptions results in partial core uncovery
  - PCTs well below 10 CFR 50.46 limit w/ maximum IRWST line void considered

Response to ACRS Question 2a What ITAAC is Needed?

- CN66 changes evaluated as part of SER Chapter 23
- CN66 SER inputs are complete – No further action
- Added DCD Subsection 6.3.6.3 (discusses Mitigation of Gas Accumulation)
  - Includes a discussion of the ISG-019 / GL 2008-01 gas intrusion assessment
  - Summarizes the gas mitigation design features
- DCD Subsection 6.3.6.3.2 (System Design Features to Mitigate Gas Intrusion) includes specific line sloping design / construction / fabrication requirements
- A new ITAAC is not required

ACRS Action Item #41
Reactor Trip Circuit Breaker Testing

DCD Chapter 16 - Tech Specs

Bob Seelman – NPP Licensing
John Ewald – NPP ESI

November 03, 2010

WESTINGHOUSE NON-PROPRIETARY CLASS 3

Westinghouse

ACRS Action Item #41

RTCB test frequency…

Need to know more in operating experience

Discuss basis for yearly testing

RTCB History in Westinghouse Plants

- **INPO Westinghouse Plant History 2000 to Present**
  - 17 cases of RTCB issues
  - 3 cases of RTCB failure to trip
    - *1 under voltage (UV) trip failed during testing, but shunt trip passed*
    - *1 trip failed during shutdown (S/D) testing due to mechanical failure of breaker*
    - *1 UV trip failed during S/D testing due to UV driver this prevented auto trip but not manual trip*
  - 5 cases of RTCB failure to close or reset
  - 5 cases of inadvertent trip of RTCBs during maintenance
  - 4 cases of RTCB defects identified during S/D maintenance, none that would have prevented RTCB opening

Reference OI-SRP7.2-ICE-03

Westinghouse stated that each individual RTCB would be opened during a trip actuation device operational test once per year. In current licensed plants, the maximum length of time between openings of RTCBs (or equivalent) is typically 92 days. This issue is discussed in Chapter 16 of NUREG-1793 and this supplement. This issue was determined to be adequately addressed in Revision 15 of the DCD and no changes were made to RTCB layout or design, including the periodicity of RTCB testing. Therefore, OI-SRP7.2-ICE-03 is considered resolved.

Conclusion

•There was only one breaker failure in the Westinghouse operating fleet in the last 10 years that would have prevented the opening of the reactor trip breaker. In AP1000 we only need 2 breakers out of the eight to function in order to ensure a reactor trip.

• Based on the historical low failure rate of RTCBs, combined with the increased redundancy in the AP1000 RTCB configuration, it is reasonable engineering judgement to conclude that the 92 day staggered testing frequency is acceptable.

Questions?

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
	ITEMS Below are from July 2009 meeting					
4	RCP Flywheel Design; I would like to receive stress corrosion test reports performed by W or pump supplier on the 18Cr 18Mn retainer ring material. I suspect that they have not tested this material sufficiently (if at all) to demonstrate SCC resistance in the coolant environment. Even though the ring is sealed in a Alloy 625 can, the assembly will not be inspected in service, and there will be no way of knowing whether the can will remain leak tight during service. If SCC of the retainer ring occurs, a serious accident would be likely. *-Armijo* ~~Also, interested in RCP locked rotor failure frequency used in PRA.~~ ~~Tom Kress~~	open	7/23 Summary discussion Chapter 5 Updated in Feb.	W	~~W~~ *DNRL*	~~Westinghouse to provide presentation in future ACRS meeting~~ *DNRL to provide results of staff review of revised missile analysis when complete. Was discussed during February meeting. Closed failure frequency concern at 4/22 meeting. Materials were provided to Sam after 4/22 meeting.* *Sept. 20-21 meeting had a discussion on this item but the issue remained. Additional summary of Sam's concerns after this meeting were sent to the staff on Sept. 24.* *Harold had a concern on the potential for a locked RCP rotor (due to flywheel failure) to cause a LOCA.* *Nov. 12, the staff provide information addressed Locked RCP rotor and Harold is satisfied with the response. Sam's issue remains.*

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
6	Flow distribution – Lower plenum anomaly and core inlet flow distribution. What is ratio of peak/average and minimum/average bundle flows with the skirt. Provide further information about the tests ongoing in Japan, including scaling methodology, CFD Method used, Reynolds number. What were the assumptions used in setting up the VIPER model and its justification. - Abdel-Khalik Sept. 20-21 SC meeting: The CFD code determination of flow mal-distribution due to the inlet flow shirt showed a minimum-to-average value of 0.88. To determine the potential effect on DNBR in the hot channel, VIPER was used with a 5% reduction of flow into the hot channel. As VIPER was used, it is possible that it accounted for cross-flow in the sub-channel to show that 5% reduction had acceptable effect on DBBR and is, therefore, conservative because full core cross-flow was show to re-distribute the flow at about ¼ heights from the inlet. Question: 1) What assumptions were used in the CFD calculation to determine the 0.88 value? 2) Did VIPOR invoke cross-flow in the 5% flow reduction calculations? If so, what was the assumption on cross-flow resistance? 3) Why is 5% the appropriate choice in view of the 0.88 CFD results? 4) How do we reconcile these results in view of the known fact that there are hot streams emanating from the top of core of operating reactors? - Said, Tom	open	7/24 Morning meeting Chapter 5, Chapter 4 Updated in Feb.	W	W/ DNRL/ NEW2	Westinghouse to provide additional discussion in future ACRS meeting. DNRL *has* provided background documents from AP1000 review that may help ACRS better understand the issue. Sept. 20-21 meeting had a discussion. Additional questions were raised (added).

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
10	~~Elbow Taps for RCS Flow Measurement. Need further information, discuss uniformity of flow. Provide ACRS background information for Westinghouse change for monitoring RCS flow to reflect an alternate testing method to the precision heat balance. The alternate testing method includes using elbow taps. OI SRP 16 CTSB 25.~~ ~~Banerjee~~ ~~Additional questions was raised during the April 22 meeting:~~ ~~How are various measurement indications reconciled, at operating plants?~~ ~~For AP1000 Design,~~ ~~What is the uncertainty in core flow;~~ ~~How is the uncertainty estimated;~~ ~~What is the measurement used for;~~ ~~and how accurate does it have to be?~~ ~~Said~~ Westinghouse to provide a reference for the statistical method of combining diverse measurements. - Sanjoy	open	7/24 Chapter 16	W	W/DNRL	DNRL to provide relevant Westinghouse submittals to ACRS. Need submittals from Westinghouse. Communicated to Westinghouse on 1/15/2010 Westinghouse addressed this item in July 2010 meeting. Since Said was not presented during the meeting, slides and transcripts were sent to him after the meeting. Said was satisfied with the response by Westinghouse. During the meeting, Sanjoy further requested a reference on the statistical method used for the flow uncertainty. Sept. 20-21 SC meeting, Sanjoy asked to pass the consultant reports by Dr. Wallis to staff to address his concerns. References were sent to Sanjoy and Wallis. Dr. Wallis provided feedback. Still waiting comments from Dr. Sanjoy.

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
11	Aircraft Impact Assessment staff evaluation. Subcommittee wants briefing. -Ray, Banerjee	open	7/24 Chapter 19	W	DNRL	NWE1/NWE2 to arrange closed ACRS subcommittee briefing. 19F revision
	ITEMS FROM OCTOBER 2009 SC MEETINGS					
	ITEMS FROM NOVEMBER 2009 SC MEETINGS					
37	*Statistical analysis of fuel assembly tests* "Banerjee, Wallis and I requested statistical analyses of the fuel assembly tests. There were a limited number of tests, and a several experimental variables. The issue here is the statistical validity of the reported findings and conclusions of these tests." – Armijo Armijo further clarified in his e-mail on 7/1/2010, " The heart of my question was whether there was sufficient repeatability in the tests. Given the same test variables in duplicate tests, did Westinghouse get reasonably similar results"	open	GSI-191		~~*W*~~ *ACRS*	*Provide copy of report – possibly included in RAI response* *GSI-191 Test Reports sent to Sam on July 6, 2010.* *New reports were provided to Sam and Sanjoy, Sam is satisfied with the response. Need Sanjoy/Wallis's comments.*
	ITEMS FROM FEBRUARY 2010 SC MEETINGS					
46	Components MOV, POV testing, how is the risk informed and ranked. PRA is not sufficient and need to review other criteria. *-Stetkar, Shack*	open	3		*W*	*W to provide info on risk ranking*

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
48	Confirm 1) if there are interlocks for ADS1, 2, 3, 4 actuation and what kind of failure it can occur. 2) If it occurs, what is the impact to the safety analysis?	open			*W*	*W to provide info at future meeting*
49	Sanjoy had issues on codes: a) ASTRUM is approved for other Westinghouse PWRs, justify that it can be applied to the AP1000. What is the similarity of the AP1000 compared to the Westinghouse PWR for the LBLOCA in the initial blowdown phase? b) W/TRAC is the best estimate code. What the conservativeness was used in the Rev. 15 compared to the best estimate approach used in the Rev. 17, which lowered the PCT significantly. c) Since the certified design, what are the changes in the code? Provide a summary report. WEC responded that the main changes Error of modeling in pressurizer and hot spot. (Sanjoy)	open	Chapter 15		*W*	*W to provide info at future meeting*

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
50	In LOCA calculation, the collapsed liquid level in the core remains at about six feet, what is the uncertainty of the six ft in water level? (Sanjoy)	open	Chapter 15		*W*	*W to provide info at future meeting*
	ITEMS FROM APRIL 2010 SC MEETINGS					
51	Details of the plate-to-plate welds for the SC wall steel plates and how the quality of welds are assured. - Boza and Sam.	open	Chapter 3 Shield Building Design		*W*	
52	Details of the roof beam to tension ring connection.	open	Chapter 3 Shield Building Design		*W*	
53	Explanation of the pushover analysis methodology: how were the lateral and vertical forces selected, combined and applied, and how are the results of this nonlinear analysis interpreted. - Boza	open	Chapter 3 Shield Building Design		*W*	
	ITEMS FROM June 2010 SC MEETINGS					

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
55	Testing of Squibb Valves— Verification/qualification program, IST program. - Banerjee Member Brown requested details on how many tests, what's the configuration, what are the upstream pressures, and etc, aside from how do you test them once they are in service. - Brown		Discussed in Chapter 14 and WEC will address it again in Chapter 3	*W/COL*	*W/COL*	*Both WEC and COL need to address this item.* -
56	How the functional requirements related ITAAC (e.g., Turbine overspeed protection) will be verified? (What process will be used to verify the requirements). How does ITAAC for turbine overspeed protection diversity, independence, and redundancy get written to adequately inspect computer hardware and software. There was interest in any failure experience with monoblock turbine rotors, and seeking more info about how active sensors function. (june transcripts Page 187-191) Provide RAIs on the subject. - Brown	Open	Chapter 10	*W/COL*	*W*	*TR86 and RAI*-SRP10.2-SBPA-02 *were sent to members. Brown provided additional comments and they were passed to the NRO staff.*

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
57	In Chapter 12 presentation, Mr. Roach stated: "the plants or facilities have had issues with that ventilation or contamination going into their ducting, that exhaust port was very close to the water level within a couple of feet, in the AP 1000 the exhaust is up approximately 10 - 12 feet above the water level." Member Brown requested a justification of 12 feet above the water level. (June Transcripts, page 26)	open	Chapter 12	*DCD*	*NRO*	
	ITEMS FROM July 2010 SC MEETINGS					

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
60	Numerous questions about water distribution around outside of containment and coatings application and inspection. To understand the coating on containment, ACRS needs clear diagrams and illustrations on the configurations of the containment and Shield Building. For example, Sam requested to see water management system for the shield building. Harold requested to confirm that the baffle is protected by Galvanizing. Brown asked how to ensure the right thickness of coating and some type of analysis on the fact that this coating is supposed to prevent rust. Members also requested to review the July 2 letter regarding revision to the Ch 6 of FSAR. Kress recommend to review technical basis behind the choice of 50 psi as the limit below which the chosen coating will not flake off during a LBLOCA. Will this be validated experimentally?	Open	Chapter 3/6		*WEC*	*WEC will provide more information when they come back on the Shield Building Design. Staff will address this issue in the COL safety evaluation in Chapter 6.* *July 2 letter is sent to the member through September AP1000 meeting status CD.* *Sept. 20-21 SC meeting, WEC made a detailed presentation on the configuration and coating program. The issue remain includes:* 1) Harold: (1) The COL applicant will need to define and explain the visual inspection that they will actually conduct; (2) the COL applicant will need to address how the buildup of contamination on the containment exterior could affect the required uniform wetting of the exterior by water during a DBA. 2) Said: For DCD, uniformity of the water flow around the containment and heat transfer needs to be assured. WEC will bring the expert to make a clarification. 3) Sanjoy: asked coating analysis on micrographs. ACRS will need to review research information concerning the bonding of the inorganic zinc coating to the containment vessel steel, on both internal and external surfaces – Tim of WEC will send the reference.

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
62	Consultant William Hinze suggested that the staff's safety evaluation review be updated qualitatively to reflect the findings in the U.S. Geological Survey Open-file Report 2008-1128 [Documentation for the 2008 Update of the United States National Seismic Hazards Maps] by M. Petersen et al. which has superseded the 1996 and 2002 U.S. Geological Survey reports that have been previously reviewed in the V.C. Summer FSAR. The NRC staff's safety evaluation revision should reflect the description of the U.S. Geological Survey]s 2008 seismic hazard model including a comparison of key parameters of this model to the V.C. Summer seismic model.	open	Chapter 2		*Summer*	Bill produced a meeting report for the subcommittee with comments.
63	~~South Carolina Electric and Gas provides the detailed calculation associated with the following: 1) train car release of toxic gas and its effects on control room habitability, and 2) offsite explosive hazards analysis that was done to support the conclusion that such a hazard does not pose a threat to the proposed VC Summer Units 2 and 3.~~ 3) Staff's confirmatory calculations (Sanjoy).	Closed for Part 1 and 2	Chapter 2		*Summer*	*4 reports were received and three of them were sent to the members by e-mail on 8/12. Due to its size, the last one will be add to a CD for members to review.*
64	When the hydrogen is replenished, you bring some sort of a truck onsite. Is there an additional hazard as far as the amount of hydrogen at that time or would that be handled with the COLA? - Sam, Transcripts page 22.	Open	Chapter 2		*Vogtle COLA*	
	ITEMS FROM Sept. 2010 SC MEETINGS					

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
65	In D I&C, Charlie is concerned about watch dog timer. What will happen to the other divisions and what is the end result when process overload and corrupted data occur.	Open	Chapter 7		*WEC/Staff*	*This is a new item to replace the old Item #32.*
67	Harold- question about the TSC, what is the effect of the consolidation of the unite 1&2 TSC into the new TSC serving unites 3&4	open	Chapter 18		*WEC/Staff*	
	ITEMS FROM Oct. 2010 SC MEETINGS					

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
68	1) What are the lowest flows calculated by COBRA/TRAC for various accident scenarios using the same debris loading as is used for the DVI break calculations? (2) How do numerical (nodalization and time-step) convergence tests affect the oscillations seen in the COBRA/TRAC calculations? (3) Do DEDVIGB breaks lead to the lowest driving head conditions? Are there other accident scenarios (e.g., some cold leg breaks) that lead to lower driving heads due to incomplete filling of the downcomer? (4) If the bed resistance is made a function of velocity as seen in the experiments, how are the oscillations and the average flows and pressure losses affected? (5) If the bed resistance is made a function of flow rate through the debris beds formed, then do these effects change the worst-case scenarios? Does such a flow-dependent bed resistance parameterization lead to lower flows than would be calculated with a constant bed resistance for the worst-case scenarios?	open	Chapter 6		*WEC/Staff*	*Reworded after Nov. 4 Full Committee Meeting*

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
69	(1) What is the margin between the worst-case COBRA/TRAC calculations presented and the flow that would lead to dry-out? In other words, how much would the debris bed loss factor have to be increased in order to lead to dry-out? (2) At what quality would dry-out be expected at the decay heat levels used to generate the table of COBRA/TRAC results presented by the staff? (3) What is the low-pressure, low-flow CHF correlation used in COBRA/TRAC?	open	Chapter 6		*WEC/Staff*	*Reworded after Nov. 4 Full Committee Meeting*
70	1) What happens to boron concentration levels and deposition in the event of dry-out? (Addressed in November Full Committee meeting. Need explicit reference.) (2) What are the conditions in outlet quality and flow rate at which boron precipitation becomes a concern?	open	Chapter 6		*WEC/Staff*	*Reworded after Nov. 4 Full Committee Meeting*

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
71	How sensitive are the debris bed head loss to: (1) Flow rate (2) Fiber characteristics (3) Fiber loading (4) Chemical loading (5) Testing protocols	open	Chapter 6		*WEC/Staff*	*Reworded after Nov. 4 Full Committee Meeting*
	ITEMS FROM Nov 2-3. 2010 SC MEETING					
72	Members concerned about the spurious actuation of ADS valves due to a CCF of the PMS was not addressed in the design. Under this situation, can the safety function rely on the rest of the system to mitigate the scenario? Members also concerned that for manual DAS, out of service for 30 day is too long.	open				

ID No.	Action Item	Status	Source (Chapter/ Discussion)	Westinghouse/ Bellefonte application	Who has action	Comment/Disposition
73	Close 56 and make Charlie's concern as a new item. Charlie commented to close points1 and leave points 2 and 3 open in his written write-ups. Charlie's remaining concerns are listed in the right column.	open				Status: RAI-SRP10.2-SBPA-02 Rev 3 on this issue was provided as requested. The following points apply based on a review of the RAI: 2. In addition, the response of the overall overspeed trip system is supposed to ensure that the TG speed will not exceed 120% of rated speed as stated in the Tier 2 DCD Chapter 10 Note following Table 10.2-2 Turbine Overspeed Protection. The Note follows: **Note:** Following the above sequence of events, the turbine may approach but not exceed 120 percent of rated speed. There is no acceptance criterion in Tier 1 Chapter 10 ITAAC/DAC for the Main Turbine System requiring an analysis that demonstrates that the sample time and processing architecture for each of the trip functions will be bounded such that this criterion will be met. 3. The third point is that revised Tier 2 Section 10.2.2.5.3 and the new Figure 10.2-2 state and show that the Backup trip function is part of the OA controller which is the system that is to actively control turbine speed. This means that it is possible that the OA controller could fail in a manner to demand the turbine to overspeed thus requiring the either the independent and diverse Emergency trip system or, in the event that it fails, the Backup system to act. However, since the Backup system is part of the system driving the speed up, it may be incapable of operating due to the failure mode of the OA controller. Conclusion: My opinion is that the description and ITAAC are neither specific enough nor sufficient to demonstrate compliance with the desired performance of the Turbine Overspeed system.

	CLOSED ITEMS					
1	GSI and Generic Issue Process. How is it addressed since Rev. 15? (example GSI-191)	closed	7/23 Summary discussion Chapter 1	W	DNRL	Provided additional presentation in Feb meeting
2	Can Non-condensible gases affect flow from IRWST. a) what ITAAC will be included b) heatup analysis -Abdel-Khalik, Banerjee	closed	7/23 Summary discussion Chapter 1, Updated in Feb.	W	W	ACTION: Westinghouse provided a discussion during Feb. *meeting* on how non-condensible gas issue was addressed. "need to hear rest of story" Closed in the Nov. 2-3 meeting.
3	RTD Relocation. Is there an impact on the dead-band for rod control. Are they at upper half or at top of the hot leg? -Abdel-Khalik, Ray	closed	7/23 Summary discussion Chapter 5	W	W	*Closed at October meeting.* ~~Westinghouse to provide presentation in future ACRS meeting~~
5	Pressurizer. Does the shape change affect "chugging" behavior with ADS discharge? What is the effect on level control setpoints?	closed	7/24 Summary discussion Chapter 5	W	W	Westinghouse provided presentation *at Nov* ACRS meeting. *DNRL has provided documents on safety analyses*
7	Zinc Injection (information on operating experience (14 foot core). Is there exothermic reaction; how much zinc coats on fuel.	closed	7/24 Chapter 19 meeting Chapter 5	W	W	~~Westinghouse to provide presentation in future ACRS meeting.~~ *Discussed at Oct meeting. DNRL to provide documents. Also was discussed during Nov meeting on chapter 9. Closed*
8	PTLR Process. Need to clarify how this is captured in TS, other examples (COLR).	closed	7/24 Chapter 5	W		*Closed at Oct meeting*

9	~~Turbine Overspeed Protection~~ ~~a) frequency of testing (6 months?)~~ ~~b) method of testing~~ ~~c) power supply independence~~ ~~d) diversity~~ ~~f) turbine missile analysis, include 1) How W used the available operating experience to justify both the challenge frequency and the failure rate for the valves. 2) What are those conditional probabilities of the discs coming apart for each of the overspeed conditions, design and intermediate overspeeds.~~ ~~Ray, Brown, Stetkar~~	closed	7/23 Chapter 10 Updated in Feb.	W	~~W~~ NRC	~~Westinghouse to revise DCD to correct mis-characterization about speed control, independence.~~ *Discussed at Feb meeting. Open questions on intercept valve test frequency and method of testing for overspeed.3 months -->6 months. Questions on turbine missile analyses diversity*l n June 2010 meeting, W provided sufficient information and members decided to close this item but produced an new item #56
12	Turbine missile generation. ACRS would like more information about assumptions in analysis -Sketkar questions	closed	7/24 Summary discussion Chapter 10	W	TVA/DNRL/NWE1	~~Issue to be discussed during chapter 3 review where missile generation from one unit s impact on a second unit is discussed. Also missile hazards analysis for existing units on the site should be addressed in presentation to ACRS~~ *Discussed at Oct and Feb meeting. Issue of Dual unit sites is adequately addressed. New questions were raised and they are added to Item 9.*
13	BLN Hydrology Issue and QA aspects. Staff to provide inspection report and public meeting accession numbers.	closed	7/24 Summary discussion Chapter 19	TVA	DNRL	8-10-09 update – action complete information provided to Mike Lee in a 7/28 email from Joe Sebrosky Discussion topic to be deferred to RCOLA site specific review

14	Concerned about ad-hoc basis of the staff's review of design changes to determine if a particular design change impacts other areas of the FSAR.	closed	7/23 Summary Discussion Chapter 5, Chapter 10	W	DNRL	*Closed by focus on "design changes" not just DCD changes*
15	Would like a better understanding of how GSI 199 (eastern Tennessee seismic zone) affects the seismic margins bounding approach. -Ray	closed	Chapter 19	both	DNRL/NW E1	Issue to be discussed during chapter 2 bellefonte presentation or during other SC on GSI-199. Closed in Feb. -site specific
16	Does the recent flood in France shed any In sights with regard to PRA? -Banerjee	closed	Chapter 19	both	DNRL/NW E1	Issue to be discussed during chapter 2 bellefonte presentation. Closed in Feb -site specific
17	Present information on "testing". Present testing done to support Rev 15 and 17 design certifications. Present testing done to demonstrate "as-built" – i.e. the initial test program. Present testing that is done throughout the life of the plant. -Abdel-Khalik	closed	Chapter 14	Both	W, TVA, DNRL	See item #2
18	Concerned about workload and what can be done to help ACRS (suggested that alternatives can be explored like thermal hydraulic issues being discussed for all design centers during one set of ACRS meetings).	closed	7/24 Summary Discussion		DNRL	DNRL to discuss issue with upper management and determine if there are alternatives. *Closed*

19	Staff to provide information regarding what is meant by rad significant	closed	Chapter 12			~~8/10- update added based on comment from Mike Lee. Need to review transcripts when available to better understand item~~ *Relates to July 22 ACRS letter on NEI-08-08. Generic to all COLs – closed with respect to AP1000 SC*
20	Provide information regarding how digital I&C failure rates were addressed in the PRA and whether there were improvements made in the design as a result of insights from the PRA. -Kress?	closed	Chapter 19			8/10- update added based on comment from Mike Lee. Need to review transcripts when available to better understand item. Discussed at Feb meeting
21	In several areas, the Committee sought figures or other visuals to understand the design changes (flow skirt, flywheel), functional block diagram on turbine controls. The Committee will be looking for this in future chapters.	closed	NA	Both	W/TVA/DNRL	*Chapter 7 presentation includes several figures.* Westinghouse will provide more figures in future presentations (1/15/2010). Closed in Feb
22	In most cases, the Committee was not particularly interested in process issues, such as handling of COL holder items. For future meetings, suggest not presenting COL and open items where this is the primary consideration.	closed	NA	Both	W/TVA/DRNL	discussed in February meeting
23	The Committee was interested in how the staff ensures that overall impacts are considered, such as: could something about COL impact upon the IBR usage, and are all effects of a particular design change evaluated. (relates to item 14 above)	closed	NA	Both	DNRL	DNRL to consider if additional information in this area should be presented to the ACRS. *Westinghouse will discuss their process during Nov meeting. Closed*
24	The Committee indicated that there is still confusion about RCOL transition process.	closed	NA	TVA	NWE1	Provide additional discussion in future ACRS meeting – *included during Nov 5 FC meeting. Closed in Feb*

25	*Human Factors Engineering, including Computer-Based procedures audit . Task analyses*	closed	*18*	*W*	*NWE2*	*DNRL provided documents. GA wants information on integration of HRA into HFE (from 11/5) –documents provided*
26	*Waste management forecast (by category and volume if available) -Ryan* *After June 2010 meeting, Dr. Ryan has the following comments:* The answers are there except for the forecast of volumes of materials in storage as Chairman Ray noted at line 12 on page 109. The purpose of these questions is to probe the amount of waste radioactive materials and their onsite storage periods. At some point 20, 40, 60, year hence they can become problematic. The query is to inquire as to their longer term plans for accumulated wastes. I do not agree that these answers close the question.	closed	*11*		COL	*COL to provide* Updated after June 2010 meeting. Closed in July 2010 meeting.
27	*PRA audit results. COL PRA?*	closed	*19*	*W*	~~*NWE2*~~ *Member Action*	*DNRL has provided documents and sent to members on 3/30/2010– under review*
28	*Pipe break hazard analyses (DAC) -Banerjee, Ray*	closed	*3.6*	*W*	*W/NWE2*	*Provide report when completed (2010)). Closed in Feb*
29	*Screening criteria for striping (thermal fatigue)* *-Banerjee*	closed	*3.12*	*W*	*W*	*Discuss at future meeting. Westinghouse is targeting April.* *Closed at 4/22 meeting*
30	*WESTEMS code and J-weld -Shack*	closed	3.9.1	*W*	*NWE2*	*Open items in SER – will discuss with AFSER.* *Closed in Feb.*

31	*Chapter 2 geotech information*	closed		*W*	*W/NWE2*	*Include when discussing related chapter 3 (seismic)* *Chapter 2 and part of Chapter 3 was discussed in July 2010 meeting.*
32	I&C Architecture(major changes) -Brown And there is still the open questions such as on high speed links Brown 6/25/2010	Closed	11/5	W	NRC	Addressed on November 19 and Feb 2-3. May be future questions. 6/25/2010, WCAP-17201-P (high speed links) sent to Brown. Integrated Action Item 43 to this item, since it is related to the high speed links. This Item is closed by a replacement of Action Item 6?
33	*In addition to design/hardware changes, Committee wants changes to methods* *-Abdel-Khalik*	closed	11/5 Updated in Feb.	*W*	*NRC*	*ASTRUM was discussd in Feb. New action item 49 has more questions about TH methods.; seismic analyses (future meeting). Pg 76 of Nov 5 Transcripts. Future changes to be highlighted* *Sept. 20-21 SC meeting discussed it. This is a general question and can be closed*

34	*HFE DAC closure* a) For I&C and HEF, Rev 15 DAC that have been deleted in Rev 17, Show the subcommittee details of how those DAC were satisfied, Two or three examples might be sufficient. (Dennis C. Bley) b) I&C DAC – Westinghouse indentified in the Nov 09 meeting that DAC close out was divided into 3 phases: Phase 1 DAC 1, Phase 2 DAC 2, Phase 3 DAC 3 What each DAC was intended to include and how each item was closed in each phase should be provided. (Charles Brown)	closed	11/5 Updated in Feb.	*W*	*NRC*	*Final SER should document DAC closure including acceptance criteria* *Sept. 20-21 discussed the DAC closure, Ch 18 resolved all DAC problem and this item is closed.*

35	*Boric acid deposition report (Bajorek) for Armijo* "The thrust of these concerns relates to the lack of prototypicality of the coolant used in the downstream flow blockage tests performed by W. Banerjee requested information on the concentration of dissolved aluminum and I was interested in the complete composition of the coolant (not just boric acid). Based on the material presented in the GSI 191 presentation, the coolant carrying the debris in these tests did not match or even approximate the composition, pH or temperature of the coolant that will exist after a LOCA. The physical state of the AlOOH will be highly dependent on chemistry and temperature, and this is the material that cements the fibrous debris. Without tests in prototypical environments, I do not see how anyone can conclude that the debris will not block the entries to the fuel assemblies. Maybe the staff can resolve my concern." - Armijo	closed	GSI-191 Updated in Feb.		*NRC*	*Provide copy of report* *In the Oct. 5, 2010 meeting and a few new Items (68, 69, 70, and 71) were raised to replace this item.*
36	*Amount of aluminum. See 35 -Banerjee and Armijo*	closed	GSI-191		*W*	*Discuss with staff SER. Pg 1-293 of Nov 19 meeting Transcripts* *Closed in the Oct. 5 meeting*
38	*Concrete scouring -Harold*	closed	GSI-191		*W and NRC*	*Discuss at future meeting (RAI)* *Closed in the Oct. 5 meeting*
39	*Hot leg break – debris at top of core -Wallis*	closed	GSI-191		*W and NRC*	*Discuss at future meeting (RAI)* *Closed in the Oct. 5 meeting*

40	Underground piping (fluids) and conduit (electrical) and how they perform with regard to groundwater intrusion and surface water infiltration. The concern includes the pipe, connections and material performance at the connections (joint adhesives "welding" materials, etc.). A related question are any of the tritium task force results and recent experiences reported for Vermont Yankee and Indian Point raising issues for such piping. (Mike Ryan)	closed	9		*W and NRC*	*Discuss at future meeting. March/April pg 2-187 of Nov 20 meeting Transcripts. Closed at 4/22 meeting*
41	*RTCB test frequency* *Need to know more in operating experience.* *Charlie/Harold*	closed	7, 16		*W and NRC*	*Discuss basis for yearly (OI)* *Additional Information was provided by NRO and sent to Members in Sept. 2010 Status CD.* *Sept. 20-21 SC meeting discussed this issue and it remained open.* *Nov. 2-3 discussed and close it.*
42	*Cyber Security*	closed	7		*NRC*	*NWE2 provided copy of TR. Closed in Feb*
43	*HSL (high speed links) "topical report"* *-Brown*	open	7		*W*	*Westinghouse to provide reference. Related to SER OI? Under review. A report was sent on April 5, 2010.* *This item is replaced by action Item 32.*
44	*RTNSS tutorial* *-Ray*	closed			*DNRL*	*At Feb meeting*
45	*Multiple spurious actuation report* *-Ray,Maynard*	closed	9		*~~DNRL~~ W*	*Westinghouse to provide copy of report. Proprietary concerns? Feb discussion --> closed.*
47	Table 15.0-5 Uncertainties table need further discussion. Were instrument drift/ other uncertainties counted in the 1-2% power changes? (Said)	closed	15		*W/DNRL*	*Present at future meeting* *A brief was made to Said in the past and Said informed to close this item in Sept. 20-21 SC meeting.*

51	Get a NRC consultant report on ASTRUM applicability evaluation (NRO provided the report after the meeting).	closed			*DNRL*	*DNRL provided report following Feb meeting. Closed*
54	~~AP1000 Containment coating issues – corrosion allowance, coating monitoring, Inspection program (ASME – ASTM requirements), RG 1.54, containment leak rate testing in relation with corrosion caused leakage. The ACRS subcommittee chairman would like to have this item on the July meeting.~~ ~~Ray~~	Closed	Chapter 6	*COL Applicant*	*COL Applicant*	*SNC discussed the programs in the July meeting. However, members asked more questions on the configurations of the containment system and shield building. Westinghouse committed to provide more information when they discuss the SB in future. New action Item was created as #60.*
58	~~Requested a report that describes the method applicant is using for the spent fuel racks criticality analysis? - Bley June Transcripts Page 13.~~	Closed	Chapter 4		*WEC*	*It will be discussed in Chapter 9* *Additional Information was provided by NRO and sent to Members in the Sept. 2010 Status CD.*
	ITEMS FROM July 2010 SC MEETINGS					
59	~~Provide Bley with copy of WCAP on setpoint control methodology~~.	Closed	Chapter 16		*WEC*	*The document* WCAP-16361 (ML061530485) *was sent to the members on 8/6/2010*
61	~~Desire by some members to review ISG-1, pertaining to coherency function and ISG-18 Reliability Assurance Program.~~	Closed	Chapter 2		*Staff*	*ISG-1 Sent to the Members on 8/6/2010.* *ISG-18 was sent to the members with the AP1000 September meeting Status CD*

66	DI&C: Harold and Charlie are requesting the staff for a follow up subcommittee meeting to present the safety concerns and considerations associated with what the staff learned from United Kingdom (UK) on: 1) Diverse Actuation System (DAS) Configuration 2) Protection and Safety Monitoring System (PMS) Common Cause Failure (CCF) Spurious 3) Component Interface Module (CIM)/DAS Diversity	Open	Chapter 7		*WEC/Staff*	