



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

April 5, 2010

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,
 JULY 23-24, 2009, ROCKVILLE, MARYLAND

The minutes of the subject meeting were certified on January 12, 2010, as the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Enclosure: As Stated

Cc w/o Attachment: E. Hackett
 A. Dias



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

April 5, 2010

MEMORANDUM TO: Said Abdel-Khalik, Chairman
Advisory Committee on Reactor Safeguards

FROM: Harold B. Ray, Chairman
ACRS AP1000 Subcommittee

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS
SUBCOMMITTEE ON THE AP1000 REACTOR,
JULY 23-24, 2009, ROCKVILLE, MARYLAND

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting held on July 23-24, 2009, are an accurate record of the proceedings.

<u>/RA/</u>	<u>3/4/2010</u>
Harold B. Ray, Chairman	<i>Date</i>
ACRS AP1000 Subcommittee	

Certified by: Harold B. Ray
Certified on: March 4, 2010

Issued: April 5, 2010

**REVISION 17 TO AP1000 DESIGN CONTROL DOCUMENT: SELECTED CHAPTERS
and
BELLEFONTE NUCLEAR POWER PLANT UNITS 3 & 4
COMBINED OPERATING LICENSE APPLICATION**

July 23-24, 2009
ROCKVILLE, MARYLAND

INTRODUCTION

The Advisory Committee on Reactor Safeguards (ACRS) Subcommittee on the Westinghouse Electrical Company's AP1000 advanced pressurized water reactor (PWR) design met in Room T-2B3 at the Headquarters of the U.S. Nuclear Regulatory Commission (NRC), located at 11545 Rockville Pike, Rockville, Maryland, on July 23–24, 2009. The Subcommittee was briefed by representatives of the Westinghouse Electrical Company (WEC), the NuStart Energy multi-utility consortium, and NRC's Office of New Reactor Licensing (NRO) on two items. The first item was selected chapters of revision 17 (hereafter REV17) of the proposed amended design control document (or DCD) describing the standard plant design for the AP1000 PWR. The second (related) item concerned selected chapters of the combined operating license application (COLA) Safety Analysis Report (SAR), corresponding to the like chapters in the proposed amended DCD, submitted by the Tennessee Valley Authority (TVA) for two AP1000 reactors at TVA's existing yet inactive Bellefonte reactor site. The NuStart consortium¹ has designated the Bellefonte site, in Jackson County, Alabama, as the "reference" COLA or RCOLA for any future AP1000 reactors that might be licensed at other consortium sites. As part of the respective review processes, NRC's regulations under 10 CFR Part 52 direct the staff to consult with the ACRS on safety-related issues before any reactor design can be certified or any NRC operating license can be approved.

The staff's SER review 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 first of four scheduled Subcommittee meetings on the proposed amended DCD and the Bellefonte/TVA RCOLA SAR.

The Chairman for this ACRS Subcommittee was Mr. Harold Ray. Mr. Michael P. Lee was the cognizant ACRS staff engineer for this topic and served as the Designated Federal Official for this meeting. The entire meeting was open to public attendance. The Subcommittee received no written comments, or requests for time to make oral statements from any members of the public concerning the subject of this meeting. This two-day meeting convened at approximately 8:30 am each morning.

¹ The NuStart Energy LLC consortium consists of Constellation Generation Group, Duke Energy, EDF International North America, Entergy Nuclear, Exelon Generation, Florida Power & Light Co., Progress Energy, Southern Nuclear Operating Company (SNC), General Electric Energy, TVA, and WEC.

The detailed agenda identifying the specific presentation topics comprising this meeting can be found in Attachment 1. 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 answers thereto, and the speaker's responses thereto, have been captured in the verbatim meeting transcript. Nevertheless, as a result of Member questions and comments, and speaker responses (answers) thereto – so-called 'Qs and As', a number of follow-up actions were identified for further discussion at subsequent Subcommittee meetings. These follow-up actions will be tracked by the ACRS staff.

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/>.

ATTENDEES

The following list of Individuals (and their affiliations) attending this meeting was compiled using both the sign-in sheets (attached) and the Subcommittee meeting transcript.

ACRS		
H. Ray, Subcommittee Chairman	S. Banerjee, Member	T. Kress, Invited ACRS Consultant
S. Abdel-Khlik, Member	C. Brown, Member	M. Lee, ACRS Staff

NRC Staff		
F. Akstulewicz, NRO	G. Hsui, NRO	E. Roach, NRO
C. Ader, NRO	A. Hodgdon, NRC-Office of the General Counsel	N. Saltos, NRO
S. Arora, NRO	D. Jaffee, NRO	S. Sanders, NRO
P. Buckberg, NRO	T. Jackson, NRO	S. Schaffer, NRO
J. Budzynski, NRO	R. Jenkins, NRO	J. Schmidt, NRO
S. Coffin, NRO	R. Joshi, NRO	D. Scully, NRO
M. Commar, NRO	R. LaVera, NRO	J. Sebrosky, NRO
D. Dodson, NRO	H. Le, NRO	M. Shams, NRO
J. Donoghue, NRO	G. Makar, NRO	A. Stubbs, NRO
L. Dudes, NRO	M. McKenna, NRO	J. Tatum, NRO
T. Ford, NRO	S. Mitra, NRO	B. Tjader, NRO
F. Forsaty, NRO	K. Mott, NRO	S. Tray, NRO
T. Frye, NRO	E. Osterle, NRO	D. Terao, NRO

NRC Staff (continued)

E. Fuller, NRO	M. Patterson, NRO	B. Thomas, NRO
G. Galletti, NRO	J. Peralta, NRO	M. Valentin, NRO
G. Georgiev, NRO	S. Pope, NRC Region III	J. Wilson, NRO
S. Goetz, NRO	N. Ray, NRO	J. Woodfield, NRC Region III
C. Harbuck, NRO	I. Rajaw, NRO	
J. Heisserer, NRC Region II	D. Reddy, NRO	

Others

A. Aughtman, SNC	R. Grumbir, NuStart	S. Ray, WEC
J. Bailey, TVA	N. Haggerty, NuStart	T. Ray, WEC
J-P Berger, Électricité de France (EDF International North America)	P. Hastings, NuStart (Duke Energy)	F. Redwanz, NuStart
C. Brockhoff, WEC	B. Hermanpour, NuStart	K. Schwab, WEC*
M. Cazaubon, Exelon	F. Kenny, TVA*	N. Shah, TVA*
J. Chung, MNES	A. Levin, Areva	B. Sisk, WEC
E. Cummins, WEC	T. Meneeley, WEC*	W. Smith, SNC
R. Davis, NuStart	J. Monroe, WEC*	T. Spink, TVA
J. Deblasio, WEC	M. Morris, WEC*	A. Sturdis, TVA
R. Ely, WEC*	B. Pantis, WEC	D. Waters, Progress Energy
P. Garnier-Davis, TVA*	A. Paglia, SCE&G	M. Williams, WEC
E. Grant, NuStart	B. Prunty, SNC (Bechtel)	D. Wiseman, WEC

* *Participated via telephone*

SCHEDULED PRESENTATIONS

The published meeting agenda called for the discussion of approximately 10 topics corresponding to specific chapters in the proposed amended DCD. About 10 of the 19 REV17 DCD chapters and their counterparts in the Bellefonte/TVA RCOLA SAR were understood to have uncontested open items. That is to say the NRC staff, WEC, and members of the NuStart consortium were in agreement as to the types and kinds of information needed to address the staff-identified concern as it related to REV17 of the amended DCD as well as the Bellefonte/TVA RCOLA SAR. It was those chapters, listed below, that were discussed at this Subcommittee meeting:

DCD Chapter 1	<i>Introduction and General Description of Plant</i>
DCD Chapter 4	<i>Reactor</i>
DCD Chapter 5	<i>Reactor Coolant System and Connected Systems</i>
DCD Chapter 10	<i>Steam and Power Conversion System</i>
DCD Chapter 11	<i>Radioactive Waste Management</i>
DCD Chapter 12	<i>Radiation Protection</i>
DCD Chapter 14	<i>Initial Test Program and ITAAC-Design Certification</i>
DCD Chapter 16	<i>Technical Specifications</i>
DCD Chapter 17	<i>Quality Assurance</i>
DCD Chapter 19	<i>Severe Accidents</i>

In general, for each SRP chapter discussed, a standard briefing template was followed that consisted of essentially four elements:

- (1) a Westinghouse-led discussion on the proposed revision 17 changes (i.e., amendments) to the currently-certified DCD.
- (2) a NuStart/TVA-led discussion of the RCOLA SAR corresponding to the proposed amended DCD chapter.
- (3) an NRC-led discussion concerning the results of the staff's review of the proposed amended DCD, including the discussion of applicable open items bearing on AP1000 DCD standard content.
- (4) an NRC-led discussion of the proposed Safety Evaluation Report (SER) developed by the staff following their review of the Bellefonte/TVA RCOL SAR, including a discussion of applicable open items.

The respective presentations corresponding to the 10 DCD/RCOLA chapters can be found in Attachment 2.

Introductory Statements

Mr. Ray stated that the purpose of this Subcommittee meeting was two-fold. First, it was to learn more about the nature and scope of the Westinghouse-proposed changes to revision 15 (the current NRC-certified design) of the AP1000 DCD. Second, it was to hear from the NRC staff on the results of both their DCD amendments review as well as their RCOL reviews for the Bellefonte site. Mr. Ray also observed that certain other members of this ACRS Subcommittee (e.g., Members Bonaca, Bley, and Ryan) were not in attendance owing to previous commitments. As a consequence, he noted that those absent members might raise questions on the material presented at a later date. The Subcommittee also had the benefit of an invited consultant in the person of Dr. Tom Kress, a former ACRS member who had participated in the Committee's earlier review of the currently NRC-certified AP1000 design.

Mr. Frank Akstulewicz, Deputy Director for NRO's Division of New Reactor Licensing, made some brief opening remarks. He noted that at the request of NuStart, the SNC's Vogtle (Georgia) site would be designated as the new RCOLA as it already had an NRC-issued early site permit. Mr. Akstulewicz noted that there would be a transition (administratively) to the Vogtle site in the near future for the purpose of addressing COLA content-related comments raised by the NRC staff. Mr. Jack Bailey, TVA's Vice President of Nuclear Generation Development, and Mr. Ed Cummins, WEC's Vice president for Regulatory Affairs and Standardization, also offered some remarks at the onset of the meeting.

Opening Statements

There were three presentations associated with this agenda item. The first talk was a joint NRO presentation by Ms. Eileen McKenna and Stephanie Coffin. Ms. McKenna is the NRO Branch Chief responsible for the AP1000 DCD amendment review. Ms. Coffin is the NRO Branch Chief responsible for the Bellefonte RCOLA review. Key points raised during this presentation were that the review of the proposed DCD amendments was to take place in six phases. Ms. McKenna noted that NRO staff were in the process of completing its Phase 2 review with the issuance of draft SER chapters, with open items. Phase 3 called for an initial meeting with the ACRS (the subject of this July 2009 and subsequent Subcommittee meetings) on the results of that review. Phases 4, 5, and 6 focus on an advanced Final SER, with no open items, which includes a second meeting with the Committee, and then the issuance of the final SER. Ms. Coffin noted in response to a question that a desired outcome from this and future Subcommittee meetings would be a series of interim ACRS letters, from this and subsequent Phase 2 meetings, identifying where the Committee agrees with the conclusions reached by the staff in their reviews as well as those areas where additional inquiry/clarification might be warranted. Ms. Coffin also noted that following the approval of the RCOLA, published as a NUREG SER, subsequent staff meetings with the ACRS on additional COLAs would essentially be limited to discussing unique and/or non-standard license application content applicable only to the reactor site under discussion (as the standard RCOLA content would have already been addressed and approved by the staff as part of their earlier RCOLA review. The procedure had been discussed previously with the ACRS, in May 2009, at a full Committee meeting.)

The second presentation was by Ms. Andrea Sterdis, TVA's Manager of Licensing for Nuclear Generation Development and Construction. Her presentation consisted of an overview of the Bellefonte site as well as the current schedule for the RCOLA review.

The third presentation was Mr. Robert Sisk, the WEC AP1000 Licensing Manager. Mr. Sisk's presentation focused on the key changes to the AP1000 amended DCD for the 10 SRP Chapters under discussion. He noted that the proposed amended REV 17 DCD builds upon the existing NRC-certified AP1000 design. Mr. Sisk also noted that for the 10 chapters under discussion, there were no new DAC (design acceptance criteria). Thirty-eight open items had been identified by the NRC staff as part of its review of the amended design. Thirty-one confirmatory items had been identified by the staff as well.

SUBCOMMITTEE FOLLOW-UP ACTIONS

As a result of questioning by the Members of the Subcommittee, a number of follow-up actions were identified for tracking at future Subcommittee meetings, the next of which was scheduled for October 6-7, 2009.

Attachments (2):

1. Detailed Meeting Agenda
2. Presentation Materials and Sign-In Sheets

**Advisory Committee on Reactor Safeguards
Meeting of the Subcommittee on the
Westinghouse AP1000 DCD and Bellefonte AP1000 RCOL Application
Rockville, MD
July 23-24, 2009**

- Agenda -

July 23, 2009

Item	Topic	Presenter(s)	Time
1	Opening Remarks and Objectives	Harold B. Ray, ACRS	8:30 – 8:35 a.m.
2	Introductions and Opening Comments	E. McKenna and S. Coffin, NRO AP1000 Design Center Working Group (DCWG)	8:35 – 8:45 a.m.
3	a. DCD/FSAR Chapter 1 b. SER/OI Chapter 1	a. AP1000 DCWG b. S. Sanders and J. Sebrosky, NRO	8:45 – 9:45 a.m.
4	a. DCD/FSAR Chapter 5	a. AP1000 DCWG	9:45 – 10:30 a.m.
	Break		10:30 – 10:45 a.m.
5	b. SER/OI Chapter 5	b. P. Buckberg, R. Joshi, D. Terao, and A. Hsia NRO	10:45 – 12:00 p.m.
	Lunch		12:00 – 1:00 p.m.
6	a. DCD/FSAR Chapter 10 b. SER/OI Chapter 10	a. AP1000 DCWG b. S. Goetz, P. Buckberg, D. Terao, J. Segala, and S. Bloom, NRO	1:00 – 2:30p.m.
	Break		2:30 – 2:45 p.m.
7	a. DCD/FSAR Chapter 11 b. SER/OI Chapter 11	a. AP1000 DCWG b. S. Sanders, R. Joshi, and S. Schaffer, NRO	2:45 – 3:45 p.m.
8	a. DCD/FSAR Chapter 12 b. SER/OI Chapter 12	a. AP1000 DCWG b. S. Sanders, R. Joshi, and E. Roach, NRO	3:45 – 5:00 p.m.
9	Committee Discussion	Harold B. Ray, ACRS	5:00 p.m.
	Adjourn		5:15 p.m.

July 24, 2009

Item	Topic	Presenter(s)	Time
1	Opening Remarks and Objectives	Harold B. Ray, ACRS	8:30 – 8:35 a.m.
2	a. DCD/FSAR Chapter 14 b. SER/OI Chapter 14	a. AP1000 DCWG b. D. Jaffe, M. Comar, G. Galletti, and J. Peralta, NRO	8:35 – 9:35 a.m.
3	a. DCD/FSAR Chapter 17 (except 17.4 and 17.6) b. SER/OI Chapter 17 (except 17.4 and 17.6)	a. AP1000 DCWG b. P. Clark, M. Comar, G. Galletti, and J. Peralta, NRO	9:35 – 10:30 a.m.
	Break		10:30 – 10:45 a.m.
4	a. DCD/FSAR Chapter 17.4 and 17.6 b. SER/OI Chapter 17.4 and 17.6	a. AP1000 DCWG b. D. Jaffe, M. Comar, and M. Patterson, NRO	10:45 – 11:45 a.m.
	Lunch		11:45 – 12:45 p.m.
5	a. DCD/FSAR Chapter 19 b. SER/OI Chapter 19	a. AP1000 DCWG b. D. Jaffe, M. Comar, and M. Patterson, NRO	12:45 – 2:45 p.m.
	Break		2:45 – 3:00 p.m.
6	a. DCD/FSAR Chapter 16 b. SER/OI Chapter 16	a. AP1000 DCWG b. M. Comar and B. Tjader, NRO	3:00 – 4:00 p.m.
7	a. DCD/FSAR Chapter 4 b. SER/OI Chapter 4	a. AP1000 DCWG b. R. Joshi, P. Clack, and J. Donoghue, NRO	4:00 – 4:30 p.m.
8	Committee Discussion	Harold B. Ray, ACRS	4:30 p.m.
	Adjourn		4:45 p.m.



Presentation to the ACRS Subcommittee

Westinghouse Design Certification Amendment and Bellefonte COL Application Review

Safety Evaluation Report with Open Items

Chapters 1, 4, 5, 10, 11, 12, 14, 16, 17, 19

Eileen McKenna and Stephanie Coffin

July 23 – 24, 2009

ACRS Subcommittee Presentation

Westinghouse Design Certification Amendment and Bellefonte COL Application SER/OI

- **Westinghouse Design Certification**
 - Current AP1000 Design Certification - Appendix D to 10 CFR Part 52 (Revision 15 to the AP1000 Design Control Document (DCD)) – effective 2006
 - Safety Evaluation Report – NUREG-1793, “Final Safety Evaluation Report Related to Certification of the AP1000 Design”
- **Westinghouse Design Certification Amendment**
 - Application of May 26, 2007 based upon Revision 16 to the AP1000 DCD
 - Reference to 10 CFR Part 52, Section 52.63
 - Finality of Standard Design Certifications
 - Submittal of Revision 17 of the AP1000 DCD September 22, 2008

ACRS Subcommittee Presentation Westinghouse Design Certification Amendment and Bellefonte COL Application SER/OI

- Review of the Westinghouse Design Certification Amendment
 - Six phase review schedule
 - Review is focused on changes proposed by Westinghouse, using SRP-based review
 - Issuance of Individual Chapters in Phase 2 (SER with Open Items [SER/OIs]) to become a supplement to NUREG-1793

ACRS Subcommittee Presentation Westinghouse Design Certification Amendment and Bellefonte COL Application SER/OI

- Bellefonte Combined License application SER with open items
 - Six phase review schedule
 - In general based on revision 1 of the application dated January 21, 2009
 - Incorporates by Reference Westinghouse DCD revision 17

ACRS Subcommittee Presentation Westinghouse Design Certification Amendment and Bellefonte COL Application SER/OI

- **Structure of SE/OI for Bellefonte**
 - Incorporate by reference sections
 - Staff makes finding that IBR is appropriate
 - Refers to the NUREG
 - Standard COL content
 - Staff evaluation will apply to all SCOL applications, as appropriate
 - Site-specific COL content
 - Staff evaluation will apply only to TVA/Bellefonte

ACRS Subcommittee Presentation Westinghouse Design Certification Amendment and Bellefonte COL Application SER/OI

- **RCOL Applicant Transition**
 - Entire SE/OI issued based on the TVA/Bellefonte application
 - Southern/Vogtle responds to all OIs related to standard content
 - Southern/Vogtle responds to all site-specific issues
 - NRC staff evaluates responses and develops Advanced Final SER with no OIs based on Southern Nuclear application. This is expected to be first AP1000 COL application to come to ACRS for final determination.

ACRS Subcommittee Presentation Westinghouse Design Certification Amendment and Bellefonte COL Application SER/OI

- **Presentation sequence**
 - Westinghouse present design certification amendment content
 - TVA presents FSAR content
 - Staff presents Westinghouse design certification amendment safety evaluation and Bellefonte COL safety evaluation
- **Future Subcommittee Meetings**
 - October 6 -7, November 19-20 – additional chapters
 - Possibility of additional subcommittee meeting in early 2010
- **Interim Letter Reports**

Bellefonte COL Technical Topics of Interest

- Financial qualifications review
 - Evaluates financial resources to build operate and eventually decommission a nuclear facility
- Effects of reinstatement of the Bellefonte 1 and 2 Construction Permits on Bellefonte 3 and 4 application
- COL holder items
- Operational program implementation



AP1000 Reference Combined License Application Presentation to ACRS Selected Chapters



COL-1





Bellefonte site – Artist's rendering



COL-2





COLA Team Meeting Participants

Scheduled Presenters:

Jack Bailey – TVA

Andrea Sterdis - TVA

Tom Spink – TVA

Eddie Grant – NuStart

Amy Aughtman – SNC

Peter Hastings – AP1000 DCWG



COL-3





Combined License (COL) Schedule

- 2007 October – Original submittal
- 2008 January – NRC acceptance
- 2009 January – FSAR Revision 1
- 2009 June – SER with Open Items
- 2009 July – ACRS for some chapters



COL-4





Combined License (COL) Application

- Cover Letter, Affidavits, etc. (“Part 0”)
- Part 1 – General & Financial Information
- **Part 2 – Final Safety Analysis Report**
- Part 3 – Environmental Report
- Part 4 – Plant Specific Technical Specifications
- Part 5 – Emergency Planning Information
- Part 6 – Limited Work Authorization Information
- Part 7 – Departures & Exemption Requests
- Part 8 – Safeguards Information
- Part 9 – Withheld Information
- Part 10 – Proposed License Conditions, including ITAAC
- Part 11 – Enclosures (e.g., QAPD)

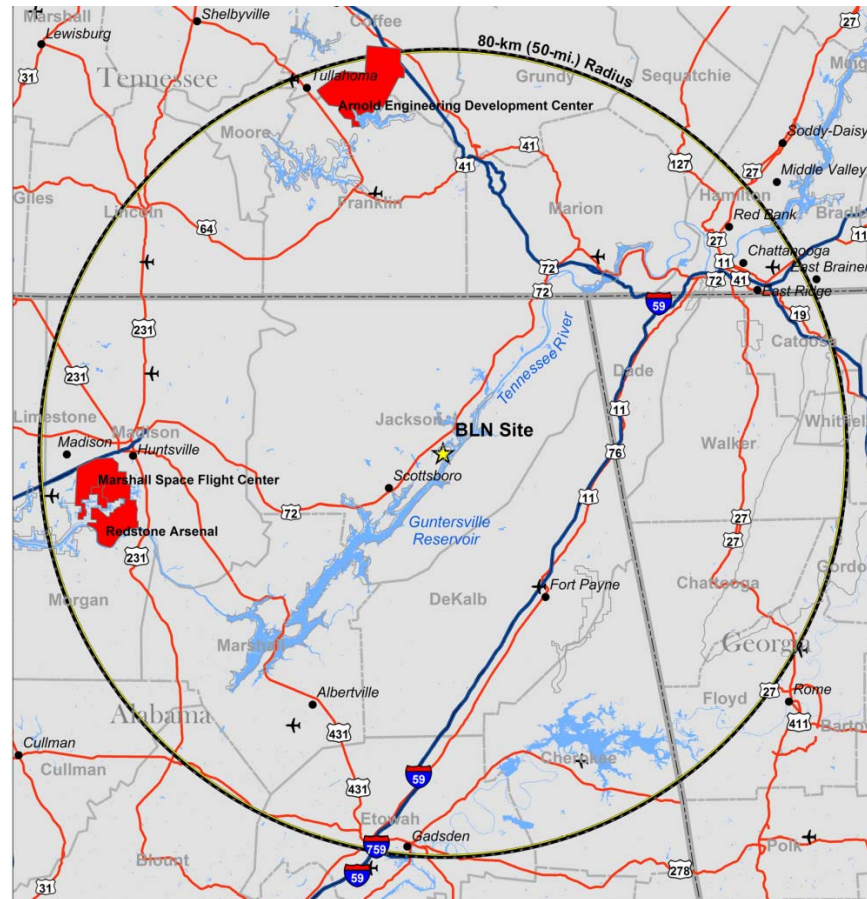


COL-5





Bellefonte site – 50 mile radius

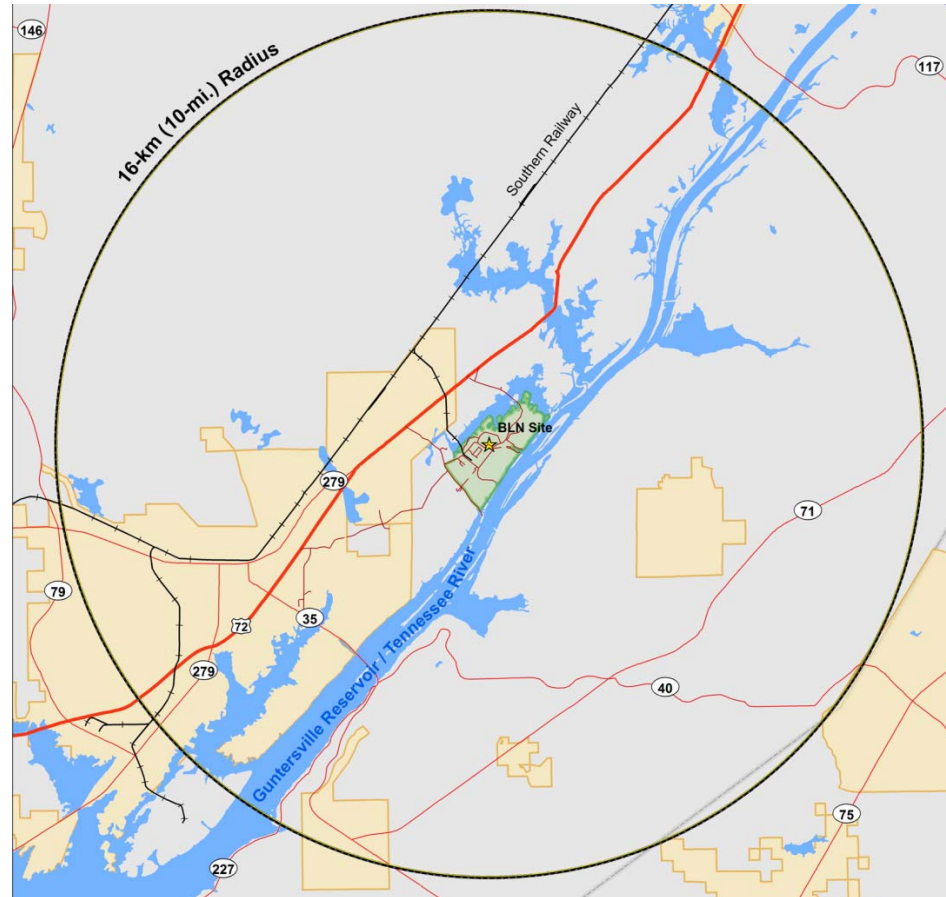


COL-6





Bellefonte site – 10 mile radius

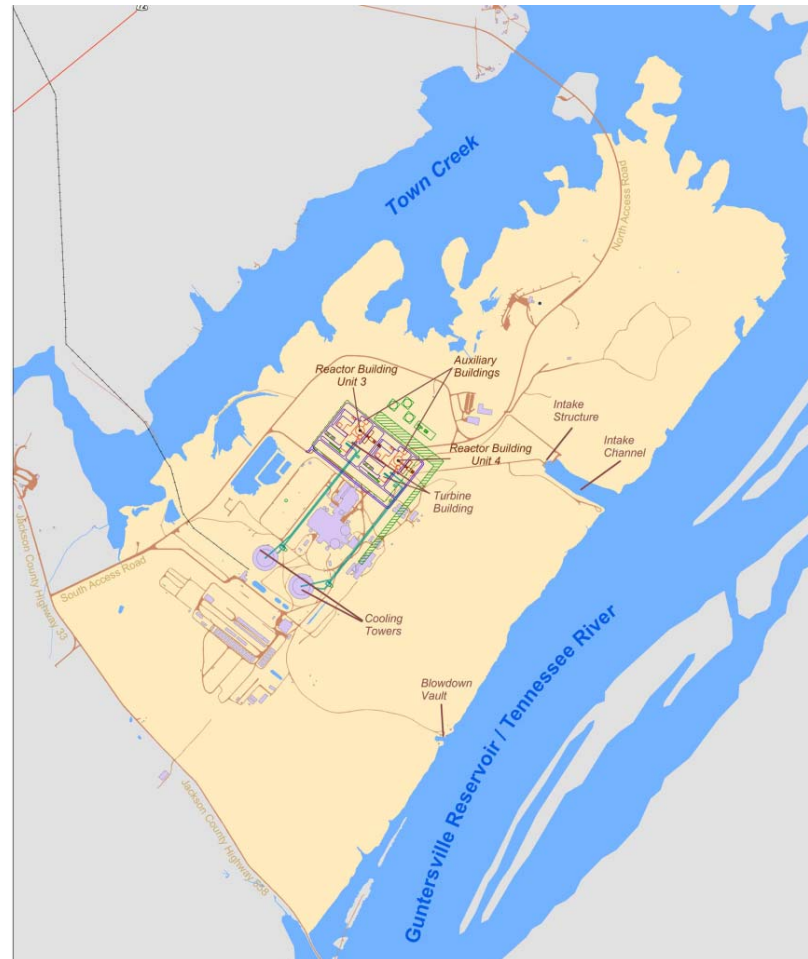


COL-7





Bellefonte site – local site area



COL-8



AP1000 Design Control Document Amended Design

July 23-24, 2009

**Rob Sisk, Manager
AP1000 Licensing and Customer Interface
Westinghouse - Nuclear Power Plants**

DCD Amendment Overview

- Introduction of the WEC AP1000 Team
- The amended design builds on the NRC AP1000 Certified Design (Rev 15)
- Changes were made consistent with regulatory requirements
 - Address COL Information items
 - Address Design Acceptance Criteria
 - Address NRC requirements (i.e., Security)
 - Enhance Standardization
 - Design Maturity (i.e., procurement details; Integrated Head Package)
 - Address editorial changes and changes for consistency

DCD Amendment Overview

- Future changes would be addressed in accordance with the Interim Staff Guidance (DC/COL-ISG-11)
- WEC has received 13 SERs on the amended design. 10 SERs will be discussed today:
 - July 23-24 – Chapters 1, 4, 5, 10, 11, 12, 14, 16, 17 & 19 [Green Rev 17, Yellow Partial Rev 17]
 - October 6& 7 – TBD
 - November 19 & 20 – TBD
- No New Exemptions
- No New DAC [continue effort resolve Piping, HFE and I&C DAC]
- 38 Open Items identified in 10 SERs
- 31 Confirmatory Items – Mostly involved with confirming proper incorporation into the final DCD

AP1000 Design Control Document Amended Design

Chapter 1- “Introduction and General Discussion”

Tier 2 Chapter 1 - “Introduction and General Discussion”



- **Chapter Overview**

- Provides a general overview of the Westinghouse AP1000 simplified passive advanced light water reactor plant; a discussion of the objectives, design criteria operating characteristics of the AP1000; plant site interface requirements; the referenced design documents, and the regulatory basis for the certified design
- Changes to the certified design are discussed in depth in their appropriate chapters
 - Extension of Seismic spectra to soil conditions (Chapters 2 & 3, 19)
 - Revision to buildings for enhanced protection (Chapters 3, 19F)
 - Protection System Instrumentation (Chapter 7)
 - Revision to electrical systems (Chapter 8)
 - *Turbine Manufacturer (Chapter 10)*

Tier 2 Chapter 1 - “Introduction and General Discussion”



- **Changes continued:**
 - Sump Screen Design and Analysis (Chapter 6)
 - Control Room Ventilation (Chapters 6 & 15)
 - Spent Fuel Pool Capacity (Chapters 9 & 12)
 - Update Load Handling Capability (Chapter 9)
 - *Additional Waste-Water Monitoring Tanks (Chapter 11)*
 - Integrated Head Package (Chapters 3, 9 & 12)
 - Revised LOCA Methodology (Chapter 15)
 - *Reactor Internal Changes (Chapters 3, 4, and 5)*
 - *Pressurizer Shape Change (Chapter 5)*

Tier 2 Chapter 1 – “Introduction and General Discussion”



- **OI-1.0-NWE2-01**
 - Reconciliation of the tables, list of figures and COL Action Items will be finalized upon completion of the other chapters
- **OI-1.0-NWE2-02**
 - Confirmation of the final Reg Guides list and other information as part of the reconciliation of Chapter 1 with the other chapters



- Chapter 1

Introduction and General Description of the Plant



COL-9





R-COLA Chapter 1 – Content

Introduction and General Description of the Plant

- 1.1 INTRODUCTION**
- 1.2 GENERAL PLANT DESCRIPTION**
- 1.3 COMPARISONS WITH SIMILAR FACILITY DESIGNS**
- 1.4 IDENTIFICATION OF AGENTS AND CONTRACTORS**
- 1.5 REQUIREMENTS FOR FURTHER TECHNICAL INFORMATION**
- 1.6 MATERIAL REFERENCED**
- 1.7 DRAWINGS AND OTHER DETAILED INFORMATION**
- 1.8 INTERFACES FOR STANDARD DESIGN**
- 1.9 COMPLIANCE WITH REGULATORY CRITERIA**
- 1.10 NUCLEAR POWER PLANTS TO BE OPERATED ON MULTI-UNIT SITES**





R-COLA Chapter 1 – 1 COL Item

BLN 1.1-1 Construction and Startup Schedule
– schedule information provided

STD 1.9-1 Regulatory Guide Conformance
– conformance addressed

STD 1.9-2 Bulletins and Generic Letters
– conformance addressed

STD 1.9-3 Unresolved Safety Issues and Generic Safety Issues
– conformance addressed



COL-11





R-COLA Chapter 1 – Other

STD SUP 1.1 Describes formatting of the FSAR and LMAs

e.g., COL SUP DEP CDI

BLN SUP 1.4 ID of agents and contractors

STD SUP 1.6 Incorporated by Reference documents

DCD & NEI 06-13, 07-02, 07-03, 07-08

BLN SUP 1.7 Plant specific systems

BLN SUP 1.8 Interfaces, COL items & Departures

STD SUP 1.9 Regulatory Criteria and Guidance conformance



COL-12





R-COLA Departures (see Part 7)

STD 1.1-1 Organization and Numbering – STD/BLN

- Regulation requires FSAR to follow DCD organization and numbering – Some additional sections needed – various Ch.

BLN 8.2-1 Transformer arrangement for Unit 3 - BLN

- Moved to avoid crossing lines – Ch. 8

BLN 9.2-1 Service water system blowdown flow path – BLN

- All blowdown to waste water systems, none to CWS – Ch. 9

BLN 18.8-1 Relocated TSC and OSC – BLN

- Single TSC for both units – Ch. 13
- OSC moved to DCD TSC Location – Ch. 13

BLN 2.3-1 Exclusion Area Boundary Atmospheric Dispersion Value (χ/Q)

- Plant Specific Analyses – not bounded by DCD





R-COLA Chapter 1 – Open Items

OI 1-1 **Final DCD Conforming Changes - STD**

- Applicant to update COLA to incorporate final DCD

OI 1-2 **License Condition Criteria - STD**

- Staff to finalize criteria for license conditions

OI 1.4-1 **Interface Content Identification - STD/BLN**

- Identify where DCD interfaces are addressed

OI 1.4-2 **Regulatory Guide Compliance - STD/BLN**

- Address remaining NRC questions





R-COLA Chapter 1 – Open Items

OI 1.4-3 **Construction Impacts on Operating Units – STD**

- NRC Staff to complete review and identify any concerns

OI 1.4-4 **Construction Impacts on Operating Units – STD**

- Provide positive statement of implementation timing

OI 1.5-1 **Part 30/40/70 Licenses – STD**

- Licenses to receive, possess, and use source, byproduct, and special nuclear material – RAI 162 received





Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review**

**SER/OI Chapter 1
Introduction and General Discussion**

July 23 – 24, 2009

Staff Review Team

- Technical Staff
 - **Steve Koenick**, Project Manager, Organizational Effectiveness and Productivity Branch
 - **Eric Oesterle**, Project Manager, Rulemaking, Guidance and Advanced Reactors Projects Branch
 - **Mike Dusaniwskyj**, Economist, Financial Policy and Rulemaking Branch, NRR
 - **Rick Pelton**, Training and Assessment Specialist, Operator Licensing and Human Performance Branch
- Project Managers
 - **Serita Sanders**, AP1000 DCA
 - **Joe Sebrosky**, AP1000 Bellefonte COL
 - **Sujata Goetz**, Project Manager, AP1000 Projects Branch 1

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		DCA	Bellefonte
1.1	Introduction	0	IBR w/SUP
1.2	General Plant Description	0	IBR w/SUP
1.3	Comparisons with Similar Facility Designs	0	IBR
1.4	Identification of Agents and Contractors	0	IBR w/SUP
1.5	Requirements for Further Technical Information	0	IBR
1.6	Material Referenced	0	IBR w/SUP
1.7	Drawings and Other Detailed Information	0	IBR w/SUP
1.8	Interfaces for Standard Designs	0	1
1.9	Compliance with Regulatory Criteria	0	1
1.10	Nuclear Power Plants to be Operated on Multi-Units Sites	0	2
	General updating of information in Chapter 1	2	N/A
	Other Parts of Application	N/A	3
Totals		2	7

Overview of AP1000 DCD Chapter 1 - Introduction and General Discussion

DCD Section		Summary of Changes to DCA
1.1	Introduction	No major changes
1.2	General Plant Description	Conforming changes
1.3	Comparisons with Similar Facility Designs	No major changes
1.4	Identification of Agents and Contractors	No major changes
1.5	Requirements for Further Technical Information	No major changes
1.6	Material Referenced	Conforming changes
1.7	Drawings and Other Detailed Information	No major changes
1.8	Interfaces for Standard Designs	No major changes
1.9	Compliance with Regulatory Criteria Appendix – 1A Conformance with Regulatory Guides	Conforming changes
	Appendix – 1B Severe Accident Mitigation Design Alternatives	No Major changes

AP1000 SER Chapter 1 – Key Functions

- **Historical**
 - Chronology, Key References
- **Summary**
 - Design Features & Changes
- **Generic**
 - Editorial & Conforming Changes, COL Items Tabulation, Regulatory Guides and Criteria
- **Open Items**
 - 2 NRC OIs for Tracking

Bellefonte RCOL Review

Bellefonte RCOL Application Part		Evaluation
1	General and Administrative Information including Financial Information	Section 1.5.1 of SER
2	Final Safety Analysis Report	Evaluated in appropriate SER Chapters
3	Environmental Report	Final Environmental Impact Statement
4	Technical Specifications	Chapter 16 of SER
5	Emergency Plan	Chapter 13 of SER
6	Limited work authorization (not used)	NA
7	Departures Report	Evaluated in appropriate SER chapter
8	Security Plan	Summary provided in Chapter 13 of SER
9	Withheld Information	Evaluated in appropriate SER Chapter
10	Proposed Combined License Condition including ITAAC	Evaluated in appropriate SER Chapter

Bellefonte COL Technical Topics of Interest

- Departures and Exemptions
 - Departures
 - COL application organization and numbering
 - unit 3 transformer area arrangement
 - service water system blowdown flow path
 - emergency response facility locations
 - exclusion area boundary atmospheric dispersion value
 - Exemptions
 - COL application organization and numbering
 - exclusion area boundary atmospheric dispersion value

Overview of Bellefonte COL FSAR Chapter 1

FSAR Section		Summary of Departures/Supplements
1.1	Introduction	IBR* with standard and site-specific supplements
1.2	General Plant Description	IBR with site-specific supplements
1.3	Comparisons with Similar Facility Designs	Completely IBR
1.4	Identification of Agents and Contractors	IBR with site-specific supplements
1.5	Requirements for Further Technical Information	Completely IBR
1.6	Material Referenced	IBR with standard supplement
1.7	Drawings and Other Detailed Information	IBR with site-specific supplement
1.8	Interfaces for Standard Designs	IBR with site-specific supplement
1.9	Compliance with Regulatory Criteria	IBR with standard supplement
1.10	Nuclear Power Plants to be Operated on Multi-Units Sites	Standard and site-specific supplemental material

* IBR - incorporated by reference
July 23 - 24, 2009

Bellefonte COL Technical Topics of Interest

- Open items
 - 1-1, TVA to update application based on outcome of AP1000 design certification amendment
 - 1-2, staff to determine which FSAR commitments require a license condition
 - 1.4-1, TVA to identify how interface items from the AP1000 DCA are addressed in the Bellefonte COL application
 - 1.4-2, Regulatory Guide tables to be updated and confirmed correct
 - 1.4-3, staff to complete review of applicant's assessment of potential hazards due to construction of one unit on operating units on site
 - 1.4-4, TVA to provide a positive commitment for when management programs to be in place to address hazards of construction on operating units
 - 1.5-1, TVA to provide a discussion of which parts of application support issuance of 10 CFR 30 and 40 (byproduct and source material) licenses

Bellefonte COL Technical Topics of Interest

- Financial qualifications review
 - Evaluates financial resources to build operate and eventually decommission a nuclear facility
- Effects of reinstatement of the Bellefonte 1 and 2 Construction Permits on Bellefonte 3 and 4 application
- COL holder items
- Operational program implementation

**AP1000 Design Control
Document
Amended Design
Chapter 5**

Tier 2 Chapter 5

- **Chapter Overview**

- Reactor Coolant System and Connected Systems
- Integrity of Reactor Coolant Pressure Boundary
- Reactor Vessel
- Reactor Coolant System Component and Subsystem Design

Description of Major Changes Post Revision 15



- RCS Loop Instrumentation Relocation
 - Loop 1 narrow range and diverse actuation system RTD relocated upstream of the pressurizer surge nozzle
 - Wide range RTD relocated upstream of the passive residual heat removal nozzle
- Addition of Applicable Code Cases
- Incorporation of Changes for Zinc Injection Capability
- Pressure Boundary Material Changes to Address Material Supply, Fabrication, and Schedule
- Surveillance Capsule Lead Factor and Azimuthal Location Confirmation
- Reactor Coolant Pump Design
 - Revised the heat removal design
 - Flywheel material change
- Pressurizer Configuration Change
- Reactor Vessel Changes
 - Addition of flow skirt
 - Reduction of in-core instrumentation head penetrations
- Normal Residual Heat Removal Low Temperature Relief Valve Size Increase

SER Open Items (OI)

- **OI-SRP-5.2.1 – EMB-01**
 - Addition of Code Cases for ISI (RG 1.147) and O&M (RG 1.192) in DCD
- **OI-SRP5.2.1-EMB-02**
 - Reference to RG 1.84 rather than RG 1.85 in DCD
- **OI-SRP5.4.1-SRSB-01**
 - Design specification for RCP heat exchanger
- **OI-SRP5.4.1-CIB1-01**
 - Addition of flywheel material specifications to be referenced in DCD



- Chapter 5
Reactor Coolant System
and Connected Systems



COL-16





R-COLA Chapter 5 – Content

Reactor Coolant System and Connected Systems

5.1 SUMMARY DESCRIPTION

5.2 INTEGRITY OF REACTOR COOLANT PRESSURE BOUNDARY

5.3 REACTOR VESSEL

5.4 COMPONENT AND SUBSYSTEM DESIGN



COL-17





R-COLA Chapter 5 – COL Items

STD 5.2-1 ASME Code and Addenda – code year identified

STD 5.2-2 Plant Specific Inspection Program
- program described

STD 5.3-1 Reactor Vessel Pressure – Temperature Limit Curves – post COL item – license condition proposed

STD 5.3-2 Reactor Vessel Materials Surveillance Program
- program described



COL-18





R-COLA Chapter 5 – COL Items

**STD 5.3-4 Reactor Vessel Materials Properties Verification
– as-built item – license condition proposed**

STD 5.4-1 Steam Generator Tube Integrity
- program described
- NEI 07-06 “Steam Generator Program Guidelines”
and EPRI Steam Generator Management Guidelines





R-COLA Chapter 5 – Other

5.2 STD SUP Reactor coolant chemistry program

5.3 STD SUP Pressure – temperature control procedures

R-COLA Chapter 5 – Open Items

There are no open items for Chapter 5.



COL-20





Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review**

**SER/OI Chapter 5
Reactor Coolant System and Connected Systems**

July 23 – 24, 2009

Staff Review Team

- Technical Staff
 - **David Terao**, Chief, Component Integrity, Performance and Testing Branch 1, Division of Engineering (CIB1/DE)
 - **Neil Ray**, Acting Chief, CIB2/DE
 - **Yi-Hsiung (Gene) Hsui**, Reactor Systems, Nuclear Performance and Code Review Branch, Division of Safety Systems and Risk Assessment (SRSB/DSRA)
- Project Managers
 - **Perry Buckberg**, AP1000 DCA
 - **Ravindra Joshi**, AP1000 Bellefonte COL

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		DCA	Bellefonte
5.1	Introduction	0	0
5.2	Integrity of Reactor Coolant Pressure Boundary	2	0
5.3	Reactor Vessel	0	0
5.4	Reactor Coolant System Component and Subsystem Design	2	0
Totals		4	0

Overview of AP1000 DCA Chapter 5 - Reactor Coolant System and Connected Systems

DCD Section		Summary of Changes to DCA
5.1	Summary Description	- Minor RCS P&ID changes
5.2	RCPB Integrity	<ul style="list-style-type: none"> - Clarified seismic limitations in 50.55a for piping design - Added additional ASME code cases to standard design - Revised design to incorporate zinc injection into RCS - Added/revised material specifications for RCPB
5.3	Reactor Vessel (RV)	<ul style="list-style-type: none"> - Surveillance capsule lead factors and azimuthal locations - Submitted a pressure-temperature limit report (PTLR) - Revised RV insulation (addressed in SER Section 19)
5.4	Component and Subsystem Design	<ul style="list-style-type: none"> - Revised the reactor coolant pump (RCP)/flywheel design - Revised the RCP heat exchanger design (Rev. 17) - Revised steam generator design and ISI - Revised material for mainsteam line flow restrictor - Revised pressurizer design (height, diameter) - Revised RNS Long-term makeup to containment

Technical Topics of Interest, AP1000 DCA

Applicable Code Cases

- Westinghouse revised DCD Table 5.2-3 to include additional ASME Code cases used in the standard plant design (Section III).
- The staff requested that Westinghouse also include Code cases used in lieu of ASME Code, Section XI inservice inspection and ASME OM Code inservice testing requirements.
- Westinghouse will provide supplemental information in its DCD to address use of ASME Code cases for ISI and IST.
- This open item is identified as OI-SRP5.2.1-EMB-01.

Technical Topics of Interest, AP1000 DCA

Reactor Coolant Pressure Boundary (RCPB) Materials

- DCA Changes:
 - 304, 304L, 316 and 316L in addition to the current Rev.15 materials (304LN and 316LN)
 - Reactor vessel (RV) material (maximum Cu limit of 0.06%)
 - Delta ferrite upper limit of 20 FN for stainless steel welds
 - Allowance of Zinc addition to the reactor coolant
- RCPB materials comply with requirements of ASME Code, Section III
- No Open Items.
- Revision 17 to AP1000 DCD includes option to use carbon steel – staff currently reviewing.

Technical Topics of Interest, AP1000 DCA

Pressure and Temperature Limits

- Westinghouse addressed submittal of P-T limits by providing a Pressure-Temperature Limits Report (PTLR)
 - PTLR
 - Follows guidelines of GL 96-03
 - Contains bounding P-T limits and complete methodology
 - COL Information Item 5.3-1 (STD COL 5.3-1)
 - Plant-specific P-T limit curves will be addressed by the COL Holder during procurement and fabrication of the reactor vessel prior to fuel load
- NRC staff approved Westinghouse's generic AP1000 PTLR in a letter dated 12/30/08 (ML083470258)

Technical Topics of Interest, AP1000 DCA

Reactor Coolant Pump Flywheel Integrity

- DCA Changes:
 - Heavy tungsten inserts with Type 403 Stainless steel inner hub and 18-Ni maraging steel outer hub.
 - Alloy 625 outer shell
 - Revised flywheel analysis for the above material
- Changes are acceptable:
 - Analysis demonstrates flywheel does not generate missile.
 - Materials are compatible with PWR reactor coolant chemistry.
- One Open Item (OI-SRP 5.4.1-CIB1-01):
 - Include flywheel material used in flywheel analysis in DCD.
- In addition, Westinghouse recently proposed a material change to RCP flywheel outer hub (staff is reviewing).

Technical Topics of Interest, AP1000 DCA

RCP External Heat Exchanger Design

- In DCD Rev 15, RCP used thermal barrier internal cooling coils and wrap-around heat exchanger for motor cooling
- DCD Rev. 17 changes motor cooling design to externally mounted, conventional shell and tube HX and stator cooling jacket
- External piping and tube side of external HX is part of pressure boundary components that comply with requirements of ASME Code, Section III
- AP1000 RCP external heat exchanger design specifications describe the external HX mechanical and thermal design bases and requirements
- OI-SRP5.4.1-SRSB-01 - pending submittal of the external HX design specifications

Overview of Bellefonte COL Chapter 5 - Reactor Coolant System and Connected Systems

FSAR Section		Summary of Departures/Supplements
5.1	Summary Description	none
5.2	Integrity of RCPB	STD COL 5.2-1 Use of later Code editions/addenda STD COL 5.2-2 Plant-specific PSI/ISI program STD SUP 5.2-1 Primary water chemistry guidelines STD SUP 5.2-2 ISI of threaded fasteners
5.3	Reactor Vessel (RV)	STD COL 5.3-1 Plant-specific P-T limits curves STD COL 5.3-2 Reactor vessel surveillance program STD COL 5.3-4 Verify as-built RV beltline materials for Pressurized Thermal Shock STD SUP 5.3-1 Plant operating procedures for P-T limits
5.4	Component and Subsystem Design	STD COL 5.4-1 Steam generator tube surveillance program

Technical Topics of Interest, BLN COL

Plant-specific Inspection Program

- AP1000 COL Information Item 5.2-2

COL applicant will provide a plant-specific preservice inspection (PSI) and inservice inspection (ISI) program and address NRC Order EA-03-009 or later NRC requirements

- STD COL 5.2-2

- PSI/ISI “fully described” in BLN COLA and AP1000 DCD as discussed in SECY-05-0197
- COL applicant will revise FSAR to meet 10 CFR 50.55a(g)(6)(ii)(D) on reactor vessel head inspections
- Milestones for PSI and ISI implementation: In accordance with ASME Code, Section XI
- COL holder will submit to NRC a schedule to support operational program readiness after fuel load (COLA Part 10 Proposed License Condition 6)

- No open items

Technical Topics of Interest, BLN COL

Use of Plant-specific P-T Limit Curves

- AP1000 COL Information Item 5.3-1
 - COL holder will address use of plant-specific curves
- STD COL 5.3-1
 - BLN committed to update P-T limits using PTLR methodologies approved in AP1000 DCD using plant-specific material properties (COLA Part 10 – Proposed License Condition 2)
 - Milestones for Implementation: prior to fuel load
- No open items

Technical Topics of Interest, BLN COL

Reactor Vessel Surveillance Program (RVSP)

- AP1000 COL Information Item 5.3-2
 - COL applicant will address RVSP
- STD COL 5.3-2
 - RVSP “fully described” in BLN COLA and AP1000 DCD as discussed in SECY-05-0197
 - Milestones for RVSP implementation: Prior to initial criticality (FSAR Part 10 Proposed License Condition 3.J.1)
 - COL holder will submit to NRC a schedule to support operational program readiness after fuel load (COLA Part 10 Proposed License Condition 6)
- No open items

Technical Topics of Interest, BLN COL

RV Beltline Material Properties Verification

- AP1000 COL Information Item 5.3-4
COL holder will provide plant-specific RV beltline material properties including pressurized-thermal-shock (PTS) evaluation and submit report to NRC prior to fuel load
- STD COL 5.3-4
 - Provide plant-specific beltline material properties prior to fuel load (COLA Part 10 – Proposed License Condition 2)
 - Submit PTS evaluation at least 18 months prior to fuel load for staff review (COLA Part 10 – Proposed License Condition 6)
- No open items

Technical Topics of Interest, BLN COL

SG Tube Surveillance Program

- AP1000 COL Information Item 5.4-1
COL applicant will address a steam generator tube integrity and surveillance program
- STD COL 5.4-1
 - Applicant described SG tube integrity and surveillance program for BLN in FSAR
 - Acceptable because the program is based on the standard technical specifications, NEI 97-06 and EPRI SG guidelines
- No open items

**AP1000 Design Control
Document
Amended Design
Chapter 10**

Tier 2 Chapter 10

- This Chapter discusses Steam and Power Conversion
- Major changes:
 - Revised interval of turbine valve testing
 - Revised turbine layout to accommodate Toshiba design
 - Replaced Toshiba Turbine Control System with Ovation

Tier 2 Chapter 10

- **5 Open Items (OI) and 1 Confirmatory Item (CI)**
 - **OI-SRP10.2-SBPA-01**
 - Overspeed Protection System meets Single-Failure criterion
 - **OI-SRP10.2-SBPA-02a**
 - ITAAC confirms diversity between overspeed trip systems
 - **OI-SRP10.2-SBPA-02b**
 - Backup turbine speed sensors are magnetic
 - **OI-SRP10.2.3-CIB1-01**
 - Low-trajectory turbine missiles are analyzed
 - **OI-SRP10.2.3-CIB1-02**
 - Clarify discrepancy in turbine missile analysis



- Chapter 10
Steam and Power Conversion



COL-21





R-COLA Chapter 10 – Content

Steam and Power Conversion

10.1 SUMMARY DESCRIPTION

10.2 TURBINE-GENERATOR

10.3 MAIN STEAM SUPPLY SYSTEM

10.4 OTHER FEATURES OF STEAM AND POWER CONVERSION SYSTEM



COL-22





R-COLA Chapter 10 – COL Items

STD 10.1-1 Erosion-Corrosion Monitoring

– Program Considers

- Generic Letter 89-08
- EPRI NSAC-202L-R3
- Industry Operating Experience
- CHECWORKS

STD 10.2-1 Turbine Maintenance and Inspection

– post COL item – license condition proposed

BLN 10.4-1 Circulating Water Supply – system described



COL-23





R-COLA Chapter 10 – COL Items

**BLN 10.4-2 Condensate, Feedwater and Auxiliary Steam
System Chemistry Control – system described**

BLN 10.4-3 Potable Water – system described



COL-24





R-COLA Chapter 10 – Other

- 10.2 STD SUP Turbine missile generation for dual units
 STD SUP Testing, operations, and maint. procedures
 STD SUP Inservice inspection program

- 10.3 STD SUP Operations and maintenance procedures
 STD SUP Chemical addition program

- 10.4 BLN CDI Circulating water design to replace CDI
 STD SUP Operations, and maintenance procedures
 STD SUP Chemical addition program





R-COLA Chapter 10 – 1 Open Item

OI 10.1-1 **FAC Program Implementation Schedule - STD**

- **Applicant to identify schedule for flow accelerated corrosion program**



COL-26





Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review**

**SER/OI Chapter 10
Steam and Power Conversion Systems**

July 23 – 24, 2009

Staff Review Team

- Technical Staff
 - **David Terao**, Chief, Component Integrity, Performance and Testing Branch 1, Division of Engineering (CIB1/DE)
 - **Gregory Makar**, CIB1/DE
 - **Devender Reddy**, Balance of Plant Branch 1, Division of Safety Systems and Risk Assessment (SBPA/DSRA)
- Project Managers
 - **Perry Buckberg**, AP1000 DCA
 - **Sujata Goetz**, AP1000 Bellefonte COL

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		DCA	Bellefonte
10.1	Introduction	0	1
10.2	Turbine Generator	5	0
10.3	Main Steam Supply System	0	0
10.4	Other Features	0	0
Totals		5	1

Overview of AP1000 DCA Chapter 10 - Steam and Power Conversion Systems

DCD Section		Summary of Changes to DCA
10.1	Summary Description	- Revised design description of SPC system
10.2	Turbine-Generator	- Revised turbine overspeed protection (Rev. 17) - Changed turbine rotor design from W/MHI to Toshiba
10.3	Main Steam Supply System	- Changes to SPC system relief valve setpoints
10.4	Other Features of SPC System	- Added 7 th stage feedwater heaters to condensate and feedwater system

Technical Topics of Interest, AP1000 DCA

Turbine Overspeed - D-EHC System

- Changes:
 - Replaced mechanical overspeed protection device with a diverse electrical overspeed device
- Staff Evaluation:
 - Tier 1 ITAAC needed to ensure diversity between the two electrical overspeed protection devices
- Open Item:
 - Pending review of RAI response

Technical Topics of Interest, AP1000 DCA

Turbine Rotor Integrity

- DCA Changes:
 - Toshiba turbine replaces the model in the certified design (Westinghouse/Mitsubishi)
 - Valve test interval increased from 3 months to 6 months
 - New missile-generation probability and valve-test-frequency reports submitted to support the turbine-design change
 - Submittal of maintenance/inspection program changed from “3 years after license approval” to “prior to fuel load”
- Staff Evaluation:
 - Based on operating experience, the missile-probability requirements of GDC 4 can be met with the new design and valve-test frequency
 - The maintenance/inspection program will be verified using as-built information
- Two Open Items:
 - **Open Item OI-SRP10.2.3-CIB1-01**
Provide a bounding turbine-missile analysis for low-trajectory missiles for dual units
 - **Open Item OI-SRP 10.2.3-CIB1-02**
Correct an error in the turbine-missile-probability value in the valve-test-frequency report

Overview of Bellefonte COL Chapter 10 - Steam and Power Conversion Systems

FSAR SECTION		SUMMARY OF DEPARTURES/SUPPLEMENTS
10.1	Summary Description	STD COL 10.1-1 Flow Acceleration Corrosion Program
10.2	Turbine-Generator	STD COL 10.2-1 Turbine Maintenance/Inspection Program STD SUP 10.2-1 Turbine Missile For Dual Units STD SUP 10.2-3 ISI For Turbine Assembly STD SUP 10.2-4 Pre-op/Start-up Testing STD SUP 10.2-5 Operation/Maintenance Procedures
10.3	Main Steam Supply System	STD SUP 10.3-1 Procedures To Control Steam-hammer STD SUP 10.3-2 Main Steam Chemistry STD SUP 10.3-3 Procedures To Control IGSCC
10.4	Other Features of SPC System	BLN COL 10.4-1 Circulating Water System BLN COL 10.4-2 Secondary-side Chemical Additives BLN COL 10.4-3 Potable Water (Ref. Ser 9.2.5) STD SUP 10.4-1 Procedures To Control CFS Water-hammer STD SUP 10.4-2 Secondary-side Chemistry BLN CDI Circulating Water System (CWS)

Technical Topics of Interest, BLN COL

Flow-Accelerated Corrosion Program

- AP1000 Information Item 10.1-1
COL applicant will address an erosion-corrosion monitoring program (flow-accelerated corrosion)
- STD COL 10.1.1
 - Applicant described the FAC monitoring and management program in the FSAR
 - Acceptable because applicant is following EPRI NSAC-202L and using CHECWORKS
- Open Item 10.1-1: Include the program implementation schedule in the COLA

Technical Topics of Interest, BLN COL

Turbine Maintenance/Inspection Program

- AP1000 COL Information Item 10.2-1
 - COL applicant will submit and implement a turbine maintenance and inspection program
- STD COL 10.2-1
 - Applicant will submit a program that is consistent with the DCD and based on the as-built rotor
 - Acceptable because the applicant will provide the program prior to fuel load
 - No open items

Technical Topics of Interest, BLN COL

Circulating Water System

- BLN CDI:
The applicant provided plant specific design, operation, instrumentation and controls, flood protection, and chemical injection for the BLN CWS.
- Staff Evaluation:
The staff evaluated the BLN CWS site-specific information in accordance with the Commission regulations and SRP guidance, in particular protection against flooding.
- The staff finds the BLN CWS site-specific design acceptable - no open items.

Technical Topics of Interest, BLN COL

Circulating Water System (Cont.)

- CWS water chemistry is maintained by the Chemical Storage and Transfer System.
- Plant chemistry specifies the required chemicals used within the system.
- Chemical injection maintains a non-corrosive, non-scale-forming condition and limits the biological film formation that reduces the heat transfer rate in the condenser and cooling towers.
- Chemicals selected are compatible with selected materials or components used in the CWS.



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**SER/OI Chapter 10
Steam and Power Conversion Systems**

July 23 – 24, 2009

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- Project Managers
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 - **Sujata Goetz**, AP1000 Bellefonte COL

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		DCA	Bellefonte
10.1	Introduction	0	1
10.2	Turbine Generator	5	0
10.3	Main Steam Supply System	0	0
10.4	Other Features	0	0
Totals		5	1

Overview of AP1000 DCA Chapter 10 - Steam and Power Conversion Systems

DCD Section		Summary of Changes to DCA
10.1	Summary Description	- Revised design description of SPC system
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- Changes:
 - Replaced mechanical overspeed protection device with a diverse electrical overspeed device
- Staff Evaluation:
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- Open Item:
 - Pending review of RAI response

Technical Topics of Interest, AP1000 DCA

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 - Based on operating experience, the missile-probability requirements of GDC 4 can be met with the new design and valve-test frequency
 - The maintenance/inspection program will be verified using as-built information
- Two Open Items:
 - **Open Item OI-SRP10.2.3-CIB1-01**
Provide a bounding turbine-missile analysis for low-trajectory missiles for dual units
 - **Open Item OI-SRP 10.2.3-CIB1-02**
Correct an error in the turbine-missile-probability value in the valve-test-frequency report

Overview of Bellefonte COL Chapter 10 - Steam and Power Conversion Systems

FSAR SECTION		SUMMARY OF DEPARTURES/SUPPLEMENTS
10.1	Summary Description	STD COL 10.1-1 Flow Acceleration Corrosion Program
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10.3	Main Steam Supply System	STD SUP 10.3-1 Procedures To Control Steam-hammer STD SUP 10.3-2 Main Steam Chemistry STD SUP 10.3-3 Procedures To Control IGSCC
10.4	Other Features of SPC System	BLN COL 10.4-1 Circulating Water System BLN COL 10.4-2 Secondary-side Chemical Additives BLN COL 10.4-3 Potable Water (Ref. Ser 9.2.5) STD SUP 10.4-1 Procedures To Control CFS Water-hammer STD SUP 10.4-2 Secondary-side Chemistry BLN CDI Circulating Water System (CWS)

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- Open Item 10.1-1: Include the program implementation schedule in the COLA

Technical Topics of Interest, BLN COL

Turbine Maintenance/Inspection Program

- AP1000 COL Information Item 10.2-1
 - COL applicant will submit and implement a turbine maintenance and inspection program
- STD COL 10.2-1
 - Applicant will submit a program that is consistent with the DCD and based on the as-built rotor
 - Acceptable because the applicant will provide the program prior to fuel load
 - No open items

Technical Topics of Interest, BLN COL

Circulating Water System

- BLN CDI:
The applicant provided plant specific design, operation, instrumentation and controls, flood protection, and chemical injection for the BLN CWS.
- Staff Evaluation:
The staff evaluated the BLN CWS site-specific information in accordance with the Commission regulations and SRP guidance, in particular protection against flooding.
- The staff finds the BLN CWS site-specific design acceptable - no open items.

Technical Topics of Interest, BLN COL

Circulating Water System (Cont.)

- CWS water chemistry is maintained by the Chemical Storage and Transfer System.
- Plant chemistry specifies the required chemicals used within the system.
- Chemical injection maintains a non-corrosive, non-scale-forming condition and limits the biological film formation that reduces the heat transfer rate in the condenser and cooling towers.
- Chemicals selected are compatible with selected materials or components used in the CWS.

**AP1000 Design Control
Document
Amended Design
Chapter 11**

Tier 2 Chapter 11

- **Chapter Overview**
 - Radioactive Waste Management
 - Source Terms
 - Liquid Waste Management System
 - Gaseous Waste Management System
 - Solid Waste Management System
 - Radiation Monitoring

Description of Major Changes Post Revision 15



- Increased overall liquid waste holdup capacity and improved operational flexibility by adding three additional liquid waste monitor tanks to the Design
- Clarified compliance with 10 CFR 20.1406 by stating how the design minimizes contamination and generation of waste
- Updated DCD Sections for closure of COL items related to Section 11.2.5.3, “Identification of Ion Exchange and Adsorbent Media,” 11.2.5.4, “Dilution and Control of Boric Acid Discharge” and 11.3.5.2, “Identification of Adsorbent Material”
- Clarified compliance with RG 1.143 and 10 CFR 71
- Corrected inconsistencies in compliance with 10 CFR 50 App. I and 10 CFR 20.1301

SER Open Item

- **OI-SRP11.3-CHPB-01**
 - Section 11.3.3 needed consequence evaluation of a gaseous system leak or failure



- Chapter 11
Radioactive Waste Management



COL-27





R-COLA Chapter 11 – Content

Radioactive Waste Management

11.1 SOURCE TERMS

11.2 LIQUID WASTE MANAGEMENT SYSTEMS

11.3 GASEOUS WASTE MANAGEMENT SYSTEM

11.4 SOLID WASTE MANAGEMENT

11.5 RADIATION MONITORING





R-COLA Chapter 11 – COL Items

STD 11.2-1 Liquid Radwaste Processing by Mobile Equipment
– mobile equipment design features provided

STD/BLN 11.2-2 Liquid Cost Benefit Analysis of Population Doses
– method utilized is standard
– site specific inputs and results

STD/BLN 11.3-1 Gaseous Cost Benefit Analysis of Population Doses
– method utilized is standard
– site specific inputs and results

STD 11.4-1 Solid Waste Management System Process Control Program – commitment to use NEI 07-10A





R-COLA Chapter 11 – COL Items

**STD 11.5-1 Plant Offsite Dose Calculation Manual (ODCM)
– commitment to use NEI 07-09A**

**BLN/STD 11.5-2 Effluent Monitoring and Sampling
– standard program described
– site-specific program for quality assurance of
radiological monitoring programs based on RG 4.15**

**BLN 11.5-3 10 CFR 50, Appendix I
– described estimated doses due to liquid and
gaseous effluents**





R-COLA Chapter 11 – Other

- 11.2 STD SUP Quality control provisions of the codes and standards specified in RG 1.143, Table 1**
- 11.3 STD SUP Quality control provisions of the codes and standards specified in RG 1.143, Table 1**
- 11.4 STD SUP Quality control provisions of the codes and standards specified in RG 1.143, Table 1**
- 11.4 STD SUP Describes procedures related to process control**

R-COLA Chapter 11 – Open Items

- **Low Level Radwaste Storage - STD**
 - **Address long-term storage capabilities**





Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review**

**SER/OI Chapter 11
Radioactive Waste Management**

July 23 - 24, 2009

Staff Review Team

Technical Review Team

- **Steven Schaffer**, Health Physicists (Lead)
- **Joshua Wilson**, Radwaste System Engineer
- **Douglas Dodson**, Radwaste System Engineer

Project Managers

- **Serita Sanders**, AP1000 DCD
- **Ravindra Joshi**, AP1000 Bellefonte COL

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		DCA	Bellefonte
11.1	Source Term	0	IBR
11.2	Liquid Waste Management System	0	0
11.3	Gaseous Waste Management System	1	0
11.4	Solid Waste Management System	0	1
11.5	Radiation Monitoring	0	0
Totals		1	1

Overview of AP1000 DCD Chapter 11 Radioactive Waste Management

DCD SECTION		SUMMARY OF CHANGES TO DCD
11.1	Source Term	<ul style="list-style-type: none"> No technical changes
11.2	Liquid Radioactive Waste Management	<ul style="list-style-type: none"> 3 additional waste monitoring tanks in the radwaste building Extension of the radwaste building Selection of ion exchange and adsorption media by plant operator Preoperational confirmation of resins
11.3	Gaseous Radioactive Waste Management	<ul style="list-style-type: none"> Reduced capacity of the charcoal delay beds by 50% Monitoring temperature instead of moisture in gas of the moisture separator Added Automatic isolation of guard bed Closed discharge isolation valve to maintain positive pressure
11.4	Solid Radioactive Waste Management	<ul style="list-style-type: none"> Replaced progressive cavity pump with a material handling positive displacement pump
11.5	Radiation Monitoring	<ul style="list-style-type: none"> Switched from offline to inline monitors for service water blowdown and liquid radwaste discharge Added monitors and improved performance of some monitors Design standard for gaseous sampling

Technical Topics of Interest, AP1000 DCD

Liquid Waste Management System

- Additional monitoring tanks design complies with RG 1.143
- Added a preoperational confirmation of resin type and amount in demineralizer vessels
- No open items

Technical Topics of Interest, AP1000 DCD

Gaseous Waste Management System

- GALE code analysis proves reduction in delay bed capacity has small effect on gaseous releases
- Analysis of system leak or failure missing from DCD (BTP 11-5)
- One open item

Technical Topics of Interest, AP1000 DCD

Radiation Monitoring System

- ANSI N13.1-1969 vs. ANSI/HPS N13.1-1999
- No open items

Overview of Bellefonte FSAR Chapter 11

Radioactive Waste Management

FSAR SECTION		SUMMARY OF DEPARTURES/SUPPLEMENTS
11.1	Source Term	<ul style="list-style-type: none"> • None - Incorporated by reference with no departures or supplements
11.2	Liquid Radioactive Waste Management	<ul style="list-style-type: none"> • STD COL 11.2-1, Processing by mobile equipment • BLN COL 11.2-2, Cost-benefit analysis of population doses • BLN COL 11.5-3, Individual dose limits in Part 50 Appendix I • STD SUP 11.2-1, Quality assurance
11.3	Gaseous Radioactive Waste Management	<ul style="list-style-type: none"> • BLN COL 11.3-1, Cost-benefit analysis of population doses • BLN COL 11.5-3, 10 CFR 50, Appendix I • STD SUP 11.3-1, Supplemental information on quality assurance
11.4	Solid Radioactive Waste Management	<ul style="list-style-type: none"> • STD COL 11.4-1, Solid waste management system process control program • STD SUP 11.4-1, Quality assurance
11.5	Radiation Monitoring	<ul style="list-style-type: none"> • STD COL 11.5-1, ODCM • STD COL 11.5-2, Effluent monitoring and sampling program • BLN COL 11.5-2, Use of existing programs

COL Chapter 11 - Doses from Routine Liquid and Gaseous Effluent Releases

Staff performed the following review and analysis:

- Confirmed liquid and gaseous effluent releases
- Confirmed appropriate exposure pathways
- Confirmed the use of appropriate liquid dilution, and atmospheric dispersion/deposition
- Confirmed the use of appropriate land usage parameters
- Verified Applicant's calculated doses using NRC recommended models
- Performed an independent dose assessment for liquid and gaseous pathways showing the Applicant's doses to be bounding

Doses from Routine Liquid and Gaseous Effluent Releases and Comparison to Regulatory Criteria

BLN COL

Regulation	Type of Effluent	Pathway	Organ	Regulatory Limit (mrem/yr per unit)	Applicant SAR (mrem/yr per unit)	NRC SER (mrem/yr per unit)
10 CFR 50, Appendix I	Liquid	all	total body	3	0.206	0.0834
		all	any organ	10	0.265	0.136
	Gaseous	all	total body	5	0.158	0.0617
		all	skin	15	0.957	0.312
	Iodine & Particulate	all	any organ	15	9.11	4.93
	Gaseous	γ air dose	n/a	10 mrad	0.265 mrad	0.263 mrad
		β air dose	n/a	20 mrad	1.39 mrad	1.39 mrad
40 CFR 190	all	all	total body	25 per site	1.25 (2 units)	0.717 (2 units)
	all	all	thyroid	75 per site	18.6 (2 units)	10.1 (2 units)
	all	all	other organs	25 per site	4.69 (2 units)	2.88 (2 units)

Technical Topics of Interest, BLN COL

Cost-Benefit of Radwaste System Augments

Liquid System Augment

➤ ~\$33,000 to \$40,000 per person-rem

Gaseous System Augment

➤ ~\$1200 to \$4000 per person-rem

NEI Templates for FSAR Chapters 11.4 and 11.5

Template for Program Descriptions

- NEI 07-10, Generic FSAR Template for the Process Control Program
- NEI 07-09, Generic FSAR Template for the Offsite Dose Calculation Manual (ODCM) Program Description

Technical Topics of Interest, BLN COL

Solid Waste Management System

- Use of approved NEI template to fulfill operational program description for the Process Control Program
- Onsite or offsite storage of low-level radioactive waste
- One open item

Technical Topics of Interest, BLN COL

Radiation Monitoring for Process and Effluent Systems

- Use of approved NEI template to fulfill operational program description for the Offsite Dose Calculation Manual
- No open items

**AP1000 Design Control
Document
Amended Design
Chapter 12**

Tier 2 Chapter 12

- **Chapter Overview**
 - Radiation Protection
 - ALARA
 - Radiation Sources
 - Radiation Protection Design Features
 - Dose Assessment
 - Health Physics Facilities Design

Description of Major Changes post Revision 15



- Clarified compliance with 10 CFR 20.1406 by stating how the design minimizes contamination and generation of waste
- Revised Radiation effects due to design changes
 - New Radwaste Monitor Tanks
 - Spent Fuel Pool Capacity
 - Fuel Handling Area Shielding Design
 - Integrated RV Head Package and Quick-Lock Connectors
 - Concrete Density in Spent Fuel Transfer Canal and Tube Shielding

SER Open Items

- **OI-SRP12.1-CHPB-01**
 - Information on design features for HVAC systems to prevent or minimize contamination of environment
- **OI-SRP-12.2-CHPB-02**
 - More detail with airborne radioactivity due to expanded fuel pool capacity
- **OI-SRP12.3-CHPB-02**
 - Dose during refueling due to the change in minimum allowable water depth above active fuel
- **OI-SRP12.3-CHPB-01**
 - More detail to determine if the containment area radiation zones are affected or if the implementation of the Integrated RV Head Package Design results in an increase or decrease in the refueling dose estimates
- **OI-SRP12.3-CHPB-03**
 - Density change in the Spent Fuel Transfer Canal and Tube Shielding and the impacts on occupational exposure and effect on radiation zoning



- Chapter 12
Radiation Protection



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R-COLA Chapter 12 – Content

Radiation Protection

- 12.1 ASSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS-LOW-AS-REASONABLY ACHIEVABLE (ALARA)**
- 12.2 RADIATION SOURCES**
- 12.3 RADIATION PROTECTION DESIGN FEATURES**
- 12.4 DOSE ASSESSMENT**
- 12.5 HEALTH PHYSICS FACILITIES DESIGN**
- APPENDIX 12AA – RADIATION PROTECTION PROGRAM**





R-COLA Chapter 12 – COL Items

STD 12.1-1 ALARA and Operational Policies

- Applicant to incorporate NEI 07-08 template upon approval**

STD 12.2-1 Additional Contained Radiation Sources

- source controls described**

STD 12.3-1 Administrative Controls for Radiological Protection

- controls described in Appendix 12AA**

STD 12.3-2 Criteria and Methods for Radiological Protection

- criteria and methods described**





R-COLA Chapter 12 – COL Items

**STD 12.3-3 Groundwater Monitoring Program
– program described in Appendix 12AA**

**STD 12.3-4 Record of Operational Events of Interest for
Decommissioning – recordkeeping described in
Appendix 12AA**

**STD 12.5-1 Radiological Protection Organization and
Procedures – organization and procedures
described**





R-COLA Chapter 12 – Other

12.4 BLN SUP Dose to Construction Workers

- Dose estimates meet limits of 10 CFR 20.1301

R-COLA Chapter 12 – Confirmatory

CI 12.1-1 NEI 07-03 Adoption - STD

- Applicant to incorporate approved template

R-COLA Chapter 12 – Open Items

NEI 07-08 Approval - STD

- Applicant to IBR final approved template

NEI 08-08 Approval - STD

- NRC Approve and Applicant to adopt final approved template

Construction Worker Dose Program - STD

- Operating unit program to conduct radiological surveys





Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review**

**SER/OI Chapter 12
Radiation Protection**

July 23 - 24, 2009

Staff Review Team

Technical Review Team

- **Edward Roach**, Sr. Health Physicist
- **Steven Schaffer**, Health Physicist

Project Managers

- **Serita Sanders**, AP1000 DCD
- **Ravindra Joshi**, AP1000 Bellefonte COL

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		DCA	Bellefonte
12.1	Ensuring ALARA	1	1
12.2	Radiation Sources	1	0
12.3	Radiation Protection Design Features	3	1
12.4	Dose Assessment	0	1
12.5	Health Physics Facilities Design	0	0
Totals		5	3

Overview of AP1000 DCD Chapter 12

Radiation Protection

DCD SECTION		SUMMARY OF CHANGES TO DCD
12.1	Ensuring ALARA	<ul style="list-style-type: none">• Facility changes and general design layout for 10 CFR20.1406 considerations.• No other technical changes
12.2	Radiation Sources	<ul style="list-style-type: none">• Added three waste monitoring tanks in the radwaste building• Increase Spent Fuel Pool overall capacity
12.3	Radiation Protection Design Features	<ul style="list-style-type: none">• Changed Fuel Handling Area Shielding Design• Described facility and layout designs for meeting 10CFR20.1406• Added Integrated Head Package (IHP) and quick-lock connections• Changed the overall assumed concrete shielding density
12.4	Dose Assessment	<ul style="list-style-type: none">• Impact of Integrated Head package not described
12.5	Health Physics Facilities Design	<ul style="list-style-type: none">• Spent fuel pool water level, spent fuel handling and dose

Technical Topics of Interest, AP1000 DCA

Ensuring that Occupational Radiation Exposures Are As Low As is Reasonably Achievable (ALARA)

- Incorporated features to demonstrate AP1000 design complies with 10 CFR 20.1406
- One open item

Technical Topics of Interest, AP1000 DCA

Radiation Sources

- Three waste monitor tanks added-Radwaste Building
- Effect of increase in spent fuel pool capacity (619 to 884 spaces)
- One open item

Technical Topics of Interest, AP1000 DCA

Radiation Protection Design Features

- Change in water level when moving spent fuel
- Design features to meet 10CFR20.1406
- IHP radiological impact (zones/dose)
- Change in concrete shielding density
- Three open items

Technical Topics of Interest, AP1000 DCA

Dose Assessment

- Impact of Integrated Head Package not reflected in DCD Section 12.4
- No open items

Technical Topics of Interest, AP1000 DCA

Health Physics Facilities Design

- Spent Fuel handling and dose
 - SFP Handling tool interlocks
- No open items

Overview of Bellefonte FSAR Chapter 12

Radiation Protection

FSAR SECTION		SUMMARY OF DEPARTURES/SUPPLEMENTS
12.1	Assuring ALARA	<ul style="list-style-type: none"> • STD COL 12.1-1- ALARA and operational policies • STD SUP 12.1-1- use of video records
12.2	Radiation Sources	<ul style="list-style-type: none"> • STD COL 12.2-1, Miscellaneous Sources
12.3	Radiation Protection Design Features	<ul style="list-style-type: none"> • STD COL 12.3-1, administrative controls for access • STD COL 12.3-2, criteria and methods for obtaining representative measurements • STD COL 12.3-3, groundwater monitoring • STD COL 12.3-4, program to ensure documentation of operational events
12.4	Dose Assessment	<ul style="list-style-type: none"> • BLN SUP 12.4-1, dose to construction workers
12.5	Health Physics Facility Design	<ul style="list-style-type: none"> • STD COL 12.5-1, radiation protection program description • BLN DEP 18.8-1, ALARA briefing room

NEI Templates

- NEI 07-03A Generic FSAR Guidance for Radiation Protection Program Description,
- NEI 07-08 Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures Are As Low As Is Reasonably Achievable
- NEI 08-08 Generic FSAR Template Guidance for Life Cycle Minimization of Contamination

COL Chapter 12 – Radiation Protection

Staff performed the following review and analysis:

- Confirmed commitment to ALARA policy
- Confirmed appropriate exposure pathways for construction workers
- Confirmed the use of appropriate milestones to implement ALARA/RP program as necessary
- Confirmed the RP program includes appropriate measurement and work control guidance
- Verified Applicant's calculated doses for construction workers using NRC recommended models

Technical Topics of Interest, BLN COL

Assuring that Occupational Radiation Exposures are ALARA

- Use of generic NEI templates to fulfill operational program and policy description for the ALARA Program
- Implementation of ALARA procedures
- One open item
- One confirmatory item

Technical Topics of Interest, BLN COL

Radiation Protection Design Features

- Use of generic NEI template to fulfill operational program description for the Minimization of Contamination Program
- Criteria for radiological monitoring
- Onsite monitoring of groundwater
- Records of leaks and spills
- Radioactive liquid waste discharge pipe
- One open item and one confirmatory item

Technical Topics of Interest, BLN COL

Dose Assessment

- Use of program to minimize exposure to construction workers during Unit 4 construction.
 - Collective dose 1.13 person-rem
- One open item

Technical Topics of Interest, BLN COL

Health Physics Facilities Design

- Use of approved NEI template to fulfill operational program description for the Radiation Protection Program
- Clarification of implementation milestones
- One confirmatory item



AP1000



COL-37



AP1000 Design Control Document Amended Design Chapter 14

Chapter 14 Overview

- Initial Plant Test Program
 - Specific Information to be Included Preliminary/Final Safety Analysis
 - Pre-operational Test
 - Certified Design Material
 - Combined Licensee Applicant Responsibilities

Major Changes

- Combined License Holder Items for
 - Information in 14.4.3 – “Conduct of Test Program” (TR71B)
 - COL Applicant responsible for providing “Start-up Administration Manual”
 - Information in 14.4. 2 – “Test Specification and Procedures” (TR71A)
 - COL Applicant responsible for writing test specifications, test procedures and start-up procedures
- Proposed response to “As-Built” Definition

Open Items

Three open items were identified

- **OI-SRP14.3-NWE2-01**
 - Clarify AP1000 definition of As-Built
- **OI-SRP-14.2-CQVP-12**
 - Restore COL information item 14.4.2
- **OI-SRP14.2-CQVP-13**
 - Restore COL information item 14.4.3



- Chapter 14
Initial Test Program



COL-40





R-COLA Chapter 14 – Content

Initial Test Program

- 14.1 SPECIFIC INFORMATION TO BE INCLUDED IN PRELIMINARY/FINAL SAFETY ANALYSIS REPORTS**
- 14.2 SPECIFIC INFORMATION TO BE INCLUDED IN STANDARD SAFETY ANALYSIS REPORTS**
- 14.3 CERTIFIED DESIGN MATERIAL**
- 14.4 COMBINED LICENSE APPLICANT RESPONSIBILITIES**





R-COLA Chapter 14

COL Items

STD 14.4-1 Organization and Staffing
– information described

STD 14.4-2 Test Specifications and Procedures
– post COL item – license condition proposed

STD 14.4-3 Conduct of Test Program
– post COL item – license condition proposed

STD 14.4-4 Review and Evaluation of Test Results
– post COL item – license condition proposed





R-COLA Chapter 14

COL Items

STD 14.4-5 Interface Requirements

- Test abstracts provided**

STD 14.4-6 First-Plant-Only and Three-Plant-Only Tests

- post COL item – license condition proposed**



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R-COLA Chapter 14 – Other

14.2 STD SUP Schedule information

14.3 STD SUP Additional ITAAC

R-COLA Chapter 14 – Open Items

- **Proposed License Condition 6 – STD**
 - **Operational Program - Related to Chapter 1 OI – License Conditions**
- **Proposed License Condition 8 – STD**
 - **Changes to Startup Test Program - Related to Chapter 1 OI – License Conditions**





Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review**

**SER/OI Chapter 14
Initial Test Program and ITAAC**

July 23–24, 2009

Staff Review Team

- **Technical Staff**

- ♦ **Juan Peralta**, Chief, Quality and Vendor Branch 1,
Division of Construction Inspection and Operational Programs
(CQVP/DCIP)
- ♦ **Milton Concepcion**, Quality and Vendor Branch 1, CQVP/DCIP
- ♦ **James Gaslevic**, Construction ITAAC Team,
Technical Specification Branch, DCIP
- ♦ **Greg Galletti**, Quality and Vendor Branch 1, CQVP/DCIP

- **Project Managers**

- ♦ **David Jaffe**, Senior Project Manager, AP1000 DCA
- ♦ **Manny Comar**, Senior Project Manager, BLN COL

Overview of DCA and COL

Section		Open Items	
		DCA	Bellefonte
14.1	Specific Information To Be Included in Preliminary Safety Analysis Reports	0	IBR
14.2	Specific Information To Be Included in Standard Safety Analysis Reports: Initial Plant Test Program	0	IBR with supplements 2 Open items
14.3	Tier 1 Information	1	IBR with supplements
14.4	Combined License Applicant Responsibilities	2	IBR with supplements
Totals		3	2

Overview of AP1000 DCA Chapter 14

Initial Test Programs

DCD Section		Summary of Changes to DCA
14.1	Specific Information	-None
14.2	Preoperational Test Abstracts	-Changes to selected test abstracts
14.3	Tier 1 Information	- Definition of “As-Built”
14.4	COL Applicant Responsibilities	<ul style="list-style-type: none">- Proposed methodology for AP1000 test specifications and procedures development- Proposed administrative process and program controls to be utilized in the conduct of the AP1000 Startup Test Program- Clarified test requirements related to first-plant-only and three-plant-only tests

Section 14.3

July 7th ACRS presentation

Definition of “As-Built”

- It may be impractical to perform some inspections and testing for ITAAC after SSC installation
- In those cases, it may be appropriate to perform inspections or tests prior to final installation
- NEI 08-01 Section 3.1.4 includes language that limits use of other than in-place inspections for ITAAC
- Future design certifications and design certification amendments should also include the additional discussion in NEI 08-01 Section 3.1.4 for definition of “as-built”

Section 14.3

Status of “As-Built” Definition

- Staff requested that Westinghouse incorporate the clarification in the AP1000 definition
- Westinghouse proposed to include the additional language of Section 3.1.4 in Tier 2 information
- Staff’s position is that Westinghouse should add the clarification to Tier 1 in the definition of “as-built”

Overview of Bellefonte COL Chapter 14

Initial Test Programs

FSAR Section		Summary of Departures/Supplements
14.1	Specific information to be included in preliminary FSAR	- IBR
14.2	Initial test Program	- STD SUP 14.2-1 Test Program Schedule
14.3	Certified Design Material	- STD SUP 14.3-1 Selection methodology and Selection criteria for ITAAC - BLN SUP 14.3-2 SS-ITAAC
14.4	COL Applicant Responsibilities	- STD COL 14.4-1 Organization and Staffing - STD COL 14.4-2 Test Specifications and Procedures - STD COL 14.4-3 Conduct of Test Program - STD COL 14.4-4 Review, Evaluation, and Approval of Test Results - STD COL 14.4-5 Interface Requirements

Overview of AP1000 DCA Chapter 14

Initial Test Programs

DCD Section		Summary of Changes to DCA*
14.1	Specific Information	-None
14.2	Preoperational Test Abstracts	-Changes to selected test abstracts
14.3	Tier 1 Information	- Definition of “As-Built”
14.4	COL Applicant Responsibilities	<ul style="list-style-type: none"> - Proposed methodology for AP1000 test specifications and procedures development - Proposed administrative process and program controls to be utilized in the conduct of the AP1000 Startup Test Program - Clarified test requirements related to first-plant-only and three-plant-only tests

Technical Topics of Interest

AP1000 DCA

Test Specifications and Procedures

- Westinghouse proposed methodology for the development of AP1000 test specifications and procedures
 - ♦ APP-GW-GLR-037, Rev.1 (TR-71A)
 - Methodology inconsistent with current regulatory guidance applicable to COL applicants
 - ♦ COL Information Item 14.4-2 (STD COL 14.4-2)
 - COL holder will provide the preoperational and startup procedures to the NRC prior to each planned test
- NRC staff rejected Westinghouse's TR-71A in a letter dated 08/21/07 (ML072260599)

Technical Topics of Interest

AP1000 DCA

Conduct of Test Program

- Westinghouse proposed a program management description outlining the AP1000 startup administrative manual requirements
 - ♦ APP-GW-GLR-038, Rev.2 (TR-71B)
 - Methodology inconsistent with current regulatory guidance applicable to COL applicants
 - ♦ COL Information Item 14.4-3 (STD COL 14.4-3)
 - COL holder responsible for a startup administration manual containing administration procedures and requirements that govern the initial test program activities
- NRC staff rejected Westinghouse's TR-71B in a letter dated 09/18/08 (ML082520572)

Technical Topics of Interest

AP1000 DCA

First-Plant-Only and Three-Plant-Only Tests

- Westinghouse clarified timing of AP1000 first-plant-only and three-plant-only tests
 - ♦ APP-GW-GLR-021, Rev.1 (TR-6)
 - Change clarifies the COL holder responsibility, in contrast to the previous assignment of responsibility to either the COL applicant or holder
 - ♦ COL Information Item 14.4-6 (STD COL 14.4-6)
 - COL holder shall perform the tests in subsection 14.2.5 or shall provide a justification prior to preoperational testing
- NRC staff accepted Westinghouse's TR-6 proposed changes related to first-plant-only and three-plant-only tests

Overview of Bellefonte COL Chapter 14

Initial Test Programs

FSAR Section		Summary of Departures/Supplements
14.1	Specific information to be included in preliminary FSAR	- IBR
14.2	Initial test Program	- STD SUP 14.2-1 Test Program Schedule
14.3	Certified Design Material	- STD SUP 14.3-1 Selection methodology and Selection criteria for ITAAC - BLN SUP 14.3-2 SS-ITAAC
14.4	COL Applicant Responsibilities	- STD COL 14.4-1 Organization and Staffing - STD COL 14.4-2 Test Specifications and Procedures - STD COL 14.4-3 Conduct of Test Program - STD COL 14.4-4 Review, Evaluation, and Approval of Test Results - STD COL 14.4-5 Interface Requirements

Technical Topics of Interest

BLN COL

Test Specifications and Procedures

- AP1000 COL Information Item 14.4-2
COL holder will provide the preoperational and startup test procedures to the NRC prior to each planned test
- STD COL 14.4-2
 - ♦ Development process described in BLN COLA consistent with current regulatory guidance
 - ♦ COL holder will submit to NRC a schedule to support operational program readiness and will include submittal of test specifications and procedures to NRC onsite inspectors
- Adequacy of administrative controls for the development of test specifications and procedures remains an open item

Technical Topics of Interest

BLN COL

Conduct of Test Program

- AP1000 COL Information Item 14.4-3
COL holder is responsible for providing a site-specific SAM prior to initiating the test program
- STD COL 14.4-3
 - ♦ Administrative controls for the development of a site-specific SAM described in BLN COLA consistent with current regulatory guidance
 - ♦ Changes to the initial test program will be controlled and reported to the NRC
- Adequacy of administrative controls for changing the test program remains an open item

Technical Topics of Interest

BLN COL

Interface Requirements

- AP1000 COL Information Item 14.4-5
COL applicant is responsible for testing that may be required of structures and systems which are outside the scope of this design certification
- STD COL 14.4-5
 - ♦ The applicant provided test abstracts for the following systems:
 - ♦ Storm drains (Section 14.2.9.4.22)
 - ♦ Offsite ac power systems (Section 14.2.9.4.23)
 - ♦ Raw water systems (Section 14.2.9.4.24)
 - ♦ Sanitary drainage system (Section 14.2.9.4.25)
 - ♦ Fire brigade support equipment (Section 14.2.9.4.26)
 - ♦ Portable personnel monitors and radiation survey instruments (Section 14.2.9.4.27)
 - ♦ Cooling tower(s) (Section 14.2.10.4.29)
- No open items

**AP1000 Design Control
Document
Amended Design
Chapter 17**

Tier 2 Chapter 17

This chapter discusses the following:

- Quality Assurance during
 - Design and Construction Phases
 - Operations Phase
 - Design, Procurement, Fabrication, Inspection, Testing

Major changes:

- Clarification re: ASME NQA-1-1994

Tier 2 Chapter 17

- No COL Information Items changes
- **OI-SRP17.3-CQVP-01**
 - NRC may inspect the Westinghouse implementation of QMS



- Chapter 17
Quality Assurance



COL-49





R-COLA Chapter 17 – Content

Quality Assurance

- 17.1 QUALITY ASSURANCE DURING THE DESIGN AND CONSTRUCTION PHASES**
- 17.2 QUALITY ASSURANCE DURING THE OPERATIONS PHASE**
- 17.3 QUALITY ASSURANCE DURING DESIGN, PROCUREMENT, FABRICATION, INSPECTION, AND/OR TESTING OF NUCLEAR POWER PLANT ITEMS**
- 17.4 DESIGN RELIABILITY ASSURANCE PROGRAM**
- 17.5 QUALITY ASSURANCE PROGRAM DESCRIPTION – NEW LICENSE APPLICANTS**
- 17.6 MAINTENANCE RULE PROGRAM**
- 17.7 COMBINED LICENSE INFORMATION ITEMS**
- 17.8 REFERENCES**





R-COLA Chapter 17 – COL Items

BLN 17.5-1 Quality Assurance Design Phase – Utilizing existing TVA QA program until COL issued

STD 17.5-2 Quality Assurance for Procurement, Fabrication, Installation, Construction and Testing – included in proposed QAPD – based on NEI 06-14A

STD 17.5-4 Quality Assurance Program for Operations – included in proposed QAPD



COL-51





R-COLA Chapter 17 – Other

R-COLA Chapter 17 – Open Items

OI 17.1-1 **RG 1.33 application in NEI 06-14 - STD**

- NRC approve and Applicant adopt approved template

OI 17.1-2 **Inspection re: hydrology documentation - BLN**

- NRC to schedule

OI 17.1-3 **Inspection re: contractor oversight - BLN**

- NRC to schedule





R-COLA Chapter 17 – Open Items

OI 17.5-1 Regulation citation correction - STD

- NEI 06-14 revision to address

OI 17.5-2 Independent reviews - STD

- NEI 06-14 revision to address

OI 17.5-3 Identification of “licensee” - STD

- NEI 06-14 revision to address

OI 17.5-4 Commercial grade calibration - STD

- NEI 06-14 revision to address

OI 17.5-5 Commercial grade dedication - STD

- NEI 06-14 revision to address

OI 17.5-6 Clarify RG position documentation – STD



AP1000 Design Control Document Amended Design

17.4 – D-RAP

Chapter 17 - D-RAP

- Design Reliability Assurance Program (D-RAP)
- Major changes:
 - Incorporation of Maintenance Rule per NEI 07-02A
 - **OI-SRP17.4-SPLA-01**
 - Common-cause RCP trip failure removal from PRA
 - **OI-SRP17.4-SPLA-04**
 - Resolve need for an alternative D-RAP ITAAC



17.4 and 17.6

Design Reliability Assurance Program Maintenance Rule



COL-54





17.4 and 17.6

17.4 DESIGN RELIABILITY ASSURANCE PROGRAM

– IBR DCD

17.6 STD SUP Maintenance rule program description

– IBR NEI 07-02A

COL Item

**STD 17.5-8 Operational Reliability Assurance Program
Integration with Quality Assurance Program
– Implemented via Operational Programs**



COL-55





Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review**

**SER/OI Chapter 17
Quality Assurance Program**

July 23–24, 2009

Staff Review Team

Technical Staff

- **Juan Peralta**, Chief, Quality and Vendor Branch 1, Division of Construction Inspection Programs (CQVP/DCIP)
- **Kerri Kavanagh**, Lead Reviewer, CQVP/DCIP
- **Greg Galletti**, Quality and Vendor Branch 1, CQVP/DCIP
- **Malcolm Patterson**, Reviewer
PRA Licensing, Operations Support, & Maintenance Branch 1, Division of Safety Systems and Risk Assessment

Project Managers

- **Phyllis Clark**, AP1000 DCA
- **Manny Comar**, AP1000 Bellefonte COL

Overview of DCA and COL

SRP Section/Application Section		Status	
		AP1000	Bellefonte
17.1	Quality Assurance During the Design and Construction Phases	No OI	IBR with Supplement 3 OI
17.2	Quality Assurance During the Operations Phase	No OI	IBR No OI
17.3	Quality Assurance During Design, Procurement, Fabrication, Inspection, and/or Testing of Nuclear Power Plant Items	1 OI	IBR No OI
17.4	Design Reliability Assurance Program	2 OI	IBR with Supplement No OI
17.5	Quality Assurance Program Description—New License Applicants	No OI	IBR with Supplement 6 OI
17.6	Maintenance Rule Program	No OI	IBR with Supplement No OI
Totals		3 OI	9 OI

Overview of AP1000 DCA Chapter 17

QA Program Description

DCD Section		Summary of Changes to DCA
17.1	Quality Assurance During the Design and Construction Phases	None
17.2	Quality Assurance During the Operations Phase	None
17.3	Quality Assurance During the Design Phase	Proposed use of Westinghouse Quality Management System (QMS) Rev. 5, for AP1000

Technical Topics of Interest

AP1000 DCA

Section 17.3—Westinghouse QMS

- AP1000 DCD, Revision 17 proposed implementation of Westinghouse Quality Management System (QMS), Revision 5, for AP1000 Projects
 - QMS, Revision 5, previously approved by NRC staff (September 13, 2002)
 - QMS is based on American Society of Mechanical Engineers (ASME) NQA-1-1994.

Technical Topics of Interest

AP1000 DCA

QMS Implementation Inspection

- **NRC Inspection of Westinghouse Implementation of QMS, Revision 5**
 - Compliance with 10 CFR Part 50 Appendix B and Part 21
 - Three nonconformances identified (design control; control of purchased material equipment, and services; and instructions, procedures, and drawings)
 - Westinghouse developed corrective actions to address and to prevent recurrence of nonconformances
 - Actions reviewed and accepted by staff
- **Open Item OI-SRP 17.3-CQVP-01**
 - For possible future inspection of Westinghouse QMS implementation

Overview of Bellefonte COL Chapter 17

Quality Assurance

FSAR SECTION		SUMMARY OF DEPARTURES/SUPPLEMENTS
17.1	QA During Design and Construction Phases	IBR BNL COL 17.5-1 QAP prior to COL issuance
17.2	QA During the Operations Phase	IBR
17.3	QA Program Description	IBR
17.5	QA Program Description— New License Applicants	IBR Plus SUP BLN COL 17.5-1 QAP following to COL issuance STD COL 17.5-2 QAP for procurement, fabrication, installation, construction, and testing of SSCs STD COL 10.5-4 QAP for operations STD COL 17.5-8 RAP integration with QAP

Technical Topics of Interest

BLN COL

QA Program

- Prior to COL applicant using TVA Nuclear Quality Assurance Plan, TVA-NQA-PLN-89-A for oversight of contractors
- Following COL issuance—applicant is following the guidance consistent with RG 1.206 applicable to design, construction, and operations
 - COL FSAR contains a QA program description based on NEI Template 06-14, Revision 4 (NRC approval - April 2007)
 - One open issue regarding incorporation of RG 1.33
 - Resolution through adoption of revisions to NEI 06-14

Technical Topics of Interest

BLN COL

NEI 06-14

- Provides a generic template for ESP and COL applicants to develop a QAP description consistent with the regulatory requirements
 - NEI 06-14, Revision 4
 - Generic issues identified during the review of COL applications is being addressed through future revision of NEI 06-14.
 - * Organization
 - * Applicability of QA Regulatory Guides
 - * Bellefonte (6) open items related to these generic issues

Technical Topics of Interest

BLN COL

QA Implementation Inspections

- In Feb. 2008 the NRC performed limited scope inspection at TVA to verify QA effectively implemented with regard to Simulated Open Channel Hydraulics (SOCH) model (Sections 2.4.3, Probable Maximum Flood on Streams and Rivers, and 2.4.4, Potential Dam Failures.)
 - Violations identified related to design control, software verification and validation, and records control.
 - TVA provided a plan to correct and prevent recurrence of the violations and committed to provide a date when final compliance is achieved.
 - One open item—Follow-up inspection to verify compliance once TVA notifies the NRC that compliance has been achieved.
 - One open item—Perform a limited scope inspection of TVA Appendix B program implementation on supplier oversight and control.

Conclusion

- The NRC staff used the requirements of Appendix B to 10 CFR Part 50 and the guidance in SRP Section 17.5 for evaluating the acceptability of the AP 1000 DCD and Bellefonte COL FSAR Information Items 17.5-1, 17.5-2, 17.5-4 and 17.5-8 in Section 17.5 of the COL FSAR.
- The staff evaluated the QAPDs that will be applied to activities during design, construction, and operations and arrived at the following conclusions pending resolution of the remaining open issues:
 - The QAPDs complies with the acceptance criteria in SRP Section 17.5 and with the commitments to applicable regulatory guidance.
 - The QAPDs provides adequate guidance for the applicant to establish controls that, when properly implemented, complies with Appendix B.
- Questions?

Overview of Chapter 17 Sections on Reliability Assurance

Section		AP1000 DCD	BLN COL
17.4	Design Reliability Assurance Program	2 OI	IBR with supplement No OI
17.6	Maintenance Rule Program	No OI	IBR with supplement No OI

Reliability Assurance Program History

- RAP: cradle to grave
 - D-RAP: prior to initial fuel load
 - O-RAP: from fuel loading on
- OPRAAs instead of O-RAP
- D-RAP subject to ITAAC

Technical Topics of Interest

AP1000 DCA

D-RAP

- D-RAP (a program, not just a list)
- D-RAP ITAAC (changes)
- Changed **basis** for inclusion in D-RAP
- Open item: common-cause failure of RCP circuit breakers (to open)

Technical Topics of Interest

BLN COL

BLN COL D-RAP

- No plant-specific additions
- Handling of post-COL changes to D-RAP

Technical Topics of Interest

Changes in D-RAP

AP1000 DCA

- Items with reduced risk significance ($RAW < 2$) retained, now attributed to the Expert Panel
- OI (resolved): RCP trip breaker basis is RAW/CCF
- Improved D-RAP ITAAC proposed

BLN COL FSAR

- Programs for D-RAP and OPRAAs now explicitly identified
- No additional SSCs
- Design control program & maintenance rule program assure D-RAP adequacy post-COL

Technical Topics of Interest

Maintenance Rule

AP1000 DCD MR program discussed in
Section 17.4 cites NEI 07-02

“Generic FSAR Template Guidance for Maintenance
Rule Program Description for Plants Licensed under
10 CFR Part 52”

BLN COL FSAR

- Incorporates NEI 07-02A
- Provides schedule for implementation
- Describes support for post-COL changes to the scope of the maintenance rule

Technical Topics of Interest

NEI 07-02A

Maintenance rule program description

- maintenance rule scoping
- monitoring and corrective action
- preventive maintenance
- evaluation of monitoring and preventive maintenance
- risk assessment and risk management

Technical Topics of Interest, NEI 07-02A (continued)

Also addresses

- training and qualification
- program relationship with reliability assurance activities
- program relationship with industry operating experience activities
- implementation

**AP1000 Design Control
Document
Amended Design
Chapter 19**

Tier 2 Chapter 19

- **Chapter 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

Description of Major Changes Post Revision 15



- Addressed site-specific design and site-specific external hazards in a standard manner
- PRA model changed from proprietary PRA software to CAFTA and evaluated and updated as necessary for various design changes
- Addition of Appendix 19F regarding malevolent aircraft impacts

SER Open Items

- **OI-SRP19.0-SPLA-07**
 - Update of resolved and re-quantified PRA model and any DCD changes that may be necessary
- **OI-SRP19.0-SPLA-13**
 - Update of the shutdown PRA risk and any DCD changes that may be necessary
- **OI-SRP19.0-SPLA-12**
 - Maintain acceptable seismic margin for Hard Rock High Frequency sites
- **OI-SRP19.0-SPLA-14**
 - More information on the containment inventory of radionuclides used for equipment survivability evaluation
- **OI-SRP19.0F-SPLA-01**
 - OI for review of Appendix 19F, “Malevolent Aircraft Impact”
 - Awaiting Regulator Guidance for review of Section



- Chapter 19
Probabilistic Risk Assessment



COL-56





R-COLA Chapter 19 – Content

Probabilistic Risk Assessment

19.1 INTRODUCTION

19.2 INTERNAL INITIATING EVENTS

19.3 MODELING OF SPECIAL INITIATORS

...

19.57 INTERNAL FIRE ANALYSIS

19.58 WINDS, FLOODS, AND OTHER EXTERNAL EVENTS

19.59 PRA RESULTS AND INSIGHTS





R-COLA Chapter 19

COL Items

STD 19.59.10-1 As-Built SSC HCLPF Comparison to Seismic Margin Evaluation – As-built item – proposed license condition

STD 19.59.10-2a Evaluation of As-Built Plant Versus Design in AP1000 PRA – As-built item – proposed license condition

STD 19.59.10-2b Evaluation of Site-Specific PRA External Events – confirmed generic analysis is applicable

STD 19.59.10-3 Internal Fire and Internal Flood Analyses – As-built item – proposed license condition





R-COLA Chapter 19

COL Items

STD 19.59.10-4 Develop and Implement Severe Accident Management Guidance

– As-built item – proposed license condition

STD 19.59.10-5 Equipment Survivability

– As-built item – proposed license condition



COL-59





R-COLA Chapter 19 – Other

19.59.10.6 STD SUP PRA configuration controls description

R-COLA Chapter 19 – Open Items

- OI 19.58-1 Staff to complete hydrology impact review - BLN
 - NRC Staff action to complete review
- OI 19.58-2 Staff to complete toxic chemical impact review - BLN
 - NRC Staff action to complete review
- OI 19.59-1 Staff to complete DCD seismic margins review - STD
 - WEC & NRC Staff action to complete review





Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review**

**SER/OI Chapter 19
Probabilistic Risk Assessment and Severe Accidents**

July 23–24, 2009

Staff Review Team

Technical Staff

- ♦ **Malcolm Patterson**, DCD Lead Reviewer, PRA Licensing, Operations Support, and Maintenance Branch 1 (SPLA)
- ♦ **Mark Melnicoff**, BLN COL Lead Reviewer, SPLA
- ♦ **Marie Pohida**, Reviewer (shutdown/low power), PRA Licensing, Operations Support, and Maintenance Branch 2 (SPLB)
- ♦ **Ed Fuller**, Reviewer (severe accident mitigation), SPLB
- ♦ **Bret Tegler**, Reviewer (seismic margin analysis), Structural Engineering Branch 1 (SEB1)

Project Managers

- ♦ **Serita Sanders**, AP1000 DCA
- ♦ **Manny Comar**, BLN COL

Overview of Chapter 19

- Introduction
- System-by-system descriptions
 - ♦ Changed—reviewed for potential effect on PRA
 - ♦ Unchanged—already certified; not reviewed
- Other assessments*
 - ♦ Severe accident topics
 - ♦ Fire PRA
 - ♦ Seismic margins analysis
 - ♦ External events
 - ♦ Results and insights

* reviewed only the changes

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		AP1000	Bellefonte
19.2–7 19.29–33 19.35 19.42–45 19.49–51 19.54 19.56–57	previously considered (PRA Report)	0	IBR
19.46–48 19.52–53	not used	0	IBR
19.8–28	various systems (some DCD internal references)	0	IBR

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		AP1000	Bellefonte
19.1	Introduction	0	IBR
19.34	Severe Accident Phenomena Treatment	1	IBR
19.36	Reactor Coolant System Depressurization	0	IBR
19.37	Containment Isolation	0	IBR
19.38	Reactor Vessel Reflooding	0	IBR
19.39	In-Vessel Retention of Molten Core Debris	0	IBR
19.40	Passive Containment Cooling	0	IBR
19.41	H ₂ Mixing and Combustion Analysis	0	IBR
19.55	Seismic Margin Analysis	1	IBR
19.58	Winds, Floods, and Other External Events	1	2
19.59	PRA Results and Insights	3	1
Totals		6	3

Objectives of Review

AP1000 DCD

- FSER safety conclusion still valid
- PRA upgrade/update successful
- Capture new insights
- RTNSS scope still appropriate
- Requirements updated:
 - ♦ ITAAC
 - ♦ D-RAP scope
 - ♦ Tech Specs and availability controls

Technical Topics of Interest

AP1000 DCD

- Design changes
- PRA audit
- Seismic risk
- 10 CFR Part 52 change:
“...description of PRA and report of results...”

Technical Topics of Interest

Section 19.34. Severe Accident Phenomena Treatment

AP1000 DCD

- Equipment survivability (radiation)

BLN COL FSAR

- IBR

Technical Topics of Interest

Section 19.55, Seismic Margin Analysis

AP1000 DCD

- HRHF sites
- Seismic issues in the DCD
 - ♦ seismic margin at frequencies with exceedance
 - ♦ modular shield building design
 - ♦ soil-structure interaction

BLN COL FSAR

- ♦ IBR

Technical Topics of Interest

Section 19.58, Winds, Floods, and Other External Events

AP1000 DCD

- “Generic Site”

BLN COL FSAR

- Summary of external events
- High winds
- Floods
- Transportation and other external events

Technical Topics of Interest

Section 19.59, PRA Results and Insights

AP1000 DCD

- I&C systems
- Reactor coolant pumps
- Reactor vessel insulation system
- PRA configuration controls during design
- Description and results

BLN COL FSAR

- PRA configuration controls after licensing

PRA Audit

- PRA upgrade and update
 - ♦ conversion process (CAFTA)
 - ♦ new FTs (protection and control systems)
- Integration with the design process
- Qualifications
- Corrective action program

**AP1000 Design Control
Document
Amended Design
Chapter 16**

Tier 2 Chapter 16

Overview



- This chapter describes the:
 - Generic Technical Specifications
 - Investment Protection Controls

Tier 2 Chapter 16

Description of Major Changes



- Resolve technical bracketed items in the generic tech specs of the AP1000 DCD, and document activities required for COL Information Item 16.1-1
- Update Tech Specs to reflect design changes, examples include
 - Revise ADS valve stroke time requirements
 - Gray Rod Swap and Operational Requirements Consistent with use of the On-Line Power Distribution Monitoring System (OPDMS)
- Incorporated appropriate TSTFs, Generic Letters and GSIs

Tier 2 Chapter 16

Open Items



- Open Items:
 - **OI-SRP16-CTSB-42**
 - Revised OTdT & OPdT setpoint equation (Justify/Revise WCAP)
 - **OI-SRP16-CTSB-25**
 - Provide justification for RCS flow testing in place of a precision heat balance (calorimetric) and provide associated SR
 - **OI-SRP16-CTSB-32**
 - TSTF-448, MCRE testing SR and methodology
 - **OI-SRP16-CTSB-33**
 - TSP manufacturer's density
 - **OI-SRP16-CTSB-55**
 - Revised RCS max temperature for RCP start with RCS solid

Tier 2 Chapter 16

Open Items



- **Open Items (con't):**
 - **OI-SRP16-CTSB-54**
 - Apparent LTOP TS Bases inconsistencies
 - **OI-SRP16-CTSB-61**
 - Chapter 15 references
 - **OI-SRP16-CTSB-62**
 - Minimum RCS flow for boron mixing
 - **OI-SRP16-CTSB-07**
 - Clarification of ADS flow path Operability requirements
 - **OI-SRP16.1.1-SEB1-01**
 - Containment Equipment Hatch bolting



- Chapter 16
Technical Specifications



COL-45





R-COLA Chapter 16 – Content

Technical Specifications

16.1 TECHNICAL SPECIFICATIONS

16.2 DESIGN RELIABILITY ASSURANCE PROGRAM

16.3 INVESTMENT PROTECTION



COL-46





R-COLA Chapter 16 – COL Items

**STD 16.1-1 Technical Specification Preliminary Information
- all bracketed information completed**

**STD 16.3-1 Procedure to Control Operability of Investment
Protection Systems, Structures and Components
- procedures described**



COL-47





R-COLA Chapter 16 – Other

No other information necessary.

R-COLA Chapter 16 – Open Items

- **Setpoint methodology - STD**
 - **Describe setpoint control program**



COL-48





Presentation to the ACRS Subcommittee

Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review

**SER/OI Chapter 16
Technical Specifications**

July 23–24, 2009

Staff Review Team

Technical Staff

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- **Hien Le**, Reactor Systems, Plant Systems, Containment Systems, ECCS Systems, CTSB/DCIP
- **Dayna Dority**, Electrical & Instrumentation Systems, CTSB/DCIP
- **Rick Scully**, Safety Limits, Reactivity Control Systems & Power Distribution Limits, Refueling Systems, CTSB/DCIP
- **Malcolm Patterson**, PRA Licensing, Operations Support and Maintenance Branch 1, Division of Safety Systems and Risk Assessment

Project Managers

- **Sikhindra Mitra**, AP1000 DCA
- **Manny Comar**, AP1000 Bellefonte COL

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		AP1000	Bellefonte
16.1	Technical Specifications	10	1
16.2	Design Reliability Assurance Program	0	IBR
16.3	Investment Protection	0	IBR w/ SUP
Totals		10	1

Open Issues, DCA

- **OTdT & OPdT (Justify/Revise WCAP)**
- **Need SR for RCS elbow tap flow measurements**
- **ADS TS conditions/stage requirements not clear**
- **Control room habitability TS change not incorporated**
- TSP manufacturer's density
- RCS temp limit for pump start, justification
- RCS min flow requirement inconsistency
- Equipment hatch bolt design needs audit
- Bases inconsistencies (TS 3.4.14)
- Explicit FSAR references needed

TECHNICAL SPECIFICATION (TS) COMBINED LICENSE INFORMATION

In accordance with DC/COL-ISG-8, at COL issuance all TS information must be resolved by:

- providing a plant specific value (Option 1), or
- providing a value that is bounding to plant specific value (Option 2), or
- providing an administrative control TS that requires use of an NRC-approved methodology to determine plant specific value and document for recording value (Option 3)

Technical Topics of Interest, BLN COL

- BLN proposes to provide instrumentation system settings using Option 1
- BLN has not provided sufficient information for staff to conclude Option 1 is appropriate
- BLN may need to implement a setpoint control program (SCP) consistent with Option 3 for providing instrumentation system settings
- DCD does not include SCP as an option for providing instrumentation system settings

AP1000 Design Control Document Amended Design

Chapter 4

Tier 2 Chapter 4

Overview



- This chapter describes the mechanical components of the reactor and reactor core, including:
 - fuel rods
 - fuel assemblies
 - nuclear design
 - thermal-hydraulic design
 - materials
 - functional design of reactivity control systems

Tier 2 Chapter 4

Description of Major Changes



- Updated gray rod control assembly (GRCA) design
- Revised the burnable absorber rod design to include both wet annular burnable absorbers (WABAs) to borosilicate glass to address an inconsistency in the certified design
- CRDM material changes
- Reactor internal material specification changes
- Change the Soluble Boron Credit Analysis

Tier 2 Chapter 4

Open Items



One Open Item:

- **OI-SRP4.5.1-CIB1-01**
 - Need to address the use of Reg Guide 1.44 and CRDM canopy seal welds material
- **OI-SRP9.1.1-SRSB-01**
 - Soluble Boron Credit Methodology pending staff approval of WCAP-14416-P



- Chapter 4
Reactor



COL-16





R-COLA Chapter 4 – Content

Reactor

4.1 SUMMARY DESCRIPTION

4.2 FUEL SYSTEM DESIGN

4.3 NUCLEAR DESIGN

4.4 THERMAL AND HYDRAULIC DESIGN

4.5 REACTOR MATERIALS

4.6 FUNCTIONAL DESIGN OF REACTIVITY CONTROL SYSTEMS





R-COLA Chapter 4

R-COLA Chapter 4 – 1 COL Item

STD 4.4-2 Confirm Assumptions for Safety Analyses DNBR Limits – post COL item – license condition proposed

R-COLA Chapter 4 – Other

No other information

This chapter entirely IBR except for one COL item

R-COLA Chapter 4 – Open Items

There are no open items for Chapter 4.



COL-18





Presentation to the ACRS Subcommittee

**Westinghouse AP1000 Design Certification Amendment Application Review
Bellefonte Units 3 and 4 COL Application Review**

**SER/OI Chapter 4
Reactor**

July 23 – 24, 2009

Staff Review Team

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 - **Yi-Hsiung (Gene) Hsui**, Reactor Systems, Nuclear Performance and Code Review Branch (Division of Safety Systems and Risk Assessment) (SRSB/DSRA)
 - **Fred Forsaty**, SRSB/DSRA
- Project Managers
 - **Phyllis Clark**, AP1000 DCA
 - **Ravi Joshi**, AP1000 Bellefonte COL

Overview of DCA and COL

SRP Section/Application Section		Open Items	
		AP1000 DCA	Bellefonte
4.1	Summary Description	0	IBR – 0
4.2	Fuel System Design	0	IBR – 0
4.3	Nuclear Design	1	IBR – 0
4.4	Thermal and Hydraulic Design	0	IBR – 0
4.5	Reactor Materials	1	IBR – 0
4.6	Functional Design of Reactivity Control System	0	IBR – 0
Totals		2	0

Overview of AP1000 DCA Chapter 4 - Reactor

DCD Section		Summary of Changes to DCA
4.1	Summary Description	Revised summary description of core/fuel design
4.2	Fuel System Design	Changes to gray rod control assembly design Addition of borosilicate glass burnable absorber rods Revised top nozzle design Deletion of COL Items 4.2-1, 4.3-1, and 4.4-1
4.3	Nuclear Design	On-line monitoring of power distribution Revised criticality design methodology outside reactor (OI-SRP9.1.1-SRSB-01)
4.4	Thermal and Hydraulic Design	Revision of core bypass flow paths Change of COL item 4.4-2 to COL Holder's item
4.5	Reactor Materials	Revised material specifications
4.6	Functional Design of Reactivity Control System	No major changes

Technical Topics of Interest, AP1000 DCA

Changes to Gray Rod Control Assemblies (GRCA)

- DCA modified the GRCA design
 - Increased the number of rodlets from 4 to 12 per assembly
 - Decreased the rodlet diameter
 - Maintained reactivity worth while lessening the local power perturbations
 - The new GRCA design does not result in a more limiting case and no change to the accident analysis is needed
- Staff finds this design change acceptable

Technical Topics of Interest, AP1000 DCA

Addition of Borosilicate Glass Burnable Absorber Rods Design

- DCD was modified to include borosilicate glass burnable absorbers (BAs), in addition to previously approved Wet Annular Burnable Absorber (WABA)
 - NRC previously approved use of similar borosilicate BAs
 - Expected AP1000 core operation parameters are similar to previously approved borosilicate glass BAs
- Staff finds this change acceptable

Technical Topics of Interest, AP1000 DCA

Deletion of COL Items 4.2-1, 4.3-1 & 4.4-1

- COL Items require COL applicants to address changes to reference design of fuel, BA rods, RCCA, or initial core design from DCD
- DCD Revision 17 and APP-GW-GLR-059 describe changes from DCD Revision 15
- Fuel design and initial core design are Tier 2* information
- Prior NRC approval is required for future changes to DCD Tier 2* information

Technical Topics of Interest, AP1000 DCA

Revised Criticality Design Method Outside Reactor

- DCD Revision 16 references disapproved WCAP-14416 for criticality analysis
- In DCD Revision 17 Westinghouse completely revised AP1000 Criticality Analysis
- The new SFP criticality analysis is documented in APP-GW-GLR-029 Revision 1, entitled “AP1000 Spent Fuel Storage Racks Criticality Analysis” which is under review
- Open Item OI-SRP9.1.1-SRSB-01 pending NRC approval of new SFP criticality analysis

Technical Topics of Interest, AP1000 DCA

Change of COL Information Item 4.4-2 (DCD Section 4.4.7)

- In DCD Revision 15, COL Information Item 4.4-2 specified COL applicant to calculate instrumentation uncertainties of operating plant parameters and design limit DNBR using revised thermal design procedure (RTDP) to confirm validity of the DCD design limit DNBR
- DCD Revision 17 revised COL item 4.4-2 to COL holder's required action prior to initial fuel load
- The staff finds COL holder's required action acceptable because:
 - Instrument uncertainties can only be calculated after selection of actual plant operating instrumentation
 - COL holder is required to use approved method for calculations of instrumentation uncertainties and design limit DNBR
 - DCD Design limit DNBR was calculated based typical instrumentation uncertainties expected to be bounding uncertainties of selected instrumentation
 - Margins between safety analysis minimum DNBRs and DCD design limit DNBR available to offset increase of design limit DNBR
 - Different instrumentation with less uncertainties can be selected

Technical Topics of Interest, AP1000 DCA

Control Rod Drive (CRD) Structural Materials

- DCA added austenitic stainless steels (solution annealed) - 304, 304L, 316 and 316L to certified materials (304LN and 316LN)
- Open Item OI-SRP4.5.1-CIB1-01: 304 and 316 may be more susceptible to SCC in stagnant water conditions (high oxygen) in CRD components
- Westinghouse response would revise DCD to provide controls on preventing SCC:
 - RG 1.44 – avoiding sensitized material
 - RG 1.37 – cleaning procedures and contamination prevention
 - AP1000 CRDs are redesigned – reduce number of welds, reduce stresses, use of vent drain lines to prevent stagnant water conditions
- Staff finds response acceptable

Technical Topics of Interest, AP1000 DCA

Reactor Internals and Core Support Materials

- DCA added new materials:
 - Austenitic stainless steels (solution annealed) -304, 304L and 304H
 - Nickel-based Alloys 718 and 750
 - Nickel-based Alloy 690
 - Stellite 6 hardfacing
- Staff finds these material additions acceptable based on:
 - current PWR operating experience
 - compliance with RG 1.44 guidelines
 - 304H has maximum carbon content of 0.08%
 - nickel alloys are heat-treated to prevent SCC
 - materials assessed for IASCC and void swelling
 - satisfying ASME Code, Section III, Subsection NG rules
- No open items

Overview of Bellefonte COL Chapter 4 - Reactor

FSAR Section		Summary of Departures/Supplements
4.1	Summary Description	Completely IBR*
4.2	Fuel System Design	Completely IBR
4.3	Nuclear Design	Completely IBR
4.4	Thermal and Hydraulic Design	IBR with STD COL 4.4-2
4.5	Reactor Materials	Completely IBR
4.6	Functional Design of Reactivity Control System	Completely IBR

* IBR - incorporated by reference

Technical Topics of Interest, BLN COL

- AP1000 COL Information item 4.4-2
Upon selection of the actual instrumentation, the COL Holder shall calculate the instrumentation uncertainties of the operating parameters and confirm the validity of the design-limit DNBR.
- STD COL 4.4-2:

“Following selection of actual plant operating instrumentation and calculation of the instrumentation uncertainties of the operating plant parameters, the design DNBR will be calculated using the RTDP with these instrumentation uncertainties and confirm that the design limit DNBR values as described in DCD Section 4.4 remain valid or that the safety analysis minimum DNBR bounds the new design limit DNBR values plus DNBR penalties, such as rod bow penalty. This will be completed prior to fuel load.”
- Part 10, License Condition 2, Item 4.4-2
Applicant proposed a license condition which will require the completion of the actions described in STD COL 4.4-2 prior to initial fuel load.