

PMBelCOL PEmails

From: Huang, Jason
Sent: Monday, July 13, 2009 4:56 PM
To: richard.grumbir@excelservices.com; sisk1rb@westinghouse.com
Cc: McKenna, Eileen; Coffin, Stephanie
Subject: ACRS AP1000 DCD and BLN RCOL Slides
Attachments: ACRS AP1000 DCD&RCOLA SER Ch1 rev 1.ppt; ACRS AP1000 DCD&RCOLA SER Ch5.ppt; ACRS AP1000 DCD&RCOLA SER Ch10 7-13-09 .ppt; ACRS AP1000 DCD&RCOLA SER Ch11 SlidesRev1.ppt; ACRS AP1000 DCD&RCOLA SER Ch12 Slides Rev DR final.ppt; ACRS AP1000 DCD&RCOLA SER Ch14 Rev 4.ppt; ACRS AP1000 DCD&RCOLA SER Ch16_7_13_09.ppt; ACRS AP1000 DCD&RCOLA SER Ch17 0713 with editorial changes.ppt; ACRS AP1000 DCD&RCOLA SER Ch19-formatted1_rev4.ppt; ACRS AP1000 DCD&RCOLA SER initial presentation.ppt; ACRS AP1000 DCD&RCOLA SER Ch4 R1 with BA changes.ppt

Please find attached the ACRS AP1000 DCD and BLN RCOL Slides. These are draft slides which will be undergoing changes over the week.

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Hearing Identifier: Bellefonte_COL_Public_EX
Email Number: 1602

Mail Envelope Properties (Jason.Huang@nrc.gov20090713165600)

Subject: ACRS AP1000 DCD and BLN RCOL Slides
Sent Date: 7/13/2009 4:56:04 PM
Received Date: 7/13/2009 4:56:00 PM
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Post Office:

Files	Size	Date & Time
MESSAGE	212	7/13/2009 4:56:00 PM
ACRS AP1000 DCD&RCOLA SER Ch1 rev 1.ppt	294906	
ACRS AP1000 DCD&RCOLA SER Ch5.ppt	286202	
ACRS AP1000 DCD&RCOLA SER Ch10 7-13-09 .ppt	225786	
ACRS AP1000 DCD&RCOLA SER Ch11 SlidesRev1.ppt	672762	
ACRS AP1000 DCD&RCOLA SER Ch12 Slides Rev DR final.ppt	657402	
ACRS AP1000 DCD&RCOLA SER Ch14 Rev 4.ppt	483834	
ACRS AP1000 DCD&RCOLA SER Ch16_7_13_09.ppt	240634	
ACRS AP1000 DCD&RCOLA SER Ch17 0713 with editorial changes.ppt	251386	
ACRS AP1000 DCD&RCOLA SER Ch19-formatted1_rev4.ppt	243194	
ACRS AP1000 DCD&RCOLA SER initial presentation.ppt	344058	
ACRS AP1000 DCD&RCOLA SER Ch4 R1 with BA changes.ppt	288762	

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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

AP1000 DCA Chapter 1 – Organization

- Historical
 - Chronology, Key References
- Summary
 - Design Features/Changes, Open/Confirmatory/Action Items
- Generic
 - Metrification, Requests for Additional Information, SAMDAs, Editorial/Conforming Changes, Regulatory Guides and Criteria

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



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 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	-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)	-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	- 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

AP1000 DCA – Section 5.2.1.2

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.

AP1000 DCA – Section 5.2.3

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.

AP1000 DCA – Section 5.3.3

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)

AP1000 DCA – Section 5.4.1.1

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).

AP1000 DCA – Section 5.4.1

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 PTS 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

STD COL 5.2-2

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

STD COL 5.3-1

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

STD COL 5.3-2

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

STD COL 5.3-4

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

STD COL 5.4-1

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



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 (SPC) 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 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

AP1000 DCA – Section 10.2.2

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

AP1000 DCA – Section 10.2.3

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 Mssile 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 10.4-2 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

- **STD COL 10.1-1** Erosion-corrosion monitoring program (SER Section 10.1)
- **STD COL 10.2-1** Turbine maintenance and inspection program (SER Section 10.2)
- **BLN COL 10.4-2** Oxygen scavenger and pH control (SER Section 10.4.7)
- **BLN COL 10.4-1** Circulating water system (SER Section 10.4.5)

STD COL 10.1-1

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

STD COL 10.2-1

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 has a license condition to provide the program prior to fuel load
 - No open items

Circulating Water System

- BLN COL & CDI:
 - BLN COL 10.4.1:

The applicant provided circulating water system (CWS) design parameters to address COL information item in Section 10.4.12.1 of AP1000 DCD
 - BLN CDI:

The applicant provided site specific design information in BLN CDI to replace the CDI in Section 10.4.5 of the AP1000 DCD
- Staff Evaluation:
 - Acceptable because the COL item and CDI have no regulatory significance
- No open items



Presentation to the ACRS Subcommittee

Safety Review of AP1000 Design Certification &
Reference Combined License Application

Chapter 11

“Radioactive Waste Management”

July 23, 2009

**ACRS Subcommittee Presentation
AP1000 DCD & R-COLA Safety Review
Chapter 11**

Technical Review Team

Steven Schaffer, Health Physicists (Lead)

Joshua Wilson, Radwaste System Engineer

Douglas Dodson, Radwaste System Engineer

Project Management

Serita Sanders, AP1000 DCD

Ravindra Joshi, Bellefonte R-COLA

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

AP1000 DCD

SER 11.2 Technical Topics of Interest

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

AP1000 DCD

SER 11.3 Technical Topics of Interest

Gaseous Waste Management System

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

AP1000 DCD

SER 11.5 Technical Topics of Interest

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

R-COLA 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 applicants doses to be conservative

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

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	0.157
		all	skin	15	0.957	0.0507
	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)
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)

R-COLA

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

R-COLA

SER 11.4 Technical Topics of Interest

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

R-COLA

SER 11.5 Technical Topics of Interest

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



Presentation to the ACRS Subcommittee

Safety Review of AP1000 Design Certification &
Reference Combined License Application

Chapter 12

“Radiation Protection”

July 23, 2009

**ACRS Subcommittee Presentation
AP1000 DCD & R-COLA Safety Review
Chapter 12**

Technical Review Team

Edward Roach, Sr. Health Physicist

Steven Schaffer, Health Physicist

Project Management

Serita Sanders, AP1000 DCD

Ravindra Joshi, Bellefonte R-COLA

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

AP1000 DCD

SER 12.2 Technical Topics of Interest

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

AP1000 DCD

SER 12.3 Technical Topics of Interest

Radiation Sources

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

AP1000 DCD

SER 12.4 Technical Topics of Interest

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

AP1000 DCD

SER 12.5 Technical Topics of Interest

Dose Assessment

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

AP1000 DCD

SER 12.6 Technical Topics of Interest

Health Physics Facilities Design

- Spent Fuel handling and dose
- 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

R-COLA Chapter 12 – Radiation Protection

Staff performed the following review and analysis:

- Confirmed commitment to ALARA policy
- Confirmed appropriate exposure pathways
- 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
- Performed an independent dose assessment for liquid waste monitoring tank showing the applicants doses to be conservative

R-COLA

SER 12.1 Technical Topics of Interest

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

R-COLA

SER 12.3 Technical Topics of Interest

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

R-COLA

SER 12.4 Technical Topics of Interest

Dose Assessment

- Use of program to minimize exposure to construction workers during Unit 4 construction.
 - MEI 7.7 mrem per year
 - Collective dose 1.13 person-rem
- One open item

R-COLA

SER 12.5 Technical Topics of Interest

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



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**

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
- Project Managers
 - David Jaffe, Senior Project Manager, DCA Review
 - Manny Comar, Senior Project Manager, BLN COL Review

Overview of DCA and COL

SRP Section/Application 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
14.3	Tier 1 Information	1	?
14.4	Combined License Applicant Responsibilities	2	IBR with supplements – 6 open items
Totals		3	?

Overview of AP1000 DCA Chapter 14 - Initial Test Programs

DCD Section		Summary of Changes to DCA*
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
14.2.9	Preoperational Test Abstracts	-Changes to selected test abstracts

* Staff is continuing to review changes in Revision 17 and later

Technical Topics of Interest

- Westinghouse requested closure of AP1000 COL Information Item 14.4-2, “Test Specifications and Procedures,” based on information provided in APP-GW-GLR-037 (TR-71A), Revision 1 (SER Section 14.4.1)
- Westinghouse requested closure of AP1000 COL Information Item 14.4-3, “Conduct of Test Program,” based on information provided in APP-GW-GLR-038 (TR-71B), Revision 2 (SER Section 14.4.2)
- Clarified test requirements applicability to COL holder rather than COL applicant based on the information provided in APP-GW-GLR-021, (TR-6), Revision 1 (SER Section 14.4.3)

AP1000 DCA – Section 14.4.1

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 – IBR conflict
 - 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)

AP1000 DCA – Section 14.4.2

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 – IBR conflict
 - 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)

AP1000 DCA – Section 14.4.3

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
14.2	Initial test Program	-STD SUP 14.2-1 Test Program Schedule
14.4	COL Applicant Responsibilities	<ul style="list-style-type: none"> -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

- **STD COL 14.4-2** Methodology for test specifications and test procedures development (SER Section 14.2.3)
- **STD COL 14.4-3** Administrative controls for site-specific startup administrative manual (SAM) (SER Section 14.2.3)
- **STD COL 14.4-5** Interface requirements (SER Section 14.2.9)

STD COL 14.4-2

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 (COLA Part 10 License Condition 6)
- No open items related to SAR

STD COL 14.4-3

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 (COLA Part 10 License Condition 8)
- No open items related to SAR

STD COL 14.4-5

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

Overview of Proposed License Conditions for the Initial Test Program

License Condition #		Summary of License Condition	Open Item
2	COL Holder Items	<ul style="list-style-type: none"> -14.4-2 Test Specifications and Procedures -14.4-3 Conduct of Test Program -14.4-4 Review and Evaluation of Test Results -14.4-6 First-Plant-Only and Three-Plant-Only Tests 	4
3	Operational Program Implementation	<ul style="list-style-type: none"> -Item E. Construction Testing -Item F. Preoperational Testing -Item H. Startup Testing 	1
6	Operational Program Readiness	<ul style="list-style-type: none"> -Submittal of Schedule - Includes submittal of test specifications and procedures to NRC onsite inspectors 	1
8	Startup Testing	-Controls changes to the initial test program described in Chapter 14 of the FSAR	0

Conclusion

- BLN COL FSAR Initial Test Program
 - The staff finds initial test program description acceptable
 - Proposed License Conditions related to the initial test program are still under review
- Discussion/Committee Questions



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
 - **Bob Tjader**: Lead Reviewer, Technical Specifications Branch (CTSB), Division of Construction, Inspection, & Operational Programs (DCIP)
Malcolm Patterson, PRA Licensing, Operations Support, & Maintenance Branch 1
 - **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
- 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

RAI Status Summary, DCA

- Original number of RAIs 76
- Number of RAIs resolved 66
- Number of Open Items 10

Open Issues, DCA

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

*briefly discuss

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

Significant Open Issues, BLN

- Setpoint Control Program (SCP)
 - DCD generic TS does not contain as option for Applicants
 - SCP must be in Admin Controls Tech Spec Program identifying setpoint methodology
- BLN Does not adopt SCP, intends to adopt generic design cert instrumentation & GTS, confirming values post installation

Chapter 16 COL Action Item

- COL Action Item 16.2-1 (COL Information Item 16.1-1): Replace information in brackets with valid plant specific information suitable for plant operation (DC/COL-ISG-08), for example:
 - PTS 3.3.1 & 3.3.2, adopt GTS Setpoints & Allowable Values (use ITAAC to confirm values?)
 - PTS 4.1, 4.1.1, & 4.1.2, site location/boundary information provided
 - PTS 5.1.1, 5.1.2, 5.2.1.a, & 5.2.1.b, plant specific position titles provided

Discussion/Committee Questions

Technical Topics of Interest

- **AP1000 DCD** Section 16.2 refers to Section 17.4
- **BLN COL FSAR** Section 16.2: IBR

Technical Topics of Interest

- **AP1000 DCD** Section 16.3
little changed from DC
- Original staff evaluation documented
in Chapter 22, “RTNSS”
- **BLN COL FSAR**
IBR with supplemental information

Conclusion

- The AP1000 DCA Section 16.2 is unchanged; the BLN COL FSAR IBR and provides an appropriate supplement.
- The AP1000 DCA Section 16.3 changes are editorial or are merely to conform to changes approved elsewhere. The FSAR incorporates them and applies adequate availability controls.



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
 - **Malcolm Patterson**, Reviewer
PRA Licensing, Operations Support, & Maintenance Branch 1
- 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	IBR No OI
17.4	Design Reliability Assurance Program	1	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		2	9

Overview of AP1000 DCA Chapter 17 - QA Program Description

DCD Section		Summary of Changes to DCA
17.3	Quality Assurance During the Design Phase	Proposed use of Westinghouse Quality Management System (QMS) Rev. 5, for AP1000

Technical Topics of Interest

- Westinghouse QMS Revision 5
- NRC Inspection of Implementation of QMS

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.

QMS Implementation Inspection

- NRC Inspection of Westinghouse implementation of QMS, Rev. 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	IBR BNL COL 17.5-1 QAP prior to COL issuance 3 Open Items
17.2	QA During Design and Construction	IBR
17.3	QA Program Description	IBR
17.5	QA Program Description – Design Certification, Early Site Permits, and 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 6 Open Items

Technical Topics of Interest

- BNL COL 17.5-1 QAP prior to and following COL
- Nuclear Energy Institute (NEI) 06-14, “Template for Quality Assurance Program Description,” April 2007
- QA Implementation Inspections

BNL COL 17.5-1 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

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

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	1 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 Section 17.4

- 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 (continued)

BLN COL FSAR Section 17.4

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

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 inclusion for RAW
- D-RAP ITAAC improved

Changes in D-RAP (continued)

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

AP1000 DCD does not address MR program

BLN COL FSAR Section 17.6

- Incorporates NEI 07-02A
 - “Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed under 10 CFR Part 52”
- Provides schedule for implementation
- Describes support for post-COL changes to the scope of the maintenance rule

Conclusion—Sections 17.4 & 17.6

AP1000 DCA

- D-RAP scope is sufficient
- D-RAP ITAAC is improved

BLN COL FSAR

- Plant-specific D-RAP scope: no additional SSCs
- Plant-specific RAP programs are identified
- Maintenance rule program addressed

Questions?



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**
PRA Licensing, Operations Support, & Maintenance Branch 1
 - ♦ **Mark Melnicoff**
PRA Licensing, Operations Support, & Maintenance Branch 1
- **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—reviewed changes only
 - ♦ Severe accident topics
 - ♦ Fire PRA
 - ♦ Seismic margins analysis
 - ♦ External events
 - ♦ Results and insights

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	0	2
19.59	PRA Results and Insights	7	1
Totals		9	3

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 (DCD internal reference)	0	IBR

Objectives of Review

AP1000 DCD

- PRA upgrade/update successful?
- New insights?
- RTNSS still appropriate?
- Requirements updated?
 - ◆ ITAAC
 - ◆ D-RAP scope
 - ◆ Tech Specs
- FSER safety conclusion still valid?

Technical Topics of Interest

AP1000 DCD

- Design changes
- PRA audit
- HRHF change to GMRS
- Ancillary equipment (FSER Chapter 22)
- Part 52 change:
Description of PRA and report of results

Technical Topics of Interest

AP1000 DCD Section 19.55

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

BLN COL FSAR Section 19.55

- ◆ IBR

Technical Topics of Interest

AP1000 DCD Section 19.58 “Generic Site”

BLN COL FSAR Section 19.58

- summary of external events
- high winds
- floods
- transportation and other external events

Technical Topics of Interest

AP1000 DCD Section 19.59

- reactor coolant pumps
- reactor vessel insulation system
- equipment survivability (H2 monitors)
- PRA configuration controls during design

BLN COL FSAR Section 19.59

- PRA configuration controls after licensing

PRA Audit

- PRA upgrade and updated
- integration with the design process
- conversion process (CAFTA)
- qualifications
- corrective action program



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**
 - In general based on revision 1 of the application dated January 21, 2009
 - Incorporates by Reference Westinghouse DCD revision 17
 - Six phase review schedule
 - Reference COL transitioning to Vogtle

**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 NUREG supplement
 - Standard COL content
 - Staff evaluation of RCOL application will apply to all SCOL applications, as appropriate
 - Site-specific COL content
 - Staff evaluation of RCOL application applies 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 outstanding 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**



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

- Technical Staff
 - **David Terao**, Chief, Component Integrity, Performance and Testing Branch 1 (Division of Engineering)
 - **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 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 specs to include additional materials
4.6	Functional Design of Reactivity Control System	No major changes

Technical Topics of Interest

- Changes to gray rod control assembly design (SER Sections 4.2 and 4.3)
- Addition of borosilicate glass burnable absorber rods (SER Section 4.2)
- Deletion of COL Items 4.2-1, 4.3-1, and 4.4-1
- Revised criticality design method outside reactor (SER Section 4.3)
- Change of COL Item 4.4-2 to COL Holder's item (SER Section 4.4)
- Changes to control rod drive structural materials (SER Section 4.5.1)
- Changes to reactor internals and core support materials (SER Section 4.5.2)

AP1000 DCA – Section 4.2

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.

AP1000 DCA – Section 4.2

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.

AP1000 DCD – Section 4.2

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

AP1000 DCA – Section 4.3

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.

AP1000 DCA – Section 4.4

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

AP1000 DCA – Section 4.5.1

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.

AP1000 DCA – Section 4.5.2

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 - STD COL 4.4-2

- 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.