November 17, 2005

ORGANIZATION: General Electric Nuclear Energy (GE)

PROJECT: Economic and Simplified Boiling Water Reactor (ESBWR) Design Certification

SUBJECT: SUMMARY OF MEETINGS HELD ON SEPTEMBER 27, 28, AND 29, 2005, REGARDING THE ESBWR DESIGN CERTIFICATION APPLICATION

The Nuclear Regulatory Commission (NRC) hosted public meetings with General Electric Nuclear Energy (GE) on September 27, 28, and 29, 2005, at NRC Headquarters to discuss GE's ESBWR design certification application. A list of attendees is provided as Enclosure 1. Enclosure 2 contains the agenda for the meeting.

GE provided handouts during the meeting which can be accessed through the Agencywide Documents Access and Management System (ADAMS). This system provides text and image files of NRC's publicly available documents. The handouts mentioned above may be accessed through the ADAMS system under Accession No. ML052840003. If you do not have access to ADAMS or if there are problems in accessing the handouts located in ADAMS, contact the NRC Public Document Room (PDR) Reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr@nrc.gov. A summary of the meeting is included below.

By letter dated August 24, 2005, GE submitted an application for final design approval and standard design certification of the ESBWR standard plant design. The purpose of the meeting was for GE to provide an overview of the application. A detailed summary of the meeting is provided in Enclosure 3.

/RA/

Amy E. Cubbage, ESBWR Project Manager
New Reactor Licensing Branch
Division of New Reactor Licensing
Office of Nuclear Reactor Regulation

Project No. 717

Enclosures: As stated

cc w/encls: See next page

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NAME	ACubbage	LDudes
DATE	11/16/2005	11/8/2005

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EThrom
RPalla
GParry
ADrozd
SBasu
FMReinhart
MWoods
JCalvo

ATTENDEES FOR MEETING WITH GENERAL ELECTRIC
ESBWR DESIGN CERTIFICATION
SEPTEMBER 27, 28, AND 29, 2005

Name	Title	Affiliation
Kirsi Alm-Lytz	Foreign Assignee	NRC/NRR/IPSB
Jerry Deaver	Engineering Lead	GE
Guy Cesare	Licensing Engineer	NuState/Enercon
Mark Hartzman	Sr. Mechanical Engineer	NRR/DE/EMEB
John Huang	Sr. Mechanical Engineer	NRR/DE/EMEB
Bob Youngblood	Vice President	ISL
Thomas Cheng	Sr. Structural Engineer	NRR/DE/EMEB
John Tsao	Materials Engineer	NRR/DE/EMCB
Zahim Cruz Perez	General Engineer	NRR/DE/EMEB
John Wu	Mechanical Engineer	NRR/DE/EMEB
Pete Yarsky	General Engineer	NRR/DSSA/SRXB
See Meng Wong	Sr. Reactor Analyst	NRR/DSSA/SPSB
Arnold Lee	Mechanical Engineer	NRR/DE/EMEB
Y. C. Li	Sr. Mechanical Engineer	NRR/DE/EMEB
Sam Lee	Section Chief	NRR/DRIP/RLEP
Russ Fawcett	Manager, Core Fuel	GNF-A
Jim Strnisha	Mechanical Engineer	NRR/DE/EMEB
John Honcharik	Materials Engineer	NRR/DE/EMCB
Neil Ray	Materials Engineer	NRR/DE/EMCB
George Stramback	Manager	GE Regulatory Services
Ted Sullivan	Senior Level Advisor	NRC/NRR/DE/EMCB
Patrick Sekerak	Reactor Operations Engineer	NRR/DIPM/IIPB
J. H. Raval	Reactor Systems Engineer	NRR/DSSA
Harold Walker	Sr. Reactor Systems Engineer	NRR/DSSA
Brian Lee	General Engineer	NRR/DSSA

Name	Title	Affiliation
Yamir Diaz-Castillo	Chemical Engineer	NRR/DE/EMCB
Jim Pulsipher	Reactor Systems Engineer	NRR/DSSA/SPSB
George Thomas	Reactor Systems Engineer	NRR/DSSA/SRXB
C. Craig Harbuck	Senior Reactor Engineer	NRR/DIPM/IROB/TSS
Larry Rossbach	Project Manager	NRR/DRIP/RNRP
W. Beckner	Program Director	NRR/DRIP/RNRP
John Fair	Sr. Mechanical Engineer	NRR/DE/EMEB
Gary Hammer	Mechanical Engineer	NRR/DE/EMEB
Aida Rivera	Operations Engineer	NRR/DIPM/IPSB
Jason Jennings	Operations Engineer	NRR/DIPM/IIPB
Marie Pohida	Sr. PRA Analyst	NRR/DSSA/SPSB
Jim Danna	Section Chief (new reactors)	NRR/RES
Raeann Shane	Congressional Affairs Officer	OCA
N. K. Trehan	Electrical Engineer	NRR/DE/EEIB
John N. Ridgely	Sr. Risk/Rel. Engineer	NRC/RES/DRAA
Tom Martin	D/DPR/DSSA	NRR
Chang Li	Sr. Engineer	NRR/SPLB
Cathy Haney	Dep. Dir./DLPM	NRR/DLPM
Charles Ader	Division Director, DRAA	RES
Allen Howe	NRR/EEIB	NRR/EEIB
Patrick Baranowsky	Branch Chief	RES
Kamal Naidu	Reactor Engineer	NRR/DIPM
Michael Weber	Deputy Director, NSIR	NSIR
Patricia L. Campbell	Attorney	Morgan Lewis
Amy Cubbage	NRC PM	NRC/NRR/DRIP/RNRP
Eric Oesterle	NRC PM	DRIP/RNRP
Joe Williams	NRC PM	NRC/NRR/DRIP/RNRP

Name	Title	Affiliation
Peter Yarsky	Reviewer	NRC/NRR/DSSA/SRXB
Jujit Jamaddan	Reviewer	NRC/NRR/DE
Mike Case	Division Director	NRR/DIPM
William Poertner	Engineer	NRR/EMEB
Russ Wells	Chief Engineer	Parallax
Andromahe Zografos	General Engineer	DE/EEIB-A
Kendra Klump	General Scientist, NSPDP	NRR/DRIP
David Allsopp	General Engineer	NRR/DIPM
Don Hickman	Sr. Nuclear Engineer	NRR/DIPM
G. S. Bede	Mechanical Engineer	NRR/DE
Hugh Upton	Lead Designer, ESBWR	GE
Joseph Colaccino	Senior PM	NRC
Jack Grobe	Director	NRR/Division of Comp. Integ
Jerry Wilson	Sr. Policy Analyst	NRR/DRIP
Roger Pedersen	Sr. Health Physics	NRR/DIPM
Gregory Suber	PM	NRR/APPT
Louis Quintana	GE Licensing Director	GE
John Hannon	NRR/DSSA BC	NRC
Jorge Hernandez	NRR/DSSA/SPLB	NRC
Charles Brinkman	Director, Wash. Ops.	Westinghouse
Liang-Bin Lai	Trainee	NRR
David Fischer	Reviewer	NRC/NRR/EMEB
Mark Beaumont	Visitor	Westinghouse
Lauren Quinones	Project Manager	NRR/RNRP
Cedric Jube	Senior Project Engineer	NEI
Steven Hucik	Manager, New Plant Projects	GE Nuclear Energy
Rick Wachowiak	ESBWR PRA Lead	GE

Name	Title	Affiliation
Alan Beard	Program Manager	GE Nuclear
David Hinds	Manager, ESBWR	GE
Pei-Ying Chen	Reviewer	NRC/NRR/EMEB
Alan Levin	Visitor	Framatome, ANP
David Roth	Reviewer	NRC/DIPM/IROB/TSS
Bob Tjader	Reviewer	NRR/DIPM/IROB-A
Pete Hearn	Reviewer	NRR/DIPM/IROB/TSS
Jared Wermiel	Branch Chief	NRR/DSSA/SRXB
Cindi Carpenter	Director	NRR/PMAS
Bruce Boger	Division Director	NRR/DIPM
Carl Paperiello	Director	RES
Kerri Kavanagh	Reviewer	NRR/DIPM/IPSB
Charles S. Hinson	Reviewer	NRR/DIPM
Dave Solorio	Section Chief	NRR/DSSA/SPLB
John Thorp	PM	NRR/DRIP/RNRP
Rich Barrett	Division Director	RES/DET
Nick Saltos	Reviewer	NRR/DSSA/SPSB
Jared Nadel	Region IV	RIV/DRS
John Tsao	Reviewer	DE/EMCB
Royce Beacom	Electronics Engineer	DE/EEIB
Undine Shoop	Senior Tech Comm. Assistant	OEDO
Jim Lyons	Director	NRR/DSSA
B. P. Jain	Project Manager	RES/DET
Matt Chiramal	Sr. Advisor	NRC/NRR/DE/EEIB
Carl Schulten	Sr. Reactor Engineer	NRC/NRR/DIPM/IROB/TSS
Tom Jenkins	C & I Engineer	GE
Fred Chao	Primary Engineer	COL-GE

Name	Title	Affiliation
Gary Armstrong, Jr.	Human Factors Engineer	NRC/NRR/DIPM/IROB
Kamishan Martin	Human Factors Engineer	NRC/NRR/DIPM/IROB
Jim Meyer	Manager-Nuclear Sys.	ISL, Inc.
Naeem Iqbal	Fire Protection Engineer	NRR/DSSA/SPLB
Jin-Sien Guo	Reactor Systems Engineer	NRR/DSSA/SPLB
Steven Jones	Section Chief, POB Section	NRR/DSSA/SPLB
Wayne Marquino	Team Lead, ESBWR Performance	GE Energy
Erik Kinstien	Engineer	GENE-via phone 9/28
Sara Bernal	General Engineer	NRR/DIPM/Tech Specs
Mohammad Razzaque	Engineer	NRR/DSSA/SRXB
Ralph Landry	Sr. Reactor Engineer	NRR/DSSA/SRXB
Edward D. Throm	Sr. Reactor Engineer	NRC/RES
Jim Han	Sr. Reactor Systems Engineer	NRC/RES
Bob Palla	Sr. Reactor Engineer	NRR/DSSA/SPSB
Jim Fulford	Consultant	ISL
Gareth Parry	Senior Advisor for PRA	NRR/DSSA
Andrew Howe	Sr. Reliability and Risk Analyst	NRR/DSSA
Andrzej Drozd	Sr. Reactor Engineer	NRR/DSSA
Sud Basu	Research Engineer	NRC/RES
Mark Reinhart	Section Chief	NRC/NRR/DSSA/SPSB
Mike Woods	Attorney	NRC/OGC
Jose Calvo	Branch Chief	NRC/EEIB

AGENDA FOR PUBLIC MEETINGS WITH GENERAL ELECTRIC
ESBWR DESIGN CERTIFICATION
SEPTEMBER 27, 28, AND 29, 2005

Time	Location	Topic	Presenter
Day 1			
9:30 - 11:00	Commission Hearing Rm, O1-G16	Executive Presentation ESBWR Design Overview	GE Hinds/Beard
11:00 - 12:00	Commission Hearing Rm, O1-G16	Probabilistic Risk Assessment (PRA) and Severe Accident Overview	GE Wachowiak
12:00 – 1:00		Lunch	
1:00 – 3:00	Room T8-A1	DCD Chapter 3 Design of Structures Systems and Components (SSCs) DCD Chapter 4 Reactor Systems	GE Deaver/Upton/ Fawcett
3:00 – 3:15		Break	
3:15 – 5:00	Room T8-A1	DCD Chapter 5 Reactor Systems DCD Chapter 6 Engineered Safety Features Loss of Coolant Accident Analysis	GE Deaver Marquino
Day 2			
8:30 – 10:15	Room T8-A1	DCD Chapter 7 Instrumentation & Control DCD Chapter 18 Human Factors Engineering	GE Chao/Jenkins
10:15 – 10:30		Break	
10:30 – 12:00	Room T8-A1	DCD Chapter 8, Electrical Systems DCD Chapter 9 Auxiliary Systems DCD Chapter 10 Turbine Generator	GE Upton
12:00 – 1:00		Lunch	
1:00 – 1:30	Room O4-B6	DCD Chapter 11 Rad Waste DCD Chapter 12 Radiation Protection DCD Chapter 13 Conduct of Operations DCD Chapter 14 Test Programs	GE Beard/Upton
1:30 – 2:45	Room O4-B6	DCD Chapter 15 Accident Analysis	GE Marquino
2:45 – 3:00		Break	
3:00 – 4:00	Room O4-B6	DCD Chapter 15 Accident Analysis (continued)	GE Marquino
4:00 – 5:00	Room O4-B6	DCD Chapter 16 Technical Specifications Tier 1 Certified Design Material	GE Beard

Enclosure 2

Time	Location	Topic	Presenter
Day 3			
8:30 – 10:00	Room T8-A1	Follow-up from Days 1 and 2	GE All
10:00 – 10:15		Break	
10:15 – 12:00	Room T8-A1	Follow-up from Days 1 and 2 (continued)	GE All
12:00 – 1:00		Lunch	
1:00 – 2:45	Room T9-A1	Probabilistic Risk Assessment (PRA) and Severe Accidents	GE Wachowiak
2:45 – 3:00		Break	
3:00 – 5:00	Room T9-A1	Probabilistic Risk Assessment (PRA) and Severe Accidents (continued)	GE Wachowiak

SUMMARY OF PUBLIC MEETINGS WITH GENERAL ELECTRIC (GE)
REGARDING ESBWR DESIGN CERTIFICATION
SEPTEMBER 27, 28, AND 29, 2005

September 27, 2005

Executive Design Overview

Mr. Steven Hucik, General Manager of New Plant Projects (GE), provided introductory remarks for GE. He discussed the boiling water reactor (BWR) design evolution from the early BWRs to the advanced boiling water reactor (ABWR), the simplified boiling water reactor (SBWR) and the ESBWR design. He also discussed GE's experience with the operating Kashiwazaki Kariwa (K6 and K7) Units in Japan and the two Lungmen ABWR units under construction in Taiwan.

Mr. David Hinds, Engineering Manager for ESBWR (GE), provided a high level overview of the format and content of the ESBWR design certification application. He also discussed the basic plant parameters, site parameters, and site plan for the ESBWR which is a 4,500 MWth (1,550 MWe gross) plant design using natural circulation and passive safety systems.

Mr. Alan Beard, GE, provided a more detailed design overview of the ESBWR. The presentation highlighted the unique aspects of the ESBWR as compared to operating BWRs and the ABWR design, including the use of natural circulation and passive safety systems. He provided an overview of the passive systems including the gravity driven cooling system (GDCS), the isolation condenser system (ICS), the passive containment cooling system (PCCS), and the standby liquid control system (SLCS). He discussed the four safety-related divisions of electrical power and the digital instrumentation and control system, including the reactor protection system (RPS) and engineered safety features (ESF) logic. He also described the ESBWR plant response to abnormal operational occurrences (AOOs) and loss-of-coolant accidents (LOCAs).

PRA and Severe Accident Overview

Mr. Richard Wachowiak, GE, provided an overview of the ESBWR probabilistic risk assessment (PRA) and severe accident response. Mr. Wachowiak discussed the scope of the PRA and the contents of ESBWR PRA report, NEDC-33201P. He presented the results of the ESBWR PRA and provided a discussion of how the reduced core damage frequency was achieved through redundancy and diversity in the design. He also discussed the design and function of the basemat internal melt arrest and coolability (BiMAC) system which is a severe accident mitigation design feature. The staff asked if the BiMAC system was credited in the severe accident analysis, and GE responded that it was. The staff indicated that the design of the BiMAC system should be described in Tier 2 of the ESBWR design control document (DCD) and that the system should be considered for inclusion in the regulatory treatment of non-safety systems (RTNSS) process.

Overview of DCD Chapter 3, "Design of Structures, Components, Equipment and Systems"

GE provided an overview of the ESBWR structural design. The presentation covered the following topics:

- Wind and tornado loadings
- External flooding
- Internal flooding
- Missile Protection
- Seismic design

The staff had several questions in the seismic design area. The staff asked whether GE used a coupled analysis of the reactor building and control building, and whether these buildings were "tied" together structurally. The staff asked whether the same methods were used by GE for the Category II seismic analyses as was used for Category I analyses. The staff asked for information about the "elastic half-space" program that GE used for seismic analysis. The staff asked whether diagonal rebar was used in the structures to resist sheer forces. It was agreed that a followup teleconference or meeting would be required to address the staff's questions in the seismic/structural area.

GE provided an overview of the following subjects related to the ESBWR reactor pressure vessel (RPV) and internals:

- Piping analysis
- Reactor internals vibration program including the chimney and steam dryer
- Motor operated valves

Regarding the subject of steam dryer structural integrity, the staff asked whether GE planned scale model testing of the steam dryer design. GE stated they are developing a plan that may include testing. Regarding inservice testing (IST) of pumps and valves, the staff informed GE that additional guidance was available in the standard review plan (SRP) regarding IST for check valves. The staff requested that GE state which specific code cases are applicable to which portions of the design rather than providing blanket lists of all codes and standards. The staff also asked GE to provide a copy of NEDE-24326-1-P, "GE Equipment Qualification Program," January 1983. This document was referenced in the DCD but the staff does not have a copy of this report.

Overview of DCD Chapter 4, "Reactor"

This presentation focused on the control rod drive (CRD) system. The overview of the ESBWR fuel and control blade design was presented on September 29.

GE described the function and major elements of the CRD system, the fine motion control rod drives (FMCRDs), the hydraulic control units (HCUs), and the CRD hydraulic system. The operating modes of the CRD systems are normal control rod insertion and withdrawal, scram, alternate rod insertion (ARI), and high pressure makeup.

Overview of DCD Chapter 5 "Reactor Coolant System (RCS) and Connected Systems"

GE provided an overview of the ESBWR RCS and connected systems including the nuclear boiler system (main steam system and feedwater system), the reactor water cleanup (RWCU/shutdown cooling (SDC) system, and the ICS. The major equipment in the nuclear boiler system are the main steam isolation valves, automatic depressurization system (ADS) valves (18) which include 10 safety relief valves and 8 depressurization valves (DPVs), safety valves (8), and feedwater isolation valves. GE described the safety related and non-safety related functions of the RWCU/SDC system and the modes of operation.

The staff asked if GE had conducted testing of the DPVs and requested that GE submit the test report. The staff asked what the delta P and temperature setpoints are for isolation of the filter demineralizers in the reactor water cleanup system (RWCU), and GE said they would respond later.

Overview of DCD Chapter 6, "Engineered Safety Features"

GE provided an overview of the ESBWR engineered safety features (ESF). The TRACG LOCA analyses were presented on September 29. GE described the design of the following ESFs, their functions, and their material properties:

- Containment system
- Passive containment cooling system (PCCS)
- Gravity driven cooling system (GDCS)
- Automatic depressurization system (ADS)
- Isolation condenser system (ICS)
- Standby liquid control system (SLCS)

<u>September 28, 2005</u>

Overview of DCD Chapter 7, "Instrumentation and Control Systems"

GE provided an overview of the ESBWR instrumentation and control (I&C) system. GE stated that most of the ESBWR I&C system design is based on the same design architect and system design concepts of the ABWR digital I&C systems. GE described the I&C features that were unique to ESBWR, for example the ESBWR has passive safety systems rather than active safety system but the I&C system structure and logic are similar. The ESBWR design includes a diverse protection system which is a new design feature to comply with Branch Technical Position (BTP) HICB-19. The diverse protection system uses separate and independent sensors, hardware and software, to scram the reactor and to initiate certain ESF systems as a diverse means from the primary reactor protection system (RPS) and the primary ESF system. The diverse protection system also includes alternate rod insertion (ARI) which is part of the anticipated transient without scram (ATWS) mitigation function. ARI is included in the ABWR design. GE described another new design feature, the gamma thermometer, which is an fixed-in-place in-core sensor, used for calibrating the in-core local power range monitors (LPRMs) as an alternative to the traversing in-core probe (TIP) system. The gamma thermometer has been tested in the Limerick plant and at two foreign reactors. GE submitted

NEDE-33197P, "Gamma Thermometer System for LPRM Calibration and Power Shape Monitoring," on September 16, 2005, which describes this instrument in more detail.

GE stated that DCD Chapter 7 will be revised to more clearly address IEEE Std. 603 (1998), BTP HICB-16, BTP HICB-12 and Regulatory Guide 1.105 regarding setpoint methodology, commercial-off-the-shelf (COTS) qualification, and software verification and validation. GE will also submit several topical reports regarding software life cycle process planning to address BTP HICB-14. These actions are to address issues raised in the staff's September 23, 2005, acceptance review letter.

Overview of DCD Chapter 18, "Human Factors Engineering"

GE provided an overview of the human factors engineering (HFE) program, design process and implementation process. GE stated that they are revising DCD Chapter 18 to conform with the current version of the standard review plan and NUREG 0711, revision 2, and to add additional details. GE also stated that they would submit several supporting topical reports including the HFE plan. These actions are to address issues raised in the staff's September 23, 2005, acceptance review letter.

Overview of DCD Chapters 8, "Electric Power"

GE provided and overview of the ESBWR electrical power system. The presentation addressed the following topics:

- Off-site AC power system
- On-site AC power system
- Medium voltage AC power system
- Low voltage AC power system
- Uninterruptible AC power supply (class 1E and non-class 1E)
- DC power system (class 1E and non-class 1E)
- Standby on-site SC power supply
- Load shedding and sequence on plant protection system (PIP) bus

The uninterruptible AC power supply (UPS) includes four divisions of class-1E power to safety-related motor operated valves (MOVs) and other safety-related loads. On loss of AC power, the UPS is powered by Class 1E batteries via Class 1E inverters. The Class 1E DC power system includes four separated divisions. Division 1 and 2 batteries are rated to supply safety related loads for 24 hours (control) and 72 hours (monitoring) following station blackout (SBO). Division 3 and 4 batteries are rated for 24 hours (monitoring and control).

Overview of DCD Chapter 9, "Auxiliary Systems"

This presentation covered the following areas:

- New fuel storage
- Spent fuel storage
- Fuel and auxiliary pools cooling system (FAPCS)
- Reactor component cooling water system

- Chilled water system
- Standby liquid control system (SLCS)
- HVAC systems (control building, reactor building, and fuel building)
- Emergency breathing air system (EBAS)
- Drywell cooling system
- Containment inerting system
- Fire protection system

The staff questioned the non-safety related classification of the spent fuel racks. The staff asked if any of the spent fuel pool piping was safety-related. The staff also asked if common-mode failures and drain down scenarios had been evaluated for the spent fuel pool. These questions were left for GE followup.

Regarding the control room HVAC and EBAS, the staff asked what functions (safety-related and non safety-related) were provided after 72 hours post-accident. The staff asked what control room leakage was assumed and if ASTM 741 testing would be conducted. The staff also asked what codes and standards are applicable to these systems. GE took these questions for followup action.

Overview of DCD Chapter 10, "Steam and Power Conversion System"

GE provided an overview of the steam and power conversion system including the turbine generator, turbine main steam system, main condenser, turbine bypass system and condensate and feedwater system. A unique feature of the ESBWR is that the system is designed with 110 percent bypass capability and the turbine generator can accept a sudden full load rejection with sufficient margin to overspeed trip. GE stated that DCD Appendix 10 A presents an alternate steam and power conversion system, and that there is no difference between the reference and alternate designs with respect to safety. The staff asked whether the main condenser is designed to withstand the safe shutdown earthquake (SSE) as it is credited for fission product holdup. This question was left for GE followup.

Overview of DCD Chapter 11, "Radioactive Waste Management," Chapter 12, "Radiation Protection," Chapter 13, "Conduct of Operations," and Chapter 14, "Initial test Program"

GE provided a brief overview of DCD Chapters 11, 12, 13, and 14. The staff had questions regarding radiation protection that GE took as action items, including a request for more detailed radiation zones (i.e. high radiation, very high radiation), and whether the technical support center (TSC) is considered a vital area and whether the TSC was designed for habitability comparable to the control room as specified in NUREG-0696, "Functional Criteria for Emergency Response Facilities." The staff and GE also discussed the issues regarding radiation protection that were identified in the staff's September 23, 2005 letter to GE regarding the ESBWR acceptance review.

Overview of DCD Chapter 15, "Safety Analyses"

GE provided an overview of the ESBWR safety analyses included in anticipated operational occurrences, infrequent events, accidents, special events including station blackout and ATWS, offsite dose and radiological assessment, and ESBWR event classification.

The staff requested a complete list of safety and non-safety related equipment that is credited in the safety analyses. The staff also asked GE to provide deterministic information in addition to the probabilistic justification for the classification of the infrequent events. GE took these questions as action items. The staff raised the question of whether an exemption is required for 50.62 because the ESBWR design does not have recirculation pumps. The staff took this as an action item.

Regarding the dose assessment, the staff requested additional information to justify that the 2.5 REM acceptance criteria is met for the events in the infrequent event category. This information should include source term, release pathways, and the methodology for the calculations.

The staff asked several questions regarding the details supporting GE's accident dose assessment analysis including the basis for the suppression pool decontamination factor (DF) of 10, the basis for assumptions regarding fission product removal in the PCCS, the assumptions regarding fission product holdup in the reactor building, the modeling of aerosol removal in the main steam lines and main condenser, and the drywell deposition assumptions. GE will respond to these questions when they respond to the issues raised in the staff's September 23, 2005, acceptance review letter.

Overview of DCD Chapter 16, "Technical Specifications" and DCD Tier 1

GE discussed how the technical specifications (TS) are based on the BWR 6 standard technical specifications, the ABWR TS in the I&C areas, and then customized to address new ESBWR-specific passive safety systems. GE indicated that some of the bracketed information in the TS could be filled in during the design certification review and that the remaining bracketed information would stay bracketed for the design certification. The staff requested that GE provide clarification as to which bracketed information is expected to change during the design certification review. GE also indicated that they recognize that a risk basis will have to be provided for some of the proposed allowed outage times. The staff informed GE that they will need to make sure that they have addressed the requirements necessary to implement some of the TS in NUREG-1434, "Standard Technical Specifications General Electric Plants, BWR/6 Specifications," for example, an approved methodology is needed for the pressure and temperature limits report (PTLR).

GE stated that they will likely revise the inspections, test, analysis and acceptance criteria (ITAAC) in Tier 1 of the DCD to follow the AP1000 basic system configuration approach, to remove ambiguity, to incorporate industry lessons learned, and to align with expected construction activities. The staff had a question about how the piping design acceptance criteria (DAC) were addressed in the ITAAC, and GE will provide additional information.

<u>September 29, 2005</u>

Overview of the ESBWR Fuel Design

GE presented information about the ESBWR fuel design which is a shorter version (10 foot vs. 12 foot) of the GE14 fuel design being used in some of the currently operating BWRs. In addition to the difference in overall length of the ESBWR bundle, the part length rods are

shortened and the spacer positions are slightly altered. There are no new materials in the ESBWR fuel bundle relative to GE14. There are 1132 fuel bundles and 269 control blades in the ESBWR core. The design uses an N-lattice which is also used in the ABWR. GE stated that they will provide justification that the ESBWR fuel is within the "envelope" of the GE14 fuel licensing basis and discussed the scope of work planned to provide this justification. The staff requested GE to address the different operating conditions (flow, pressure drop, and void fraction) of the ESBWR vs. operating BWRs in their justification.

GE stated that fuel melting is permitted for localized AOOs (rod withdrawal error). The staff questioned the basis for allowance of fuel melt for the rod withdrawal event, and GE will provide more information.

The staff questioned the applicability of the TGBLA code and the availability of applicable gamma scan data for the ESBWR fuel and stated that the issues with GE14 fuel for the operating reactor fleet will also need to be addressed for the ESBWR fuel.

Overview of the Loss of Coolant Accident Analysis

GE presented the ESBWR LOCA analysis performed with the TRACG thermal hydraulic computer code including the nodalization diagrams for the reactor pressure vessel and containment, the initial conditions and the summary of the results. Results were presented for the limiting break, the feedwater line break (FWLB). The results indicate that margin is provided to core uncovery, there is no core heatup, long term cooling is provided. These results are based on the use of only passive safety with no operator action required for the first 72-hour post accident.

The staff asked for additional information on how the area of the feedwater line break was established. GE committed to provide additional information including a detailed diagram of the break location. The staff also asked for additional information to explain the containment response to a FWLB vs. the main steam line break that was analyzed during the preapplication review and why the FWLB is now limiting. The staff also asked GE to justify the use of the Sparrow-Uchida correlation. Lastly, the staff requested additional information regarding the design of the PCCS vent in order to evaluate the hydrodynamic loads and the potential for steam bypass. GE will provide additional information to address these questions.

Overview of the PRA and Severe Accidents

GE provided an overview of the PRA and severe accident treatment which discussed in Chapter 19 of the DCD and NEDC-33201-P, "ESBWR Certification Probabilistic Risk Assessment." The following topics were addressed:

- Level 1 PRA
- Level 2 PRA
- Level 3 PRA
- Shutdown PRA
- External events
- Severe accident phenomena treatment
- Regulatory treatment of non-safety systems (RTNSS)

The staff asked how the thermal hydraulic success criteria were established, for example how did GE determine how many safety relief valves must open to maintain core cooling. GE responded that they would provide additional information to support the success criteria that were selected. The staff said that there should be a systematic approach to evaluating the success criteria for all sequences for all phases of the event. GE stated that they have made bounding conservative assumptions and that they would document their assumptions in a future revision of the PRA report. The staff also asked for clarification of the time frame considered in the PRA (i.e., 24 hours vs. 72 hours).

Regarding the shutdown PRA, GE stated that the shutdown events dominate the large release frequency (LRF) frequency because of the equipment hatch. GE is looking at how the equipment hatch can been addressed. The staff asked why modes 3 and 4 were not evaluated in the shutdown PRA. GE stated that this was discussed in the PRA report. The staff asked GE to evaluate special maintenance scenarios during shutdown including the potential use of freeze seals and to evaluate potential drain down paths. The staff also had questions about the fire risk during shutdown given that fire barriers could be breached during the refueling outage. GE stated that they would address this issue and determine which barriers are risk significant and may require compensatory measures when open. The staff asked GE to evaluate the need for RTNSS for equipment need to perform functions during shutdown such as shutdown cooling. GE was also asked to consider the risk associated with the containment being de-inerted during the refueling outage.

Regarding severe accident treatment, the staff had several questions regarding the BiMAC system. GE stated that the BiMAC system would now be considered a RTNSS system. The staff asked what the “containment worth” is without crediting the BiMAC system and GE said they would look into it. The staff also asked GE to provide the calculated water level at the time of vessel breach, and the staff asked GE to look at the core melt with respect to the lower drywell equipment and personnel hatches.

The staff requested GE to provide additional “cut sets” for the PRA, the focus PRA and the shutdown PRA. Specifically, the top 90 percent or top 200 cutsets per initiating event.

GE stated that they planned to provide revision of the PRA report at the end of October 2005 and the end of December 2005 to address the issues raised by the staff in this area.

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