U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-0847
Supplement 28

Safety Evaluation Report

Related to the Operation of Watts Bar Nuclear Plant, Unit 2

Docket Number 50-391

Tennessee Valley Authority

Office of Nuclear Reactor Regulation

AVAILABILITY OF REFERENCE MATERIALS IN NRC PUBLICATIONS

NRC Reference Material

As of November 1999, you may electronically access NUREG-series publications and other NRC records at NRC's Library at www.nrc.gov/reading-rm.html. Publicly released records include, to name a few, NUREG-series publications; *Federal Register* notices; applicant, licensee, and vendor documents and correspondence; NRC correspondence and internal memoranda; bulletins and information notices; inspection and investigative reports; licensee event reports; and Commission papers and their attachments.

NRC publications in the NUREG series, NRC regulations, and Title 10, "Energy," in the *Code of Federal Regulations* may also be purchased from one of these two sources.

1. **The Superintendent of Documents**
   U.S. Government Publishing Office
   Mail Stop IDCC
   Washington, DC 20402-0001
   Internet: bookstore.gpo.gov
   Telephone: (202) 512-1800
   Fax: (202) 512-2104

2. **The National Technical Information Service**
   5301 Shawnee Rd., Alexandria, VA 22312-0002
   www.ntis.gov
   1-800-553-6847 or, locally, (703) 605-6000

A single copy of each NRC draft report for comment is available free, to the extent of supply, upon written request as follows:

Address: **U.S. Nuclear Regulatory Commission**
Office of Administration
Publications Branch
Washington, DC 20555-0001
E-mail: distribution.resource@nrc.gov
Facsimile: (301) 415-2289

Some publications in the NUREG series that are posted at NRC's Web site address www.nrc.gov/reading-rm/doc-collections/nuregs are updated periodically and may differ from the last printed version. Although references to material found on a Web site bear the date the material was accessed, the material available on the date cited may subsequently be removed from the site.

Non-NRC Reference Material

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, transactions, *Federal Register* notices, Federal and State legislation, and congressional reports. Such documents as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings may be purchased from their sponsoring organization.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at—

The NRC Technical Library
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

These standards are available in the library for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from—

American National Standards Institute
11 West 42nd Street
New York, NY 10036-8002
www.ansi.org
(212) 642-4900

Legally binding regulatory requirements are stated only in laws; NRC regulations; licenses, including technical specifications; or orders, not in NUREG-series publications. The views expressed in contractor prepared publications in this series are not necessarily those of the NRC.

The NUREG series comprises (1) technical and administrative reports and books prepared by the staff (NUREG–XXXX) or agency contractors (NUREG/CR–XXXX), (2) proceedings of conferences (NUREG/CP–XXXX), (3) reports resulting from international agreements (NUREG/IA–XXXX), (4) brochures (NUREG/BR–XXXX), and (5) compilations of legal decisions and orders of the Commission and Atomic and Safety Licensing Boards and of Directors' decisions under Section 2.206 of NRC's regulations (NUREG–0750).

DISCLAIMER: Where the papers in these proceedings have been authored by contractors of the U.S. Government, neither the U.S. Government nor any agency thereof, nor any U.S. employee makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use or the results of such use, of any information, apparatus, product, or process disclosed in these proceedings, or represents that its use by such third party would not infringe privately owned rights. The views expressed in these proceedings are not necessarily those of the U.S. Regulatory Commission.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-0847
Supplement 28

Safety Evaluation Report

Related to the Operation of Watts Bar Nuclear Plant, Unit 2

Docket Number 50-391

Tennessee Valley Authority

Manuscript Completed: August 2015
Date Published: August 2015

Office of Nuclear Reactor Regulation

ABSTRACT

This report supplements the safety evaluation report (SER), NUREG-0847 (June 1982), with respect to the application filed by the Tennessee Valley Authority (TVA), as applicant and owner, for a license to operate Watts Bar Nuclear Plant (WBN), Unit 2 (Docket No. 50-391).

In its SER and Supplemental SERs (SSERs) 1 through 20, issued by the Office of Nuclear Reactor Regulation (NRR) of the U.S. Nuclear Regulatory Commission (NRC), the NRC staff documented its safety evaluation (SE) and determination that WBN, Unit 1, met all applicable regulations and regulatory guidance. Based on satisfactory findings from all applicable inspections, on February 7, 1996, the NRC issued a full-power operating license (OL) to WBN, Unit 1, authorizing operation up to 100-percent power.

In SSER 21, the NRC staff addressed TVA's application for a license to operate WBN, Unit 2, and gave information on the status of the items remaining to be resolved that were outstanding at the time that TVA deferred construction of WBN, Unit 2, and were not evaluated and resolved as part of the licensing of WBN, Unit 1. SSERs 22 to 27 documented the NRC staff's ongoing evaluation and closure of open items in support of TVA's application for a license to operate WBN, Unit 2.

In this and future SSERs, the NRC staff continues its documentation of its review of open items in support of TVA's application for an OL for WBN, Unit 2.

TABLE OF CONTENTS

ABBREVIATIONS

AC	alternating current
ACR	auxiliary control room
ACRS	Advisory Committee for Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
ALARA	as low as is reasonably achievable
ANSI	American National Standards Institute
ANS	American Nuclear Society
ASME	American Society of Mechanical Engineers
BEACON	Westinghouse Best Estimate Analyzer for Core Operations—Nuclear
BL	bulletin
BOP	balance of plant
BTP	Branch Technical Position
CAP	corrective action program
CCS	component cooling system
CECC	Central Emergency Control Center
CFR	*Code of Federal Regulations*
CI	confirmatory issue
CRDR	control room design review
CSST	common station service transformer
CP	construction permit
CSP	cyber security plan
DBA	design-basis accident
DCN	design change notice
DVR	degraded voltage relay
EA	Environmental Assessment
EAL	emergency action level
ECCS	emergency core cooling system
EDG	emergency diesel generator
EMC	electromagnetic compatibility
EOF	emergency operations facility
EOP	emergency operating procedure
EP	emergency preparedness
EPA	electrical penetration assemblies
EPIP	emergency preparedness implementation procedure
EPZ	emergency planning zone
EQ	environmental qualification
ERCW	essential raw cooling water
ERDS	emergency response data system
ERO	Emergency Response Organization
ESF	engineered safety feature
ETE	evacuation time estimate
FEMA	Federal Emergency Management Agency
FSAR	final safety analysis report
GDC	general design criterion/criteria
GL	generic letter
HAB	hostile action based
HRCAR	high range containment air radiation

ICM	interim compensatory measures
IE	Office of Inspection and Enforcement
IEB	Office of Inspection and Enforcement Bulletin
IEEE	Institute of Electrical and Electronics Engineers
IFR	Interim Finding Report
IITA	in-core instrumentation thimble assembly
IPEEE	individual plant examination of external events
ISG	interim staff guidance
JLD	Japan Lessons-learned Directorate
kV	kilovolt
kVA	kilovolt ampere
LAR	license amendment request
LOCA	loss-of-coolant accident
LOOP	loss-of-offsite power
LTOP	low-temperature overpressure protection
LVR	low voltage relay
MOV	motor-operated valve
MSIV	main steam isolation valve
NEI	Nuclear Energy Institute
NPG	Nuclear Power Group
NPP	nuclear performance plan
NRC	U.S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
NTTF	Near-Term Task Force
NUREG	report prepared by NRC staff
OBE	operating-basis earthquake
ODCM	Offsite Dose Calculation Manual
ODS	Operations Duty Specialist
OL	operating license
OSA	on-shift staffing analysis
PAD	performance analysis and design
PAMS	post-accident monitoring system
PARS	publicly available records system
PDR	public document room
PORV	power-operated relief valve
PTLR	Pressure and Temperature Limits Report
PWR	pressurized-water reactor
RAI	request for additional information
RCS	reactor coolant system
REP	Radiological Emergency Plan
RES	Office of Nuclear Regulatory Research
RG	Regulatory Guide
RPV	reactor pressure vessel
SE	safety evaluation
SER	safety evaluation report, NUREG-0847, dated June 1982
SFP	spent fuel pool
SG	steam generator
SIAS	Safety Injection Actuation Signal
SP	special program
SPND	self-powered neutron detector

SRM	Staff Requirements Memorandum
SRS	software requirements specification
SPS	signal processing system
SRP	Standard Review Plan, NUREG-0800
SSC	structure, system, and component
SSE	safe shutdown earthquake
SSEP	safety, security, and emergency preparedness
SSER	Supplemental SER
Std.	Standard
TCD	thermal conductivity degradation
TI	Technical Instruction
TMI	Three Mile Island
TPS	Transmission and Power Supply
TS	technical specification
TSO	transmission system operator
TSTF	Technical Specification Task Force
TVA	Tennessee Valley Authority
UFSAR	Updated Final Safety Analysis Report
V	volt
VAC	volt alternating current
VDC	volt direct current
V&V	verification and validation
WBA	Web-based ADAMS
WBN	Watts Bar Nuclear Plant
χ/Q	atmospheric dispersion estimate

1 INTRODUCTION AND DISCUSSION

1.1 Introduction

The Watts Bar Nuclear Plant (WBN or Watts Bar) is owned by the Tennessee Valley Authority (TVA) and is located in southeastern Tennessee, approximately 50 miles (80 kilometers) northeast of Chattanooga. The facility consists of two Westinghouse-designed four-loop pressurized-water reactors (PWRs) within ice condenser containments.

In June 1982, the U.S. Nuclear Regulatory Commission (NRC) staff issued safety evaluation report (SER), NUREG-0847, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant Units 1 and 2," on TVA's application for licenses to operate WBN, Units 1 and 2. In SER Supplements (SSERs) 1 through 20, the NRC staff concluded that WBN, Unit 1, met all applicable regulations and regulatory guidance, and on February 7, 1996, the NRC issued an operating license (OL) to Unit 1. TVA did not complete WBN, Unit 2, and the NRC did not make conclusions about it.

On March 4, 2009, TVA submitted an updated application in support of its request for an OL for WBN, Unit 2, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities."

In SSER 21, the NRC staff reported on the WBN, Unit 2, items remaining to be resolved, which were outstanding at the time that TVA deferred construction of Unit 2, and which were not evaluated and resolved as part of the licensing of WBN, Unit 1. In SSERs 22, 23, 24, 25, 26, and 27, the NRC staff documented its evaluation and closure of open items in support of TVA's application for a license to operate WBN, Unit 2.

In this and future SSERs, the NRC staff will continue the documentation of its evaluation and closure of open items in support of TVA's application.

The format of this document is consistent with the format and scope outlined in the "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Edition (NUREG-0800)," dated July 1981 (SRP, NUREG-0800). The NRC staff added additional chapters to address the overall assessment of the facility, nuclear performance plan (NPP) issues, and other generic regulatory topics.

Each of the sections and appendices of this supplement is numbered the same as the SER section that is being updated, and the discussions are supplementary to, and not in lieu of, the discussion in the SER, unless otherwise noted. For example, Appendix E continues to list the principal contributors to the SSER. However, the chronology of the safety review correspondence previously given in Appendix A has been discontinued, and a reference is supplied instead to the NRC's Agencywide Documents Access and Management System (ADAMS) or the Public Document Room (PDR). Public correspondence exchanged between the NRC and TVA is available through ADAMS or the PDR. References listed as "not publicly available" in the SSER contain proprietary information and have been withheld from public disclosure in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding."

Appendix HH includes an action items table. This table gives the status of all the open items, confirmatory issues, and proposed license conditions that must be resolved before completion

of an NRC finding of reasonable assurance on the OL application for WBN, Unit 2. The NRC staff will maintain the action items table and revise Appendix HH in future SSERs, and add new appendices, as necessary.

The NRC's ADAMS is the agency's official recordkeeping system. ADAMS has the full text of regulatory and technical documents and reports written by the NRC, NRC contractors, or NRC licensees. Documents include NRC regulatory guides, NUREG-series reports, correspondence, inspection reports, and other materials. These documents are assigned accession numbers and are searchable and accessible in ADAMS. Documents are released periodically during the day in the ADAMS PUBLIC/Legacy Interface Combined (ADAMS PUBLIC) and Web-based ADAMS (WBA) interfaces; they are released once a day in Web-based Publicly Available Records System (PARS). These documents in full text can be searched using ADAMS accession numbers or specific fields and parameters such as docket number and document dates.

More information on ADAMS and help for accessing documents may be obtained on the NRC Public Website at http://www.nrc.gov/reading-rm/adams/faq.html#1.

All WBN documents may be accessed using WBN Docket Nos. 05000390 and 05000391 for Units 1 and 2, respectively.

The WBN, Unit 2, Project Manager is Justin C. Poole, who may be contacted by calling (301) 415-2048, by email to Justin.Poole@nrc.gov, or by writing to the following address:

Mr. Justin Poole
Mail Stop O-8G9A
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

1.7 Summary of Outstanding Issues

The NRC staff documented its previous review and conclusions on the OL application for WBN, Unit 1, in the SER (NUREG-0847, dated June 1982) and its Supplements 1 through 20. Based on these reviews, the NRC staff issued an OL for WBN, Unit 1, in 1996. In the SER and SSERs 1 through 20, the NRC staff also reviewed and approved certain topics for WBN, Unit 2, though no final conclusions were made about an OL for WBN, Unit 2. To establish the remaining scope and the regulatory framework for the NRC staff's review of an OL for WBN, Unit 2, the NRC staff reviewed the SER and SSERs 1 through 20. Based on this review, the NRC staff identified "resolved" topics (i.e., out of scope for review) and "open" topics (i.e., in scope for NRC staff review) for WBN, Unit 2. Where it was not clear whether the SER topic applied to Unit 2, or not, the NRC staff conservatively identified it as "open" pending further evaluation. It should be noted that these were not technical evaluations of each topic; rather, it was a status review to determine whether the topic was "open" or "resolved." The NRC staff documented this evaluation in SSER 21 as the baseline for resumption of the review of the OL application for Unit 2. Thus, SSER 21 reflects the status of the NRC staff's review of WBN, Unit 2, up to 1995. The NRC staff notes that a subsequent, more detailed assessment may find some topics conservatively identified in the initial assessment as "open" should be redefined as "closed." Conversely, the NRC staff notes that there may be circumstances that could result in the need to reopen some previously closed topic areas that may have been adequately documented and that are considered closed in SSER 21. Such cases will be identified by a footnote in future

SSERs to document that previous “open” topics have been recategorized as “closed” without requiring further review, or vice versa.

The SER and SSERs 1 through 20 evaluated the changes to the final safety analysis report (FSAR) until Amendment No. 91. FSAR Amendment No. 91 was the initial licensing basis for WBN, Unit 1. At this time, the FSAR was applicable to both Units 1 and 2. As part of its updated OL application for WBN, Unit 2, TVA split FSAR Amendment No. 91 into two separate FSARs for WBN, Units 1 and 2. TVA has submitted WBN, Unit 2, FSAR Amendment Nos. 92 through 113 to address the “open” topics in support of its OL application for WBN, Unit 2. These FSAR amendments reflect changes that have occurred since 1995. Some changes in these FSAR amendments are currently under NRC staff review. Reviews of FSAR changes that have been completed by the NRC staff were documented in SSERs 22, 23, 24, 25, 26, and 27.

Additional general topics (e.g., financial qualifications that were not included in SSER 21, but that should be resolved before issuance of an OL) are also identified in SSER 22 and subsequent supplements.

SSER 21 initially contained the table below documenting the status of each SER topic. The relevant document in which the topic was last addressed is shown in parentheses. This table will be maintained in this and future supplements to reflect the updated status of review for each topic.

ISSUE STATUS TABLE

	Issue	Status		Section	Note
(1)	Site Envelope			2	
(2)	Geography and Demography	Resolved	(SSER 22)	2.1	
(3)	Site Location and Description	Resolved	(SER) (SSER 22)	2.1.1	3
(4)	Exclusion Area Authority and Control	Resolved	(SER) (SSER 22)	2.1.2	3
(5)	Population Distribution	Resolved	(SER) (SSER 22)	2.1.3	
(6)	Conclusions	Resolved	(SER) (SSER 22)	2.1.4	
(7)	Nearby Industrial, Transportation, and Military Facilities	Resolved	(SSER 22)	2.2	
(8)	Transportation Routes	Resolved	(SER) (SSER 22)	2.2.1	
(9)	Nearby Facilities	Resolved	(SER) (SSER 22)	2.2.2	
(10)	Conclusions	Resolved	(SER) (SSER 22)	2.2.3	
(11)	Meteorology	Resolved	(SER) (SSER 22)	2.3	
(12)	Regional Climatology	Resolved	(SER) (SSER 22)	2.3.1	
(13)	Local Meteorology	Resolved	(SER) (SSER 22)	2.3.2	

	Issue	Status		Section	Note
(14)	Onsite Meteorological Measurements Program	Resolved	(SER) (SSER 22) (SSER 25)	2.3.3	
(15)	Short-Term (Accident) Atmospheric Diffusion Estimates	Resolved	(SER) (SSER 14) (SSER 22)	2.3.4	
(16)	Long-Term (Routine) Diffusion Estimates	Resolved	(SER) (SSER 14) (SSER 22)	2.3.5	
(17)	Hydrologic Engineering	Resolved	(SSER 27) (SSER 28)	2.4	
(18)	Introduction	Resolved	(SER)	2.4.1	
(19)	Hydrologic Description	Resolved	(SER)	2.4.2	
(20)	Flood Potential	Resolved	(SER)	2.4.3	
(21)	Local Intense Precipitation in Plant Area	Resolved	(SER)	2.4.4	1
(22)	Roof Drainage	Resolved	(SER)	2.4.5	1
(23)	Ultimate Heat Sink	Resolved	(SER)	2.4.6	
(24)	Groundwater	Resolved	(SER)	2.4.7	1
(25)	Design Basis for Subsurface Hydrostatic Loading	Resolved	(SER) (SSER 3)	2.4.8	
(26)	Transport of Liquid Releases	Resolved	(SER) (SSER 22)	2.4.9	2
(27)	Flooding Protection Requirements	Resolved	(SER) (SSER 24) (SSER 27) (SSER 28)	2.4.10	
(28)	Geological, Seismological, and Geotechnical Engineering	Resolved	(SER) (SSER 24)	2.5	
(29)	Geology	Resolved	(SER)	2.5.1	
(30)	Seismology	Resolved	(SER)	2.5.2	
(31)	Surface Faulting	Resolved	(SER)	2.5.3	
(32)	Stability of Subsurface Materials and Foundations	Resolved	(SER) (SSER 3) (SSER 9) (SSER 11)	2.5.4	
(33)	Stability of Slopes	Resolved	(SER)	2.5.5	
(34)	Embankments and Dams	Resolved	(SER) (SSER 22)	2.5.6	
(35)	References		(SER) (SSER 22)	2.6	
(36)	Design Criteria - Structures, Components, Equipment, and Systems			3	
(37)	Introduction			3.1	
(38)	Conformance With General Design Criteria	Resolved	(SER)	3.1.1	

	Issue	Status		Section	Note
(39)	Conformance With Industry Codes and Standards	Resolved	(SER)	3.1.2	
(40)	Classification of Structures, Systems and Components	Resolved	(SSER 14) (SSER 22)	3.2	
(41)	Seismic Classifications	Resolved	(SER) (SSER 3) (SSER 5) (SSER 6) (SSER 8)	3.2.1	
(42)	System Quality Group Classification	Resolved	(SER) (SSER 3) (SSER 6) (SSER 7) (SSER 9) (SSER 22)	3.2.2	
(43)	Wind and Tornado Loadings			3.3	
(44)	Wind Loading	Resolved	(SER)	3.3.1	
(45)	Tornado Loading	Resolved	(SER)	3.3.2	
(46)	Flood Level (Flood) Design			3.4	
(47)	Flood Protection	Resolved	(SER)	3.4.1	
(48)	Missile Protection			3.5	
(49)	Missile Selection and Description	Resolved	(SER) (SSER 9) (SSER 14) (SSER 22)	3.5.1	
(50)	Structures, Systems, and Components to be Protected from Externally Generated Missiles	Resolved	(SER) (SSER 2) (SSER 22)	3.5.2	
(51)	Barrier Design Procedures	Resolved	(SER)	3.5.3	
(52)	Protection Against the Dynamic Effects Associated with the Postulated Rupture of Piping	Resolved	(SER) (SSER 6) (SSER 11)	3.6	
(53)	Plant Design for Protection Against Postulated Piping Failures in Fluid System Outside Containment	Resolved	(SER) (SSER 14) (SSER 22)	3.6.1	
(54)	Determination of Break Locations and Dynamic Effects Associated with the Postulated Rupture of Piping	Resolved	(SER) (SSER 14) (SSER 22)	3.6.2	3
(55)	Leak-Before-Break Evaluation Procedures	Resolved	(SSER 5) (SSER 12) (SSER 22) (SSER 24)	3.6.3	
(56)	Seismic Design	Resolved	(SER) (SSER 6)	3.7	2
(57)	Seismic Input	Resolved	(SER) (SSER 6) (SSER 9) (SSER 16)	3.7.1	2

	Issue	Status		Section	Note
(58)	Seismic Analysis	Resolved	(SER) (SSER 6) (SSER 8) (SSER 11) (SSER 16)	3.7.2	2
(59)	Seismic Subsystem Analysis	Resolved	(SER) (SSER 6) (SSER 7) (SSER 8) (SSER 9) (SSER 12) (SSER 22)	3.7.3	
(60)	Seismic Instrumentation	Resolved	(SER)	3.7.4	1
(61)	Design of Seismic Category I Structures	Resolved	(SER) (SSER 9)	3.8	2
(62)	Steel Containment	Resolved	(SER) (SSER 3)	3.8.1	
(63)	Concrete and Structural Steel Internal Structures	Resolved	(SER) (SSER 7)	3.8.2	
(64)	Other Seismic Category I Structures	Open (NRR)	(SER) (SSER 14) (SSER 16)	3.8.3	
(65)	Foundations	Resolved	(SER)	3.8.4	
(66)	Mechanical Systems and Components	Resolved	(SER)	3.9	
(67)	Special Topics for Mechanical Components	Resolved	(SER) (SSER 6) (SSER 13) (SSER 22)	3.9.1	
(68)	Dynamic Testing and Analysis of Systems, Components, and Equipment	Resolved	(SER) (SSER 14) (SSER 22)	3.9.2	
(69)	ASME Code Class 1, 2, and 3 Components, Component Structures, and Core Support Structures	Resolved	(SER) (SSER 3) (SSER 4) (SSER 6) (SSER 7) (SSER 8) (SSER 15) (SSER 22)	3.9.3	
(70)	Control Rod Drive Systems	Resolved	(SER)	3.9.4	
(71)	Reactor Pressure Vessel Internals	Resolved	(SER) (SSER 23) (SSER 26)	3.9.5	

	Issue	Status		Section	Note
(72)	Inservice Testing of Pumps and Valves	Resolved	(SER) (SSER 5) (SSER 12) (SSER 14) (SSER 18) (SSER 20) (SSER 22) (SSER 27)	3.9.6	
(73)	Seismic and Dynamic Qualification of Seismic Category I Mechanical and Electrical Equipment	Resolved	(SER) (SSER 1) (SSER 3) (SSER 4) (SSER 5) (SSER 6) (SSER 8) (SSER 9) (SSER 23)	3.10	
(74)	Environmental Qualification of Mechanical and Electrical Equipment	Resolved	(SSER 15) (SSER 22) (SSER 27)	3.11	
(75)	Threaded Fasteners — ASME Code Class 1, 2, and 3	Resolved	(SSER 22)	3.13	
(76)	Reactor			4	
(77)	Introduction		(SER) (SSER 23)	4.1	
(78)	Fuel System Design	Resolved	(SSER 23) (SSER 27)	4.2	
(79)	Description	Resolved	(SER) (SSER 13) (SSER 23)	4.2.1	
(80)	Thermal Performance	Resolved	(SER) (SSER 2) (SSER 23) (SSER 27)	4.2.2	
(81)	Mechanical Performance	Resolved	(SER) (SSER 2) (SSER 10) (SSER 13) (SSER 23)	4.2.3	
(82)	Surveillance	Resolved	(SER) (SSER 2) (SSER 23)	4.2.4	
(83)	Fuel Design Considerations	Resolved	(SER) (SSER 23)	4.2.5	
(84)	Nuclear Design	Resolved	(SSER 23)	4.3	
(85)	Design Basis	Resolved	(SER) (SSER 13) (SSER 23)	4.3.1	

	Issue	Status		Section	Note
(86)	Design Description	Resolved	(SER) (SSER 13) (SSER 15) (SSER 23)	4.3.2	
(87)	Analytical Methods	Resolved	(SER) (SSER 23)	4.3.3	
(88)	Summary of Evaluation Findings	Resolved	(SER) (SSER 23)	4.3.4	
(89)	Thermal-Hydraulic Design	Resolved	(SSER 23)	4.4	
(90)	Performance in Safety Criteria	Resolved	(SER) (SSER 23)	4.4.1	
(91)	Design Bases	Resolved	(SER) (SSER 12) (SSER 23)	4.4.2	
(92)	Thermal-Hydraulic Design Methodology	Resolved	(SER) (SSER 6) (SSER 8) (SSER 12) (SSER 13) (SSER 16) SE dated 6/13/89 (SSER 23)	4.4.3	
(93)	Operating Abnormalities	Resolved	(SER) (SSER 13) (SSER 23)	4.4.4	
(94)	Loose Parts Monitoring System	Resolved	(SER) (SSER 3) (SSER 5) (SSER 16) (SSER 23)	4.4.5	
(95)	Thermal-Hydraulic Comparison	Resolved	(SER) (SSER 23)	4.4.6	
(96)	N-1 Loop Operation	Resolved	(SER) (SSER 23)	4.4.7	
(97)	Instrumentation for Inadequate Core Cooling Detection (Three Mile Island ((TMI) Action Item II.F.2)	Resolved	(SER) (SSER 10) (SSER 23) (SSER 27)	4.4.8	
(98)	Summary and Conclusion	Resolved	(SER) (SSER 23) (SSER 25)	4.4.9	
(99)	Reactor Materials			4.5	
(100)	Control Rod Drive Structural Materials	Resolved	(SER)	4.5.1	1
(101)	Reactor Internals and Core Support Materials	Resolved	(SER)	4.5.2	
(102)	Functional Design of Reactivity Control Systems	Resolved	(SER) (SSER 23)	4.6	

	Issue	Status		Section	Note
(103)	Reactor Coolant System and Connected Systems			5	
(104)	Summary Description	Resolved	(SER) (SSER 5) (SSER 6)	5.1	2
(105)	Integrity of Reactor Coolant Pressure Boundary			5.2	
(106)	Compliance with Codes and Code Cases	Resolved	(SER) (SSER 22)	5.2.1	
(107)	Overpressurization Protection	Resolved	(SER) (SSER 2) (SSER 15) (SSER 24)	5.2.2	
(108)	Reactor Coolant Pressure Boundary Materials	Resolved	(SER) (SSER 22)	5.2.3	
(109)	Reactor Coolant System Pressure Boundary Inservice Inspection and Testing	Resolved	(SER) (SSER 10) (SSER 12) (SSER 15) (SSER 16) (SSER 23)	5.2.4	
(110)	Reactor Coolant Pressure Boundary Leakage Detection	Resolved	(SER) (SSER 9) (SSER 11) (SSER 12) (SSER 22)	5.2.5	
(111)	Reactor Vessel			5.3	
(112)	Reactor Vessel Materials	Resolved	(SER) (SSER 11) (SSER 14) (SSER 22) (SSER 25)	5.3.1	
(113)	Pressure-Temperature Limits	Resolved	(SER) (SSER 16) (SSER 22) (SSER 25)	5.3.2	
(114)	Reactor Vessel Integrity	Resolved	(SER) (SSER 22)	5.3.3	
(115)	Component and Subsystem Design			5.4	
(116)	Reactor Coolant Pumps	Resolved	(SER) (SSER 22)	5.4.1	2
(117)	Steam Generators	Resolved	(SER) (SSER 1) (SSER 4) (SSER 22)	5.4.2	

	Issue	Status		Section	Note
(118)	Residual Heat Removal System	Resolved	(SER) (SSER 2) (SSER 5) (SSER 10) (SSER 11) (SSER 23)	5.4.3	
(119)	Pressurizer Relief Tank	Resolved	(SER) (SSER 22)	5.4.4	
(120)	Reactor Coolant System Vents (TMI Action Item II.B.1)	Resolved	(SER) (SSER 2) (SSER 5) (SSER 12) (SSER 23)	5.4.5	
(121)	Engineered Safety Features			6	
(122)	Engineered Safety Feature Materials			6.1	
(123)	Metallic Materials	Resolved	(SER) (SSER 23) (SSER 27)	6.1.1	
(124)	Organic Materials	Resolved	(SER) (SSER 22)	6.1.2	
(125)	Postaccident Emergency Cooling Water Chemistry	Resolved	(SER) (SSER 22)	6.1.3	
(126)	Containment Systems			6.2	
(127)	Containment Functional Design	Resolved	(SER) (SSER 3) (SSER 5) (SSER 7) (SSER 12) (SSER 14) (SSER 15) (SSER 22)	6.2.1	
(128)	Containment Heat Removal Systems	Resolved	(SER) (SSER 7) (SSER 22)	6.2.2	
(129)	Secondary Containment Functional Design	Resolved	(SER) (SSER 18) (SSER 22)	6.2.3	
(130)	Containment Isolation Systems	Resolved	(SER) (SSER 3) (SSER 5) (SSER 7) (SSER 12) (SSER 22)	6.2.4	
(131)	Combustible Gas Control Systems	Resolved	(SER) (SSER 4) (SSER 5) (SSER 8) (SSER 22)	6.2.5	

	Issue	Status		Section	Note
(132)	Containment Leakage Testing	Resolved	(SER) (SSER 4) (SSER 5) (SSER 19) (SSER 22) (SSER 26)	6.2.6	
(133)	Fracture Prevention of Containment Pressure Boundary	Resolved	(SER) (SSER 4) (SSER 23)	6.2.7	1
(134)	Emergency Core Cooling System	Resolved	(SER)	6.3	1
(135)	System Design	Open (NRR)	(SER) (SSER 6) (SSER 7) (SSER 11)	6.3.1	
(136)	Evaluation	Resolved	(SER) (SSER 5)	6.3.2	1
(137)	Testing	Open (NRR)	(SER) (SSER 2) (SSER 9)	6.3.3	
(138)	Performance Evaluation	Resolved	(SER)	6.3.4	
(139)	Conclusions	Open (NRR)	(SER)	6.3.5	
(140)	Control Room Habitability	Resolved	(SER) (SSER 5) (SSER 11) (SSER 16) (SSER 18 (SSER 22)	6.4	
(141)	Engineered Safety Feature (ESF) Filter Systems			6.5	
(142)	ESF Atmosphere Cleanup System	Resolved	(SER) (SSER 5) (SSER 22)	6.5.1	
(143)	Fission Product Cleanup System	Resolved	(SER)	6.5.2	1
(144)	Fission Product Control System	Resolved	(SER) (SSER 22) (SSER 26)	6.5.3	
(145)	Ice Condenser as a Fission Product Cleanup System	Resolved	(SER)	6.5.4	1
(146)	Inservice Inspection of Class 2 and 3 Components	Resolved	(SER) (SSER 10) (SSER 12) (SSER 15) (SSER 23)	6.6	
(147)	Instrumentation and Controls			7	
(148)	Introduction			7.1	
(149)	General	Resolved	(SER) (SSER 13) (SSER 16) (SSER 23)	7.1.1	

	Issue	Status		Section	Note
(150)	Comparison with Other Plants	Resolved	(SER) (SSER 23)	7.1.2	1
(151)	Design Criteria	Resolved	(SER) (SSER 4) (SSER 15) (SSER 23)	7.1.3	
(152)	Reactor Trip System	Resolved	(SER)	7.2	
(153)	System Description	Resolved	(SER) (SSER 13) (SSER 15) (SSER 23) (SSER 27)	7.2.1	
(154)	Manual Trip Switches	Resolved	(SER) (SSER 23)	7.2.2	1
(155)	Testing of Reactor Trip Breaker Shunt Coils	Resolved	(SER) (SSER 23)	7.2.3	1
(156)	Anticipatory Trips	Resolved	(SER) (SSER 23)	7.2.4	
(157)	Steam Generator Water Level Trip	Resolved	(SER) (SSER 2) (SSER 14) (SSER 23)	7.2.5	
(158)	Conclusions	Resolved	(SER) (SSER 13) (SSER 23)	7.2.6	
(159)	Engineered Safety Features System	Resolved	(SER) (SSER 13)	7.3	
(160)	System Description	Resolved	(SER) (SSER 13) (SSER 14) (SSER 23)	7.3.1	
(161)	Containment Sump Level Measurement	Resolved	(SER) (SSER 2) (SSER 23)	7.3.2	
(162)	Auxiliary Feedwater Initiation and Control	Resolved	(SER) (SSER 23)	7.3.3	1
(163)	Failure Modes and Effects Analysis	Resolved	(SER) (SSER 23)	7.3.4	
(164)	Office of Inspection and Enforcement (IE) Bulletin 80-06	Resolved	(SER) (SSER 3) (SSER 23)	7.3.5	
(165)	Conclusions	Resolved	(SER) (SSER 13) (SSER 23)	7.3.6	
(166)	Systems Required for Safe Shutdown			7.4	
(167)	System Description	Resolved	(SER) (SSER 23)	7.4.1	

	Issue	Status		Section	Note
(168)	Safe Shutdown from Auxiliary Control Room	Resolved	(SER) (SSER 7) (SSER 23)	7.4.2	
(169)	Conclusions	Resolved	(SER) (SSER 23)	7.4.3	
(170)	Safety-Related Display Instrumentation			7.5	
(171)	Display Systems	Resolved	(SER) (SSER 23)	7.5.1	
(172)	Postaccident Monitoring System	Open (Inspection)	(SER) (SSER 7) (SSER 9) (SSER 14) (SSER 15) (SSER 23) (SSER 25) (SSER 27)	7.5.2	
(173)	IE Bulletin 79-27	Resolved	(SER) (SSER 23) (SSER 27)	7.5.3	
(174)	Conclusions	Open (Inspection)	(SER)	7.5.4	
(175)	All Other Systems Required for Safety			7.6	
(176)	Loose Part Monitoring System	Resolved	(SER) (SSER 23) (SSER 24)	7.6.1	
(177)	Residual Heat Removal System Bypass Valves	Resolved	(SER) (SSER 23)	7.6.2	
(178)	Upper Head Injection Manual Control	Resolved	(SER) (SSER 23)	7.6.3	
(179)	Protection Against Spurious Actuation of Motor-Operated Valves	Resolved	(SER) (SSER 23)	7.6.4	
(180)	Overpressure Protection during Low Temperature Operation	Resolved	(SER) (SSER 4) (SSER 23)	7.6.5	
(181)	Valve Power Lockout	Resolved	(SER) (SSER 23)	7.6.6	
(182)	Cold Leg Accumulator Valve Interlocks and Position Indication	Resolved	(SER) (SSER 23)	7.6.7	
(183)	Automatic Switchover From Injection to Recirculation Mode	Resolved	(SER) (SSER 23)	7.6.8	
(184)	Conclusions	Resolved	(SER) (SSER 4)	7.6.9	
(185)	Control Systems Not Required for Safety			7.7	

	Issue	Status		Section	Note
(186)	System Description	Open (NRR)	(SER) (SSER 23) (SSER 24) (SSER 25) (SSER 27)	7.7.1	
(187)	Safety System Status Monitoring System	Resolved	(SER) (SSER 7) (SSER 13) (SSER 23)	7.7.2	
(188)	Volume Control Tank Level Control System	Resolved	(SER) (SSER 23)	7.7.3	
(189)	Pressurizer and Steam Generator Overfill	Resolved	(SER) (SSER 23)	7.7.4	
(190)	IE Information Notice 79-22	Resolved	(SER) (SSER 23)	7.7.5	
(191)	Multiple Control System Failures	Resolved	(SER) (SSER 23)	7.7.6	
(192)	Conclusions	Resolved	(SER)	7.7.7	
(193)	Anticipated Transient Without Scram Mitigation System Actuation Circuitry (AMSAC)	Resolved	(SSER 9) (SSER 14) (SSER 23)	7.7.8	
(194)	NUREG-0737 Items	Resolved	(SER) (SSER 23)	7.8	
(195)	Relief and Safety Valve Position Indication (TMI Action Item II.D.3)	Resolved	(SER) (SSER 5) (SSER 14) (SSER 23)	7.8.1	
(196)	Auxiliary Feedwater System Initiation and Flow Indication (TMI Action Item II.E.1.2)	Open (Inspection)	(SER) (SSER 23)	7.8.2	
(197)	Proportional Integral Derivative Control Modification (TMI Action Item II.K.3.9)	Resolved	(SER) (SSER 23)	7.8.3	
(198)	Proposed Anticipatory Trip Modification (TMI Action Item II.K.3.10)	Resolved	(SER) (SSER 4) (SSER 23)	7.8.4	
(199)	Confirm Existence of Anticipatory Reactor Trip Upon Turbine Trip (TMI Action Item II.K.3.12)	Resolved	(SER) (SSER 23)	7.8.5	
(200)	Data Communication Systems		(SSER 23)	7.9	
(201)	Electric Power Systems			8	
(202)	General	Resolved	(SER) (SSER 22) (SSER 24) (SSER 27)	8.1	
(203)	Offsite Power System	Resolved	(SER) (SSER 22)	8.2	

	Issue	Status		Section	Note
(204)	Compliance with GDC 5	Resolved	(SER) (SSER 13) (SSER 22)	8.2.1	
(205)	Compliance with GDC 17	Resolved	(SER) (SSER 2) (SSER 3) (SSER 13) (SSER 14) (SSER 15 (SSER 22) (SSER 27)	8.2.2	
(206)	Compliance with GDC 18	Resolved	(SER) (SSER 22)	8.2.3	
(207)	Evaluation Findings	Resolved	(SER) (SSER 22)	8.2.4	
(208)	Onsite Power Systems	Resolved	(SER) (SSER 10) (SSER 19) (SSER 22)	8.3	
(209)	Onsite AC Power System Compliance with GDC 17	Resolved	(SER) (SSER 2) (SSER 7) (SSER 9) (SSER 10) (SSER 13) (SSER 14) (SSER 18) (SSER 20) (SSER 22) (SSER 27) (SSER 28)	8.3.1	
(210)	Onsite Direct Current System Compliance with GDC 17	Resolved	(SER) (SSER 2) (SSER 3) (SSER 13) (SSER 14) (SSER 22)	8.3.2	
(211)	Common Electrical Features and Requirements	Resolved	(SER) (SSER 2) (SSER 3) (SSER 7) (SSER 13) (SSER 14) (SSER 15) (SSER 16) (SSER 22)	8.3.3	

	Issue	Status		Section	Note
(212)	Evaluation Findings	Resolved	(SER) (SSER 2) (SSER 3) (SSER 7) (SSER 13) (SSER 14) (SSER 15) (SSER 16) (SSER 22)	8.3.4	
(213)	Station Blackout	Resolved	(SSER 22)	8.4	
(214)	Auxiliary Systems	Resolved	(SER) (SSER 10)	9	
(215)	Fuel Storage Facility			9.1	
(216)	New-Fuel Storage	Resolved	(SER)	9.1.1	1
(217)	Spent-Fuel Storage	Resolved	(SER) (SSER 5) (SSER 15) (SSER 16) (SSER 22)	9.1.2	
(218)	Spent Fuel Pool Cooling and Cleanup System	Resolved	(SER) (SSER 11) (SSER 15) (SSER 23) (SSER 26)	9.1.3	
(219)	Fuel-Handling System	Resolved	(SER) (SSER 3) (SSER 13) (SSER 22) (SSER 24)	9.1.4	
(220)	Water Systems			9.2	
(221)	Essential Raw Cooling Water and Raw Cooling Water System	Resolved	(SER) (SSER 9) (SSER 10) (SSER 18) (SSER 23) (SSER 27)	9.2.1	
(222)	Component Cooling System (Reactor Auxiliaries Cooling Water System)	Resolved	(SER) (SSER 5) (SSER 23) (SSER 27)	9.2.2	
(223)	Demineralized Water Makeup System	Resolved	(SER) (SSER 22)	9.2.3	
(224)	Potable and Sanitary Water Systems	Resolved	(SER) (SSER 9) (SSER 22)	9.2.4	
(225)	Ultimate Heat Sink	Resolved	(SER) (SSER 23) (SSER 27)	9.2.5	

	Issue	Status		Section	Note
(226)	Condensate Storage Facilities	Resolved	(SER) (SSER 12) (SSER 22)	9.2.6	
(227)	Process Auxiliaries			9.3	
(228)	Compressed Air System	Resolved	(SER) (SSER 22)	9.3.1	1
(229)	Process Sampling System	Resolved	(SER) (SSER 3) (SSER 5) (SSER 14) (SSER 16) (SSER 24)	9.3.2	
(230)	Equipment and Floor Drainage System	Resolved	(SER) (SSER 22)	9.3.3	3
(231)	Chemical and Volume Control System	Resolved	(SER) (SSER 22)	9.3.4	3
(232)	Heat Tracing	Resolved	(SSER 22)	9.3.8	
(233)	Heating, Ventilation, and Air Conditioning Systems			9.4	
(234)	Control Room Area Ventilation System	Resolved	(SER) (SSER 9) (SSER 22)	9.4.1	
(235)	Fuel-Handling Area Ventilation System	Resolved	(SER) (SSER 22)	9.4.2	
(236)	Auxiliary Building and Radwaste Area Ventilation System	Resolved	(SER) (SSER 22)	9.4.3	
(237)	Turbine Building Area Ventilation System	Resolved	(SER) (SSER 22)	9.4.4	
(238)	Engineered Safety Features Ventilation System	Resolved	(SER) (SSER 9) (SSER 10) (SSER 11) (SSER 14) (SSER 16) (SSER 19) (SSER 22)	9.4.5	
(239)	Reactor Building Purge Ventilation System	Resolved	(SSER 22)	9.4.6	
(240)	Containment Air Cooling System	Resolved	(SSER 22)	9.4.7	
(241)	Condensate Demineralizer Waste Evaporator Building Environmental Control System	Resolved	(SSER 22)	9.4.8	
(242)	Other Auxiliary Systems			9.5	
(243)	Fire Protection	Open (NRR)	(SER) (SSER 10) (SSER 18) (SSER 19) (SSER 26)	9.5.1	3

	Issue	Status		Section	Note
(244)	Communications System	Resolved	(SER) (SSER 5)	9.5.2	1
(245)	Lighting System	Resolved	(SER) (SSER 22)	9.5.3	
(246)	Emergency Diesel Engine Fuel Oil Storage and Transfer System	Resolved	(SER) (SSER 5) (SSER 9) (SSER 10) (SSER 11) (SSER 12) (SSER 22)	9.5.4	2
(247)	Emergency Diesel Engine Cooling Water System	Resolved	(SER) (SSER 5) (SSER 11)	9.5.5	1
(248)	Emergency Diesel Engine Starting Systems	Resolved	(SER) (SSER 5) (SSER 10) (SSER 22)	9.5.6	2
(249)	Emergency Diesel Engine Lubricating Oil System	Resolved	(SER) (SSER 3) (SSER 5) (SSER 10) (SSER 22)	9.5.7	2
(250)	Emergency Diesel Engine Combustion Air Intake and Exhaust System	Resolved	(SER) (SSER 5) (SSER 10) (SSER 22)	9.5.8	2
(251)	Steam and Power Conversion System			10	
(252)	Summary Description	Resolved	(SER)	10.1	
(253)	Turbine Generator	Resolved	(SER) (SSER 5)	10.2	
(254)	Turbine Generator Design	Resolved	(SER) (SSER 12) (SSER 22)	10.2.1	
(255)	Turbine Disc Integrity	Resolved	(SER) (SSER 23)	10.2.2	
(256)	Main Steam Supply System	Resolved	(SER)	10.3	
(257)	Main Steam Supply System (Up to and Including the Main Steam Isolation Valves)	Resolved	(SER) (SSER 19) (SSER 22)	10.3.1	
(258)	Main Steam Supply System	Resolved	(SER) (SSER 22)	10.3.2	2
(259)	Steam and Feedwater System Materials	Resolved	(SER) (SSER 22)	10.3.3	
(260)	Secondary Water Chemistry	Resolved	(SER) (SSER 5) (SSER 22)	10.3.4	
(261)	Other Features			10.4	

	Issue	Status		Section	Note
(262)	Main Condenser	Resolved	(SER) (SSER 9) (SSER 22)	10.4.1	
(263)	Main Condenser Evacuation System	Resolved	(SER) (SSER 22)	10.4.2	
(264)	Turbine Gland Sealing System	Resolved	(SER) (SSER 22)	10.4.3	
(265)	Turbine Bypass System	Resolved	(SER) (SSER 5) (SSER 22)	10.4.4	
(266)	Condenser Circulating Water System	Resolved	(SER) (SSER 22)	10.4.5	
(267)	Condensate Cleanup System	Resolved	(SER) (SSER 22) (SSER 27)	10.4.6	
(268)	Condensate and Feedwater Systems	Resolved	(SER) (SSER 14) (SSER 22)	10.4.7	
(269)	Steam Generator Blowdown System	Resolved	(SER) (SSER 22) (SSER 24)	10.4.8	
(270)	Auxiliary Feedwater System	Resolved	(SER) (SSER 14) (SSER 23) (SSER 24)	10.4.9	
(271)	Heater Drains and Vents	Resolved	(SSER 22)	10.4.10	
(272)	Steam Generator Wet Layup System	Resolved	(SSER 22)	10.4.11	
(273)	Radioactive Waste Management			11	
(274)	Summary Description	Resolved	(SER) (SSER 16) (SSER 24)	11.1	2
(275)	Liquid Waste Management	Resolved	(SER) (SSER 4) (SSER 16) (SSER 24)	11.2	
(276)	Gaseous Waste Management	Resolved	(SER) (SSER 8) (SSER 16) (SSER 24) (SSER 25) (SSER 27)	11.3	
(277)	Solid Waste Management System	Resolved	(SER) (SSER 16) (SSER 24)	11.4	
(278)	Process and Effluent Radiological Monitoring and Sampling Systems	Resolved	(SER) (SSER 16) (SSER 20) (SSER 24)	11.5	

	Issue	Status		Section	Note
(279)	Evaluation Findings	Resolved	(SER) (SSER 8) (SSER 16)	11.6	
(280)	NUREG-0737 Items	Open (NRR)	(SER)	11.7	
(281)	Wide-Range Noble Gas, Iodine, and Particulate Effluent Monitors (TMI Action Items II.F.1(1) and II.F.1(2))	Open (Inspection)	(SER) (SSER 5) (SSER 6)	11.7.1	
(282)	Primary Coolant Outside Containment (TMI Action item III.D.1.1)	Open (NRR)	(SER) (SSER 5) (SSER 6) (SSER 10) (SSER 16)	11.7.2	
(283)	Radiation Protection			12	
(284)	General	Resolved	(SER) (SSER 10) (SSER 14) (SSER 24)	12.1	
(285)	Ensuring that Occupational Radiation Doses Are As Low As Reasonably Achievable (ALARA)	Resolved	(SER) (SSER 14) (SSER 24)	12.2	2
(286)	Radiation Sources	Resolved	(SER) (SSER 14) (SSER 24)	12.3	
(287)	Radiation Protection Design Features	Resolved	(SER) (SSER 10) (SSER 14) (SSER 18) (SSER 24) (SSER 26)	12.4	
(288)	Dose Assessment	Resolved	(SER) (SSER 14) (SSER 24) (SSER 27)	12.5	
(289)	Health Physics Program	Resolved	(SER) (SSER 10) (SSER 14) (SSER 24) (SSER 26)	12.6	
(290)	NUREG-0737 Items			12.7	
(291)	Plant Shielding (TMI Action Item II.B.2)	Resolved	(SER) (SSER 14) (SSER 16) (SSER 24) (SSER 27)	12.7.1	
(292)	High Range In-Containment Monitor (TMI Action Item II.F.1.(3))	Open (NRR)	(SER) (SSER 5)	12.7.2	
(293)	In-Plant Radioiodine Monitor (TMI Action Item II.D.3.3)	Open (NRR)	(SER) (SSER 16)	12.7.3	
(294)	Conduct of Operations			13	

	Issue	Status		Section	Note
(295)	Organization Structure of the Applicant	Resolved	(SER) (SSER 16) (SSER 22)	13.1	
(296)	Management and Technical Organization	Resolved	(SER)	13.1.1	
(297)	Corporate Organization and Technical Support	Resolved	(SER)	13.1.2	
(298)	Plant Staff Organization	Resolved	(SER) (SSER 8) (SSER 22) (SSER 25) (SSER 27)	13.1.3	
(299)	Training			13.2	
(300)	Licensed Operator Training Program	Resolved	(SER) (SSER 9) (SSER 10) (SSER 22)	13.2.1	
(301)	Training for Non-licensed Personnel	Resolved	(SER)	13.2.2	
(302)	Emergency Preparedness Evaluation			13.3	
(303)	Introduction	Resolved	(SER) (SSER 13) (SSER 20) (SSER 28)	13.3.1	
(304)	Evaluation of the Emergency Plan	Resolved	(SER) (SSER 13) (SSER 20) (SSER 22) (SSER 28)	13.3.2	
(305)	Conclusions	Resolved	(SER) (SSER 13) (SSER 20) (SSER 22) (SSER 28)	13.3.3	
(306)	Review and Audit	Resolved	(SER) (SSER 8) (SSER 22)	13.4	
(307)	Plant Procedures	Resolved	(SER) (SSER 22)	13.5	
(308)	Administrative Procedures	Resolved	(SER) (SSER 22)	13.5.1	
(309)	Operating and Maintenance Procedures	Resolved	(SER) (SSER 9) (SSER 10) (SSER 22)	13.5.2	
(310)	NUREG-0737 Items	Resolved	(SER) (SSER 3) (SSER 16) (SSER 22)	13.5.3	

	Issue	Status		Section	Note
(311)	Physical Security Plan	Resolved	(SER) (SSER 1) (SSER 10) (SSER 15) (SSER 20) (SSER 22)	13.6	
(312)	Introduction	Resolved	(SSER 22)	13.6.1	
(313)	Summary of Application	Resolved	(SSER 22)	13.6.2	
(314)	Regulatory Basis	Resolved	(SSER 22)	13.6.3	
(315)	Technical Evaluation	Resolved	(SSER 22)	13.6.4	
(316)	Conclusions	Resolved	(SSER 22)	13.6.5	
(317)	Cyber security Plan	Resolved	(SSER 24) (SSER 28)	13.6.6	
(318)	Initial Test Program	Resolved	(SER) (SSER 3) (SSER 5) (SSER 7) (SSER 9) (SSER 10) (SSER 12) (SSER 14) (SSER 16) (SSER 18) (SSER 19) (SSER 23)	14	
(319)	Accident Analyses			15	
(320)	General Discussion	Resolved	(SER)	15.1	
(321)	Normal Operation and Anticipated Transients	Resolved	(SER)	15.2	
(322)	Loss-of-Cooling Transients	Resolved	(SER) (SSER 13) (SSER 14) (SSER 24)	15.2.1	
(323)	Increased Cooling Inventory Transients	Resolved	(SER) (SSER 24)	15.2.2	
(324)	Change in Inventory Transients	Resolved	(SER) (SSER 18) (SSER 24)	15.2.3	
(325)	Reactivity and Power Distribution Anomalies	Resolved	(SER) (SSER 4) (SSER 7) (SSER 13) (SSER 14) (SSER 24) (SSER 26)	15.2.4	
(326)	Conclusions	Resolved	(SER) (SSER 4)	15.2.5	
(327)	Limiting Accidents	Resolved	(SER)	15.3	

	Issue	Status		Section	Note
(328)	Loss-of-Coolant Accident (LOCA)	Resolved	(SER) (SSER 12) (SSER 15) (SSER 24)	15.3.1	
(329)	Steamline Break	Resolved	(SER) (SSER 3) (SSER 14) (SSER 24)	15.3.2	
(330)	Feedwater System Pipe Break	Resolved	(SER) (SSER 14) (SSER 24)	15.3.3	
(331)	Reactor Coolant Pump Rotor Seizure	Resolved	(SER) (SSER 14) (SSER 24)	15.3.4	
(332)	Reactor Coolant Pump Shaft Break	Resolved	(SER) (SSER 14) (SSER 24)	15.3.5	
(333)	Anticipated Transients Without Scram	Resolved	(SER) (SSER 3) (SSER 5) (SSER 6) (SSER 10) (SSER 11) (SSER 12) (SSER 24)	15.3.6	
(334)	Conclusions	Resolved	(SER)	15.3.7	
(335)	Radiological Consequences of Accidents	Resolved	(SER) (SSER 15) (SSER 25)	15.4	
(336)	Loss-of-Coolant Accident	Resolved	(SER) (SSER 5) (SSER 9) (SSER 18) (SSER 25)	15.4.1	
(337)	Main Steamline Break Outside of Containment	Resolved	(SER) (SSER 15) (SSER 25)	15.4.2	
(338)	Steam Generator Tube Rupture	Resolved	(SER) (SSER 2) (SSER 5) (SSER 12) (SSER 14) (SSER 15) (SSER 25)	15.4.3	
(339)	Control Rod Ejection Accident	Resolved	(SER) (SSER 15) (SSER 25)	15.4.4	

	Issue	Status		Section	Note
(340)	Fuel-Handling Accident	Resolved	(SER) (SSER 4) (SSER 15) (SSER 25)	15.4.5	
(341)	Failure of Small Line Carrying Coolant Outside Containment	Resolved	(SER) (SSER 25)	15.4.6	
(342)	Postulated Radioactive Releases as a Result of Liquid Tank Failures	Resolved	(SER) (SSER 25)	15.4.7	
(342a)	Postulated Waste Gas Decay Tank Rupture	Resolved	(SSER 25)	15.4.8	
(343)	NUREG-0737 Items			15.5	
(344)	Thermal Mechanical Report (TMI Action Item II.K.2.13)	Resolved	(SER) (SSER 4) (SSER 24)	15.5.1	
(345)	Voiding in the Reactor Coolant System during Transients (TMI Action Item II.K.2.17)	Resolved	(SER) (SSER 4) (SSER 24)	15.5.2	
(346)	Installation and Testing of Automatic Power-Operated Relief Valve Isolation System (TMI Action Item II.K.3.1) Report on Overall Safety Effect of Power-Operated Relief Valve Isolation System (TMI Action Item II.K.3.2)	Resolved	(SER) (SSER 5)	15.5.3	
(347)	Automatic Trip of Reactor Coolant Pumps (TMI Action Item II.K.3.5)	Resolved	(SER) (SSER 4) (SSER 16) (SSER 24)	15.5.4	
(348)	Small-Break LOCA Methods (II.K.3.30) and Plant-Specific Calculations (II.K.3.31)	Open (Inspection)	(SER) (SSER 4) (SSER 5) (SSER 16)	15.5.5	
(349)	Relative Risk of Low-Power Operation	Resolved	(SER)	15.6	
(350)	Technical Specification	Open (NRR)		16	
(351)	Quality Assurance			17	
(352)	General	Resolved	(SER)	17.1	
(353)	Organization	Resolved	(SER)	17.2	
(354)	Quality Assurance Program	Resolved	(SER) (SSER 2) (SSER 5) (SSER 10) (SSER 13) (SSER 15) (SSER 22)	17.3	
(355)	Conclusions	Resolved	(SER)	17.4	
(356)	Maintenance Rule			17.6	
(357)	Control Room Design Review			18	

	Issue	Status		Section	Note
(358)	General	Resolved	(SER) (SSER 5) (SSER 6) (SSER 15) (SSER 16) (SSER 22)	18.1	
(359)	Conclusions	Resolved	(SER) (SSER 16) (SSER 22)	18.2	
(360)	Report of the Advisory Committee on Reactor Safeguards	Resolved	(SER) (SSER 1) (SSER 4) (SSER 14) (SSER 20) (SSER 28)	19	
(361)	Common Defense and Security	Resolved	(SER)	20	
(362)	Financial Qualifications	Resolved	(SER)	21	
(363)	TVA Financial Qualifications for WBN, Unit 2	Resolved	(SSER 22) (SSER 23)	21.1	
(364)	Foreign Ownership, Control, or Domination	Resolved	(SSER 22)	21.2	
(365)	Financial Protection and Indemnity Requirements			22	
(366)	General	Resolved	(SER)	22.1	
(367)	Preoperational Storage of Nuclear Fuel	Resolved	(SER)	22.2	
(368)	Operating Licenses	Open (NRR)	(SSER 22)	22.3	
(369)	Quality of Construction, Operational Readiness, and Quality Assurance Effectiveness			25	
(370)	Program for Maintenance and Preservation of the Licensing Basis for Units 1 and 2	Resolved	(SSER 22) (SSER 27)	25.9	

Notes:

1. In the process of further validating the information in the WBN Unit 2, FSAR, TVA identified minor administrative/typographical changes to sections previously considered resolved. TVA addressed these changes to the applicable sections in its submittals and clearly indicated them to the NRC staff. The NRC staff has reviewed and confirmed that the changes made are administrative/typographical and do not impact the NRC staff's conclusions as stated in previous SSERs. Based on this review, no additional review is necessary and this section remains resolved.

2. During the assessment of the regulatory framework for completion of the project, the NRC staff characterized certain topics as "Open" pending TVA's validation of the information contained in the section. TVA has determined that the information presented in the FSAR remained valid and only identified minor

administrative or typographical changes to the section. TVA addressed the changes in its submittals and clearly indicated the changes. The NRC staff reviewed and confirmed that the changes made to the section are administrative/typographical and do not impact its conclusions as stated in previous SSERs. Therefore, no additional review is necessary and the NRC staff considers this section resolved.

3. In SSER 21, this issue was identified as "Resolved." However, TVA made changes to the Unit 2 FSAR affecting the previous NRC staff conclusions. The NRC staff evaluated the changes and the results are documented in SSERs subsequent to SSER 21.

1.8 Confirmatory Issues

At this point in the review, there are some items that have essentially been resolved to the NRC staff's satisfaction, but for which certain confirmatory information has not yet been supllied by the applicant. In these instances, the applicant has committed to supply the confirmatory information in the near future. If NRC staff review of this information does not confirm preliminary conclusions on an item, that item will be treated as open, and the NRC staff will report on its resolution in a supplement to this report.

The confirmatory items, with appropriate references to subsections of this report, are noted in Appendix HH.

1.9 License Conditions

1.9.1 Flooding License Condition

The NRC staff had proposed two license conditions in Section 2.4 of SSER 24. TVA has supplemented Section 2.4 since publication of SSER 24. The NRC staff's review of this information can be found in Section 2.4 of SSER 28. The NRC staff has determined that the previously proposed license conditions were no longer appropriate and in their place the NRC staff is proposing the following license condition.

Flooding Protection Proposed License Condition:

> TVA shall implement permanent modifications to prevent overtopping of the embankments of the Fort Loudoun Dam due to the Probable Maximum Flood by February 1, 2017.

1.9.2 Cyber security License Condition

The NRC staff had proposed two license conditions discussed in Section 13.6.6.3.22 of SSER 24. The NRC has received an updated implementation schedule from TVA. The previous license conditions were deleted and a new condition has been proposed and is discussed in Section 13.6.6.3.3 of this SSER.

Cyber security Proposed License Condition:

> The licensee shall fully implement and maintain in effect all provisions of the Commission approved cyber security plan (CSP), including changes made pursuant to

the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The licensee CSP was approved by NUREG-0847, Supplement 28.

1.9.3 Core Operating Limits License Condition

The NRC staff proposed a license condition discussed in Section 4.2.2 of SSER 27.

Performance Analysis and Design (PAD) Thermal Conductivity Degradation (TCD) Proposed License Condition:

> PAD4TCD may be used to establish core operating limits prior to the initial cycle, and prior to any remaining portion of the initial cycle. PAD 4 TCD may not be used to establish core operating limits prior to any reload cycle, and prior to any remaining portion of any reload cycle.

1.9.4 Electrical Design License Condition

The NRC staff proposed a license condition discussed in Section 8.2.2 of SSER 27.

Bulletin 2012-01, "Design Vulnerability in Electrical Power System," Proposed License Condition:

> By December 31, 2017, TVA will report to the NRC that the actions to resolve the issues identified in Bulletin 2012-01, "Design Vulnerability in Electrical Power System," have been implemented.

1.13 Implementation of Corrective Action Programs and Special Programs

In 1985, TVA developed a corporate NPP that identified and proposed corrections to problems concerning the overall management of its nuclear program and a site-specific plan for WBN entitled, "Watts Bar Nuclear Performance Plan." TVA established 18 corrective action programs (CAPs) and 11 special programs (SPs) to address these concerns.

SSER 21, Table 1.13.1 documented the status of NRC staff review of the CAPs and SPs. Currently, as indicated all items are resolved.

1.13.1 Corrective Action Programs

No.	Title	Program Review Status
(1)	Cable Issues	Resolved
	a. Silicon Rubber Insulated Cable	(See Appendix HH)
	b. Cable Jamming	
	c. Cable Support in Vertical Conduit	
	d. Cable Support in Vertical Trays	
	e. Cable Proximity to Hot Pipes	
	f. Cable Pull-Bys	
	g. Cable Bend Radius	
	h. Cable Splices	
	i. Cable Sidewall Bearing Pressure	
	j. Pulling Cables Through 90° Condulet and Flexible	

No.	Title	Program Review Status
	Conduit k. Computer Cable Routing System Software and Database Verification and Validation	
(2)	Cable Tray and Tray Supports	Resolved
(3)	Design Baseline and Verification Program	Resolved
(4)	Electrical Conduit and Conduit Support	Resolved
(5)	Electrical Issues a. Flexible Conduit Installations b. Physical Cable Separation and Electrical Isolation c. Contact and Coil Rating of Electrical Devices d. Torque Switch and Overload Relay Bypass Capability for Active Safety-Related Valves e. Adhesive-Backed Cable Support Mount	Resolved
(6)	Equipment Seismic Qualification	Resolved
(7)	Fire protection	Resolved
(8)	Hanger and Analysis Update Program	Resolved
(9)	Heat Code Traceability	Resolved
(10)	Heating, Ventilation, and Air-Conditioning Duct and Duct Supports	Resolved
(11)	Instrument Lines	Resolved
(12)	Prestart Test Program Plan	Resolved
(13)	Quality Assurance Records	Resolved
(14)	Quality-List (Q-List)	Resolved
(15)	Replacement Items Program (Piece Parts)	Resolved
(16)	Seismic Analysis	Resolved
(17)	Vendor Information Program	Resolved
(18)	Welding	Resolved

1.13.2 Special Programs

No.	Title	Program Review Status
(1)	Concrete Quality Program	Resolved
(2)	Containment Cooling	Resolved
(3)	Detailed Control Room Design Review	Resolved
(4)	Environmental Qualifications Program	Resolved
(5)	Master Fuse List	Resolved
(6)	Mechanical Equipment Qualification	Resolved
(7)	Microbiologically Induced Corrosion	Resolved
(8)	Moderate Energy Line Break Flooding	Resolved
(9)	Radiation Monitoring System	Resolved
(11)	Use-As-Is Condition Adverse to Quality	Resolved

1.14 Implementation of Applicable Bulletin and Generic Letter Requirements

From time to time, the NRC staff issues generic requirements or recommendations in the form of orders, bulletins (BLs), generic letters (GLs), regulatory issue summaries, and other documents to address certain safety and regulatory issues. These are generally termed "generic communications."

The table below outlines the status of the resolution of the generic communications. It should be noted that although many of the generic communications have been documented or otherwise resolved, the NRC staff has determined that there may be circumstances that could result in the need to reopen a previously closed topic.

	Correspondence No.	Title
(1)	GL 1980-14	Light-Water Reactor Primary Coolant System Pressure Isolation Valves.
	TVA Action:	Submit Technical Specifications (TSs) for NRC Review.
	NRC Action:	To be reviewed during validation of TS 3.4.14.
(2)	GL 1980-77	Refueling Water Level - Technical Specifications Changes.
	TVA Action:	Submit Technical Specifications for NRC Review.
	NRC Action:	To be reviewed during validation of TS 3.9.5 –TS 3.9.

	Correspondence No.	Title
(3)	GL 1982-28	Inadequate Core Cooling Instrumentation System.
	TVA Action:	Closed.
	NRC Action:	Closed. Subsumed as part of NRC staff review of Instrumentation and Controls submitted April 8, 2010.
(4)	GL 1983-28	Required Actions Based on Generic Implications of Salem Anticipated Transient without Scram Events (Screened into the Items 4 through 7).
(4.a)	GL 1983-28 (item 3.1)	Post-Maintenance Testing (reactor trip system components).
	TVA Action:	Submit Technical Specifications for NRC Review.
	NRC Action:	To be reviewed during validation of TS Bases 3.0.1.
(4.b)	GL 1983-28 (3.2)	Post-Maintenance Testing (All Surveillance Requirement Components).
	TVA Action	Submit Technical Specifications and NRC Review.
	NRC Action	To be reviewed during validation of TS Bases 3.0.1.
(4.c)	GL 1983-28 (4.2)	Reactor Trip System Reliability (Preventive Maintenance and Surveillance Program for Reactor Trip Breakers).
	TVA Action	Submit Technical Specifications and NRC Review.
	NRC Action	To be reviewed during NRC staff evaluation of Item 17 of TS Table 3.3.1-1.
(4.d)	GL 1983-28 (4.5)	Reactor Trip System Reliability (Automatic Actuation of Shunt Trip Attachment).
	TVA Action	Submit Technical Specifications and NRC Review.
	NRC Action	To be reviewed during NRC staff evaluation of Item 18 of TS Table 3.3.1-1.
(8)	GL 1986-09	Technical Resolution of Generic Issue B-59 (N-1) Loop Operation in BWRs and PWRs.
	TVA Action	Submit Technical Specifications for NRC Review.
	NRC Action	To be reviewed during validation of TS 3.4.4 - TS 3.4.8.

	Correspondence No.	Title
(9)	GL 1988-20	Individual Plant Examination for Severe Accident Vulnerability.
	TVA Action	Closed.
	NRC Action	Closed. NRC letter dated August 12, 2011 (ADAMS Accession No. ML111960228).
(10)	GL 1988-20s1	Initiation of the Individual Plant Examination for Severe Accident Vulnerabilities — 10 CFR 50.54.
	TVA Action	Closed.
	NRC Action	Closed. NRC letter dated August 12, 2011 (ADAMS Accession No. ML111960228).
(11)	GL 1988-20s2	Individual Plant Examination for Severe Accident Vulnerability. Accident Management Strategies for Consideration in the Individual Plant Examination Process.
	TVA Action	Closed.
	NRC Action	Closed. NRC letter dated August 12, 2011 (ADAMS Accession No. ML111960228).
(12)	GL 1988-20s3	Individual Plant Examination for Severe Accident Vulnerability. Completion of Containment Performance Improvement Program and Forwarding of Insights for Use in the IPE for Severe Accident Vulnerabilities.
	TVA Action	Closed.
	NRC Action	Closed. NRC letter dated August 12, 2011 (ADAMS Accession No. ML111960228).
(13)	GL 1988-20s4	Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities.
	TVA Action	Closed.
	NRC Action	Closed. NRC letter dated September 20, 2011 (ADAMS Accession No. ML111960300).

	Correspondence No.	Title
(14)	GL 1988-20s5	Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities - 10 CFR 50.54(f).
	TVA Action	Closed.
	NRC Action	Closed. NRC letter dated September 20, 2011 (ADAMS Accession No. ML111960300).
(15)	GL 1989-04	Guidelines on Developing Acceptable Inservice Testing Programs.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC letter dated October 21, 2014 (ADAMS Accession No. ML14289A222).
(16)	GL 1989-21	Request for Information Concerning Status of Implementation of Unresolved Safety Issue Requirements.
	TVA Action	TVA provided an updated status of unresolved safety issues on September 26, 2008, as supplemented on December 2, 2010, and January 25, 2011.
	NRC Action	Closed. See Appendix C of SSER 23.
(17)	GL 1990-06	Resolution of Generic Issues 70, “PORV [power-operated relief valve] and Block Valve Reliability,” and 94, “Additional LTOP [low-temperature overpressure] Protection for PWRs.”
	TVA Action	Submit Technical Specifications for NRC Review.
	NRC Action	To be reviewed during validation of TS 3.4.11 - TS 3.4.12.
(18)	GL 1992-08	Thermo-Lag 330-1 Fire Barriers.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Open. Pending NRC staff inspection verification.

	Correspondence No.	Title
(19)	GL 1995-03	Circumferential cracking of Steam Generator (SG) Tubes.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated January 21, 2010 (ADAMS Accession No. ML093631061).
(20)	GL 1995-05	Voltage –Based Repair Criteria for Westinghouse Steam Generator Tubes affected by Outside Diameter Stress Corrosion Cracking.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated January 21, 2010 (ADAMS Accession No. ML093631061).
(21)	GL 1996-06	Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated January 21, 2010 (ADAMS Accession No. ML100130227).
(22)	GL 1995-07	Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves (Not identified in SSER 21 as “Open”).
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC letter dated August 12, 2010 (ADAMS Accession No. ML100190443).

	Correspondence No.	Title
(23)	GL 1997-01	Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated June 30, 2010 (ADAMS Accession No. ML100539515).
(24)	GL 1997-04	Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps Integrity During Design-Basis Accident Conditions.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated February 18, 2010 (ADAMS Accession No. ML100200375).
(25)	GL 1997-05	SG Tube Inspection Techniques.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated January 21, 2010 (ADAMS Accession No. ML093631061).
(26)	GL 1997-06	Degradation of SG Internals.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated January 21, 2010 (ADAMS Accession No. ML093631061).

	Correspondence No.	Title
(27)	GL 1998-02	Loss of Reactor Coolant Inventory and Associated Potential for Loss of Emergency Mitigation Functions While in a Shutdown Condition.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated May 11, 2010 (ADAMS Accession No. ML101200155).
(28)	GL 1998-04	Potential for Degradation of the ECCS [Emergency Core Cooling System] and the Containment Spray System after a LOCA because of Construction and Protective Coating Deficiencies and Foreign Material in Containment.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated February 1, 2010 (ADAMS Accession No. ML100260594).
(29)	GL 2003-01	Control Room Habitability.
	TVA Action	No action or documentation is provided to show the NRC staff has reviewed the item for WBN, Unit 2, and the resolution is through submittal of a technical specification.
	NRC Action	Closed. NRC Letter dated February 1, 2010 (ADAMS Accession No. ML100270076).
(30)	GL 2004-01	Requirements for SG Tube Inspection.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated January 21, 2010 (ADAMS Accession No. ML093631061).

	Correspondence No.	Title
(31)	GL 2004-02	Potential Impact of Debris Blockage on Emergency Recirculation during Design-Basis Accidents at PWRs.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated September 18, 2014 (ADAMS Accession No. ML14163A658).
(32)	GL 2006-01	SG Tube Integrity and Associated Technical Specifications.
	TVA Action	No action or documentation is provided to show the NRC staff has reviewed the item for WBN, Unit 2, and the resolution is through submittal of a technical specification.
	NRC Action	Closed. NRC Letter dated January 21, 2010 (ADAMS Accession No. ML093631061) (See Appendix HH).
(33)	GL 2006-02	Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated January 21, 2010 (ADAMS Accession No. ML093631061) (See Appendix HH Open Item 6). Staff has reviewed Revision I to the proposed technical specifications and found that Technical Specificaiton Task Force (TSTF) 449 has been incorporated.
(34)	GL 2006-03	Potentially Nonconforming Hemyc and MT Fire Barrier Configurations.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter February 25, 2010 (ADAMS Accession No. ML100470398).

	Correspondence No.	Title
(35)	GL 2007-01	Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated January 26, 2010 (ADAMS Accession No. ML100120052).
(36)	GL 2008-01	Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems.
	TVA Action	TVA submitted the information requested by the GL.
	NRC Action	Closed. NRC letter dated August 23, 2011 (ADAMS Accession No. ML112232205).
(37)	BL 1992-01 and Supplement 1	Failure of Thermo-Lag 330 Fire Barrier System to Perform its Specified Fire Endurance Function.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Open. Pending NRC staff inspection verification.
(38)	BL 1996-01	Control Rod Insertion Problems (PWR)
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC letter dated May 3, 2010 (ADAMS Accession No. ML101200035) required Confirmatory Action (See Appendix HH Open Items 5 and 8). By letter dated July 30, 2012, TVA provided the information in the Confirmatory Action and the NRC staff verified the information and has closed Appendix HH Open Items 5 and 8.

	Correspondence No.	Title
(39)	BL 1996-02	Movement of Heavy Loads Over Spent Fuel, Over Fuel In the Reactor Core, or Over Safety-Related Equipment.
		The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
		Closed. NRC Letter dated March 4, 2010 (ADAMS Accession No. ML100480062).
(40)	BL 2001-01	Circumferential Cracking of Reactor Pressure Vessel (RPV) Head Penetration Nozzles.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. See NRC Letter dated June 30, 2010 (ADAMS Accession No. ML100539515).
(41)	BL 2002-01	RPV Head Degradation and Reactor Coolant Pressure Boundary Integrity.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. See NRC Letter dated June 30, 2010 (ADAMS Accession No. ML100539515).
(42)	BL 2002-02	RPV Head and Vessel Head Penetration Nozzle Inspection Program.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. See NRC Letter dated June 30, 2010 (ADAMS Accession No. ML100539515).

	Correspondence No.	Title
(43)	BL 2003-02	Leakage from RPV Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC Letter dated January 21, 2010 (ADAMS Accession No. ML093631061).
(44)	BL 2004-01	Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at PWRs.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach was submitted for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC letter dated August 4, 2010 (ADAMS Accession No. ML102080017).
(45)	BL 2007-01	Security Officer Attentiveness.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Closed. NRC letter dated March 25, 2010 (ADAMS Accession No. ML100770549).
(46)	BL 2011-01	Mitigating Strategies
	TVA Action	The proposed approach has been approved for WBN, Unit 1; an updated approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Open.
(47)	BL 2012-01	Design Vulnerability In Electric Power System
	TVA Action	TVA submitted a letter on September 3, 2014 (ADAMS Accession No. ML14247A231) providing wording for the FSAR and proposed a license condition.
	NRC Action	Resolved, see license condition described in SER Section 1.9.4.

	Correspondence No.	Title

NUREG-0737, TMI Action Items (TVA letter dated September 14, 1981, applies to all of the following NUREG-0737 issues):

(48)	NUREG-0737 Item I.B.1.2	Independent Safety Engineering Group.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Open.
(49)	NUREG-0737 Item I.D.1	Control Room Design Review (CRDR).
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Closed in SSER 22, Section 18.2.
(50)	NUREG-0737 Item II.B.3	Post-accident Sampling.
	TVA Action	No action or documentation is provided to show the NRC staff has reviewed the item for WBN, Unit 2, and the resolution is through submittal of a technical specification.
	NRC Action	Closed in SSER 24, Section 9.3.2.
(51)	NUREG-0737 Item II.E.4.2	Containment Isolation Dependability.
	TVA Action	No action or documentation is provided to show the NRC staff has reviewed the item for WBN, Unit 2, and the resolution is through submittal of a technical specification.
	NRC Action	Open.

	Correspondence No.	Title
(52)	NUREG-0737 Item II.F.2	Instrumentation for Detection of Inadequate Core-Cooling.
	TVA Action	Closed.
	NRC Action	Closed. See SSER 25 and SSER 26, Section 7.5.2.2. Open Items 72, 95, 96, 97, 99, 100, 102, 103, 104, 106, 107, and 109 were closed in SSER 25, Section 7.5.2.2. Open items 94, 98, 101, 105, 108, 110, and 111 were closed in SSER 26, Section 7.5.2.2.
(53)	NUREG-0737 Item II.K.3.3	Reporting Safety Valve/Reactor Vessel Failures/Challenges.
	TVA Action	No action or documentation is provided to show the NRC staff has reviewed the item for WBN, Unit 2, and the resolution is through submittal of a technical specification.
	NRC Action	Closed in SSER 22, Section 13.5.3.
(54)	NUREG-0737 Item II.K.3.10	Anticipatory Trip at High Power.
	TVA Action	No action or documentation is provided to show the NRC staff has reviewed the item for WBN, Unit 2, and the resolution is through submittal of a technical specification.
	NRC Action	Closed (SSER 23, Section 7.8.4).
(55)	NUREG-0737 Item III.D.1.1	Primary Coolant Outside Containment.
	TVA Action	No action or documentation is provided to show the NRC staff has reviewed the item for WBN, Unit 2, and the resolution is through submittal of a technical specification.
	NRC Action	Open.
(56)	NUREG-0737 Item III.D.3.4	Control-Room Habitability.
	TVA Action	The proposed approach has been approved for WBN, Unit 1; the same approach will be proposed for use on WBN, Unit 2, without change.
	NRC Action	Closed in SSER 22, Section 6.4.

	Correspondence No.	Title
(57)	Office of Inspection and Enforcement Bulletin (IEB) 75-08	PWR Pressure Instrumentation.
	TVA Action	The item has been approved either for both units at WBN or explicitly for WBN, Unit 2; however, a change to the original approval requires submittal of the technical specifications and NRC staff review.
	NRC Action	Open.
(58)	IEB 77-04	Calculation Error Affecting Performance of a System for Controlling pH of Containment Sump Water Following a LOCA.
	TVA Action	The item has been approved either for both units at WBN or explicitly for WBN, Unit 2; however, a change to the original approval requires submittal of the technical specifications and NRC staff review.
	NRC Action	Open.

Fukushima-Related Orders (NRC letters dated March 12, 2012):

(59)	EA-12-049	Mitigating Strategies for Beyond-Design-Basis External Events (ADAMS Accession No. ML12054A735)
	TVA Action	Provide final compliance letter by December 17, 2014.
	NRC Action	Open.
(60)	EA-12-051	Reliable Spent Fuel Pool Instrumentation (ADAMS Accession No. ML12054A679)
	TVA Action	Compliance letter sent October 29, 2014.
	NRC Action	Open

2 SITE CHARACTERISTICS

2.4 Hydrologic Engineering

2.4.10 Flooding Protection Requirements

Disposition of Open Item (Appendix HH)

Open Item 134

Open Item 134 states:

> TVA should provide to the NRC staff supporting technical justification for the statements in Amendment 104 of FSAR Section 2.4.4.1, "Dam Failure Permutations," page 2.4-32 (in the section "Multiple Failures") that, "Fort Loudoun, Tellico, and Watts Bar have previously been judged not to fail for the OBE [operating basis earthquake] (0.09 g). Postulation of Tellico failure in this combination has not been evaluated but is bounded by the SSE [safe shutdown earthquake] failure of Norris, Cherokee, Douglas and Tellico."

In Supplemental Safety Evaluation Report (SSER) 24, the NRC staff documented its review of updated information supplied by TVA in Amendment No. 104 of the final safety analysis report (FSAR) on flooding protection. During its review, the NRC staff documented the need for resolution to Open Item 134. Following the publication of SSER 24, TVA informed the NRC staff that further evaluation had been completed regarding the hydrologic analysis at the Watts Bar Nuclear Plant (WBN) site and that a slightly higher probable maximum flood had been calculated. As this information affected both WBN Units 1 and 2, TVA submitted a license amendment for WBN, Unit 1, and Updated FSAR (UFSAR) pages for WBN, Unit 2. Considering the guidance in SRM SECY-07-0096 that Unit 1's licensing basis could be used as a reference for the licensing basis for Unit 2, the NRC staff focused its review on the WBN, Unit 1, license amendment request (LAR) as a means to update the hydrologic analysis for the WBN site. If approved, this would also provide the basis for WBN, Unit 2.

During the NRC staff's review of the application, questions were raised on the actions taken by TVA to evaluate dam stability. Following many discussions with the NRC staff, TVA revised its hydrologic analysis for the WBN site, including the use of the U.S. Army Corps of Engineers Hydrolic Engineering Centers Hydrologic Modeling System and River Analysis System software, which resulted in changes to the flooding protection requirements for certain structures, systems, and components impacted by the revised analysis. In addition, TVA also revised the dam stability acceptance criteria by adopting the updated TVA River Operations Standards (the TVA dam authority having jurisdiction). TVA supplied this by a supplement to the WBN, Unit 1, LAR, and a letter for WBN, Unit 2, followed up by Amendment No.113 to the FSAR. By letter dated January 28, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15005A314), the NRC staff approved the WBN, Unit 1, LAR.

Based on the fact that TVA revised its hydrologic analysis for the WBN site, including the dam stability acceptance criteria, the NRC staff considers its previous concern to no longer be an issue and, therefore, considers **Open Item 134 to be closed**. The evaluation previously documented for this section has been superseded by the evaluation done for the license amendment and the two units no longer have a differing licensing basis.

The following license condition was imposed as part of the WBN, Unit 1, license amendment approval and is being proposed for WBN, Unit 2:

Flooding Protection Proposed License Condition:

> TVA shall implement permanent modifications to prevent overtopping of the embankments of the Fort Loudoun Dam due to the Probable Maximum Flood by February 1, 2017.

8 ELECTRICAL POWER SYSTEMS

8.3 Onsite (Standby) Power System

8.3.1 Alternating Current Power System

8.3.1.2 Low and Degraded Voltage Conditions

Disposition of Open Items (Appendix HH)

Open Item 30

Open Item 30 states:

> TVA should confirm that all other safety-related equipment (in addition to the Class 1E motors) will have adequate starting and running voltage at the most limiting safety related components (such as motor-operated valves, contactors, solenoid valves or relays) at the degraded voltage relay [DVR] setpoint dropout setting. TVA should also confirm that the final Technical Specifications are properly derived from these analytical values for the degraded voltage settings. (SSER 22, Section 8.3.1.2).

By e-mail dated February 27, 2014, the U.S. Nuclear Regulatory Commission (NRC) staff issued an RAI (ADAMS Accession No. ML14059A158) related to Open Item No. 30 for WBN, Unit 2, SSER, NUREG-0847 (June 1982). By letter dated January 30, 2015 (ADAMS Accession No. ML15030A511), TVA (the applicant) supplied further information on the licensing basis for WBN, Units 1 and 2. Open item No. 30 is related to DVR setpoints for protection of safety-related equipment during sustained low voltage conditions on offsite power sources.

Two levels of undervoltage protection are given on the WBN 6.9 (kilovolt) kV safe shutdown boards to protect the safety-related electrical distribution system from unexpected low voltage conditions. The first level of undervoltage protection is the loss of voltage relay (LVR), whose primary function is to detect and disconnect the safety-related boards upon a loss of offsite power. The second level of undervoltage protection is the DVR, which protects Class 1E equipment from sustained low or degraded voltage conditions on the offsite power grid. The LVR and DVR also supply a start signal to the onsite source(s) to ensure that power to the safety-related loads can be established in a timely manner for safe shutdown of the dual units during postulated events.

The DVRs have a nominal 10-second time delay at the technical specification (TS) specified relay voltage setting. When the 10-second time delay has elapsed, the plant loads are removed from the offsite power supply and transferred to the onsite emergency diesel generators. The DVRs drop-out (de-energize) when sufficient voltage is not available and normally pick-up (energize) if voltage is recovered within the 10-second delay on the 6900 (volt alternating current (VAC) Class 1E bus.

TVA's January 30, 2015 letter supplied a detailed explanation of degraded voltage and loss of voltage protection schemes installed at WBN, Units 1 and 2. Enclosure 1 of the letter gave details on applicable design and licensing basis requirements and included an overview of how

the Class 1E bus undervoltage protection schemes fully comply with applicable design and licensing basis requirements, including General Design Criterion (GDC) 17, “Electric Power Systems,” of Appendix A, “General Design Criteria for Nuclear Power Plants,” to 10 CFR Part 50. The letter also states that, “Branch Technical Position (BTP) PSB-1: Adequacy of Station Electric Distribution System Voltages,” Revision 2 (July 1981) is part of the licensing basis for WBN, Units 1 and 2, and the design of the DVRs is in full compliance with this BTP.

Section 7.2 of Enclosure 1 of the letter dated January 30, 2015, gives a summary of the analyses done on the WBN alternating current (AC) power distribution system and auxiliary loads to demonstrate that the offsite power system can perform its intended safety functions. The detailed studies are documented in TVA Calculation EDQ00099920070002, “AC Auxiliary Power System Analysis (Dual Unit Operation),” Revision 43. The applicant has stated the following pertinent design features:

- The calculation evaluates the system performance and resultant equipment voltages when powered from the 161kV offsite preferred power supply and the 500kV system.

- The AC system analyses were performed for the various transformer, bus, and circuit breaker alignments and design-basis events, including the 6.9kV Shutdown Boards aligned to a single Common Station Service Transformer (CSST) C or D, the 6.9kV Shutdown Boards aligned to CSST A or B, loss-of-coolant accident (LOCA) in one unit with orderly shutdown of the other, and Safety Injection actuation Phase A or Safety Injection actuation Phase B.

- The analysis considers the operation of the safety-related electrical distribution system under accident conditions (accident initiated block starting) with the offsite power supply at the minimum grid voltage for operable offsite sources (153kV), which bounds to a minimum expected grid voltage and capacity for an N-1 contingency.

- The scope of TVA Calculation EDQ00099920070002 includes the CSSTs A, B, C, and D, Unit Station Service Transformers 1A, 1B, 2A, and 2B, 6.9kV Reactor Coolant Pump Boards, 6.9kV Start Busses, 6.9kV Common Station Switchgear C and D, 6.9kV Shutdown Boards, 6.9kV Unit Boards, 6.9kV Common Boards, and the downstream 6900-480 (volt) V transformers, 480V distribution boards and all interconnections.

The analysis assumes that:

a. Equipment started by an automatic safety injection actuation signal (SIAS) is started at the same time (block start) unless the load’s control circuitry has a sequential time delay.

b. Equipment that is tripped off by an SIAS is disconnected.

c. Loads that could be operating immediately after the safety injection, whether safety-related or not, are running.

d. The analysis considers the maximum expected loading conditions is associated with a design-basis accident (DBA) in one reactor unit and the other reactor unit in a simultaneous orderly shutdown.

The applicant has established that approximately 7000V at the 6.9kV safety bus ensures that all safety-related equipment is capable of performing the safety functions when relying on offsite power. The applicant has indicated that the safety-related bus voltage drops below the DVR dropout voltage analytical limit (6555V) during the accident (block-start) transient and recovers above the DVR pickup voltage analytical limit (6681V) before the DVR minimum time delay analytical limit (8.5 seconds) is exceeded. Since the voltage recovers and the safeguards loads are not adversely impacted, the applicant has concluded the offsite source has the capacity and capability (start and run all required loads) to perform its intended safety functions for postulated DBA conditions and established operability limits for offsite power sources during normal plant operation.

Based on the information provided by the applicant, the NRC staff determined that the Offsite Power and Station Electric Power System Design Calculations specify the voltage operating parameters of the plant electrical distribution system using the transmission network (grid) operating parameters. This interface calculation establishes operating voltage bands for all plant electrical busses, which ensures that all plant safety-related components and systems have proper voltage for starting and running in all operational configurations (expected operational and accident line-ups and conditions). Therefore, based on normal grid operation (including post-contingency grid conditions), the plant buses will have adequate voltage above the DVR actuation point, thus maintaining the offsite power supply to the plant electrical distribution system. This design meets the capacity and capability requirement with respect to voltage requirements, thus demonstrating compliance with GDC 17 requirements.

In view of the proposed operation of WBN, Unit 2, sharing the common offsite source with WBN, Unit 1, the NRC staff requested information on protocols between the WBN units and transmission system operator (TSO) with respect to dual unit operation.

The applicant stated that WBN, Units 1 and 2, will maintain existing protocols between the nuclear power plant and the TSO to determine the operability of offsite power. These protocols are consistent with the guidance given in NRC GL 2006-02, “Grid Reliability and the Impact on Plant Risk and Operability of Offsite Power” (ADAMS Accession No. ML060180352). The design-basis requirements established for dual unit operation are discussed in Enclosure 1 of the applicant’s letter dated January 30, 2015.

North American Electric Reliability Corporation Standard NUC-001-2.1, “Nuclear Plant Interface Coordination” requires coordination between nuclear plant operators and transmission entities for the purpose of ensuring safe nuclear plant operations. The standard delineates nuclear plant interface requirements for TSOs and nuclear plant operators.

The bulk power electric system around WBN, Units 1 and 2, is owned by TVA and operated by Transmission and Power Supply (TPS). TVA Nuclear Power Group (NPG) is responsible for operation of the nuclear plants. The two entities have developed TVA intergroup agreement TVA-SPP-10.010 that established mutually agreed NPIRs and documents how the NPG and TPS satisfy the requirements of NUC-001-2.1. This TVA intergroup agreement defines how and when grid status, and changes to grid status, is communicated between TPS and WBN.

WBN Technical Instruction (TI)-12.15, “161kV Offsite Power Requirements,” Revision 26, supplies guidance to plant operators when notified by the grid operator that the 161kV power source cannot meet the pre-established criteria for either of the offsite power sources. TI-12.15 directs the plant operator to enter the appropriate WBN technical specification (TS) limiting condition of operation.

The applicant stated that the current offsite voltage acceptance criteria for the 161kV source (normal operation) for WBN is as follows:

> Maximum voltage drop from pre-event to post-event for a design bases event is an 11kV drop with a minimum post-event grid voltage at WBN of 153kV. The "ALTERNATE" offsite acceptance criteria for the 161kV source for WBN is a maximum voltage drop from pre-event to post-event for a design bases event is 6kV drop with a minimum post-event grid voltage at WBN of 153kV.

The applicant stated that with dual unit operation, the offsite voltage acceptance criteria for the 161kV source will be revised as follows to account for the additional load associated with an accident in one unit and concurrent shutdown of the second unit: "A maximum pre-event to post-event voltage drop of 9kV with a minimum grid of 153kV in "NORMAL" and a 6kV drop with a minimum grid voltage of 153kV in "ALTERNATE."

The potential loss of generation from dual WBN units has not been incorporated into the contingency planning tools used by TPS as a requirement for evaluating offsite power capabilities. The applicant has indicated that TPS procedures will be updated in alignment with WBN procedures for dual unit operation. In a followup email dated February 25, 2015 (ADAMS Accession No. ML15063A008), TVA stated the following:

> NRC Inspection Planning & Scheduling (IP&S) Item 210 for Watts Bar Unit 2, has an open action to incorporate the dual unit operation into the Transmission Operation Procedures. Specifically, IP&S Item 210 includes:
>
> "Revision to incorporate WBN dual unit operating requirements is required for Transmission Operation procedures TRO-EA-[Environmental Assessment] SOP-30.405, "Nuclear Offsite Power Operating Requirements" (Tab 12) and TRO-EA-SOP-30.406, "Incorporation of Nuclear Offsite Power NPIRs and Accident Loading into Operating System Models" (Tab 13), and WBN procedure 1-PI-OPS-1-500kV, "Main Control Room Voltage Monitoring" (Tab 15)."

Based on the information provided in Sections 7.3, 7.4, and 7.5 of Enclosure 1 (letter dated January 30, 2015) and satisfactory closure of IP&S Item 210 for WBN related to TPS and NPG interface requirements, the NRC staff has concluded that WBN has established adequate controls and procedures for notifications when the grid operator identifies an inadequacy in the offsite power systems.

In Section 8.2 of Enclosure 1 to the TVA letter dated January 30, 2015, the applicant gave a summary of the analysis documented in TVA Calculation WBN-EEB-MST1060029, "Degraded Voltage Analysis," Revision 37, on establishing the DVR dropout voltage analytical limit. To ensure that the DVRs protect the plant equipment, an industry recommended approach is analyze from the bottom up (lowest voltage level to 6.9kV bus level). For this method, the minimum required operating voltage is determined for each safety load, including ancillary equipment, based on vendor recommended nameplate values or other approaches supported by test and analysis or special procurement specifications (e.g., starting and running for motors or minimum voltage requirements for relays, contactors, etc., to operate). The minimum required bus voltage is derived by adding voltage drop due to the impedances of interconnecting components. An iterative process is used to optimize the minimum required voltage and establish the analytical limit. Based on this approach, TVA has established a value

of 6555V as the DVR dropout (actuation) voltage analytical limit. The applicant stated that the following key elements were considered for establishing the analytical limit:

- The connected medium and low voltage safety-related loads required for accident and normal operating conditions are verified to have an acceptable operating (running) voltage.

- Each safety-related motor connected to the Class 1E system under normal loading conditions as well as safety injection actuation Phase A and safety injection Phase B loading conditions is verified to have adequate starting voltage.

- Motor terminal voltage is verified to be sufficient to prevent motor overheating damage.

- Motor control circuits and 120V distribution panel loads are verified to have adequate voltages.

- Resultant terminal voltages are verified to be adequate to stroke individual motor-operated valves (MOV) as per guidance provided in NRC GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance."

The applicant stated that the DVR time delay setpoint is based on evaluation of the following factors:

- Short enough duration to provide adequate protection for the safety-related equipment.

- Long enough to avoid trips during starting transients, including the automatic actuation of the engineered safety features (ESF) loads.

- The upper limit of the DVR time delay is bounded by the time required by emergency diesel generators (EDGs) to come up to rated speed and voltage.

- The lower limit of the DVR time delay exceeds the time required for the safety bus voltage to recover from voltage transients resulting from large motor starts.

The applicant stated that to ensure that the analytical value is not exceeded, the nominal trip setpoint with allowable values (between ≤6606VAC and ≥6593VAC with a time delay between 9.73 and 10.2 seconds) were derived after consideration of all applicable errors and tolerances in accordance with TVA setpoint methodology and industry standards such as ANSI/ISA Standard 67.04.01-2000, "Setpoints for Nuclear Safety-Related Instrumentation." The NRC staff noted that the design basis for WBN is block starting the ESF loads (versus sequencing of loads from offsite power source).

Based on the technical evaluations and performance capabilities of the DVR and LVR protection schemes, TVA has concluded that the plant analytical and TS trip setpoints (voltage and time delays) for these relays are properly derived. A summary of the supporting evaluations for plant response during postulated DBA conditions with normal and degraded grid voltage conditions is discussed in Section 8.3 of Enclosure 1 to the letter dated January 30, 2015.

TVA evaluated three specific safety bus voltage bands that bound all postulated transmission system voltage variations that could impact the plant safety buses in the DVR operating range.

The first band considered is with plant safety buses operating at minimal allowable grid voltage. This condition assumes that the offsite power voltage is adequate to support all analyzed DBAs, events, conditions, and abnormal operating occurrences as verified by the offsite/station electric power system design calculations.

During normal operation, the 6.9kV safeguards buses are maintained between 7010V and 7135V. The applicant stated that an analysis was performed for the following limiting case:

- Dual unit operation;
- 161kV transmission system at minimum operable voltage of 153kV;
- The 6.9kV safeguards bus voltage is at the lower limit of 7010V pre-accident signal actuation;
- Worst case loading accident conditions considered; and
- Limiting system alignments (i.e., single station service transformer CSST C or D carrying all the safety loads).

The applicant has concluded that the safety-related bus voltage drops below the DVR dropout voltage analytical limit (6555V) during the block-start and run of accident loads and recovers above the DVR pickup voltage (reset) analytical limit (6681V) before the DVR minimum time delay analytical limit (8.5 seconds) is exceeded. During this transient, the safeguards loads remain connected to the offsite source and the DVR relay provides adequate protection. Since the voltage recovers to an acceptable level after block loading and the safeguards loads are available to mitigate the consequences of the event, the requirements of GDC 17 are met.

The second band considered is the 6.9kV safeguards bus voltage degrades to DVR analytical limit of 6555V. The NRC staff considers this to imply that the offsite power voltage is below the minimum grid voltage <153kV (i.e., sustained degraded voltage).

For this scenario, the applicant considered the 6.9kV safeguards bus voltage at the DVR dropout analytical limit of 6555V pre-accident signal actuation. Assuming the transmission system does not recover from degraded voltage conditions, the study concluded that the DVR will actuate and separate the plant buses from the offsite source after the relay has timed out. At this voltage, the offsite power source is not capable of block starting the safety loads. However, the offsite source is capable of providing adequate voltage for the safety-related loads that may be operating before the event and starting individual safety loads, including safety-related MOVs. The applicant has verified that none of the protective devices actuate if loads were to start based on the plant design requirements and operating configuration. Therefore, all required loads will be available to meet their intended safety functions from the onsite power system. After separating from the offsite source, the onsite EDGs are able to automatically connect to the safeguards buses and support safe shutdown of the plant in a timeframe consistent with the plant's safety analysis assumptions, thus maintaining compliance with GDC 17 requirements.

The third band considered is with 6.9kV safeguards bus voltage sustained between DVR analytical limit of 6555V and the minimum operable bus voltage of 7010V.

If the pre-accident signal bus voltage is below the minimum operability limit of 7010V, then the offsite power source may not be capable of performing its intended safety function depending on the capacity of the grid, transformer and bus alignments, and plant loading. The applicant performed a sensitivity analysis (TVA WBN Calculation STUDY-EEB-WBN-12-001, "Sensitivity Study of DVR Protection During Motor Starting, Revision 2") to evaluate combinations of grid

conditions and various postulated design-basis events and plant configurations to distinguish between types of events that result in safety buses remaining connected to the offsite source or types of events that result in transferring safety buses. Based on the results of specific analyses documented in Appendices B and H of this calculation, the applicant stated the following conclusions:

a. During any motor starting event where voltage drops below the DVR dropout setting and then recovers to the reset value, it will recover above the DVR Dropout Analytical Limit (6555V) within a maximum 4-second time delay.

b. The time delay is acceptable based on WBN's accident analysis assuming a 5-second time delay for restoration of safety-related bus voltage, when relying on offsite power.

c. For all cases evaluated in the sensitivity study, the offsite power source is capable of providing adequate voltage for the safety-related loads that may be operating prior to the event and starting safety loads as required automatically by the design including safety-related MOVs.

d. The DVR provides adequate protection of the Class 1E loads and prevents inadvertent trip of safety loads.

e. If the bus voltage does not recover (due to sustained degraded grid condition) to the DVR reset setpoint within the allowable limit of 10.2 seconds, then the DVR will actuate and separate the plant buses and permit the safety-related buses to be powered from the onsite standby sources in a timeframe consistent with the plant's safety analysis assumptions.

f. The scenarios for which the onsite power source is automatically allowed to power the safety busses in time consistent with accident analyses and the requirements of GDC 17 are maintained.

g. The capability to successfully actuate the accident loads on the onsite power source is maintained to assure compliance with GDC 17 requirements.

The NRC staff has not reviewed the detailed calculations and analyses associated with (1) development of the analytical and allowable limits for DVR setpoints, and (2) establishing the adequacy of the setpoints for events postulated during DBA conditions or anticipated operational occurrences coupled with varying conditions for offsite power sources. In a followup email dated February 25, 2015, the applicant stated, "TVA understands and will support subsequent inspections of the calculations that support TVA's Response to Watts Bar Nuclear Plant Unit 2 Request for Additional Information Regarding Chapter 8, 'Electrical Power' - Supplemental Safety Evaluation Report (SSER 22, Open Item 30) (TAC No. ME2731)."

The NRC staff relied on the attachments to the applicant's letter dated January 30, 2015, which supplied an explanation of WBN, Unit 2, degraded voltage protection scheme. Based on the overview of the protection scheme supplied by TVA, the NRC staff has concluded that the DVR analytical limit will protect the safety-related equipment that is operating or required to operate during degraded grid conditions. The applicant has also stated that in the event of degraded voltage conditions concurrent with an accident signal, safety-related equipment will have adequate starting and running voltage at the most limiting safety-related components (such as motor-operated valves, contactors, solenoid valves or relays), either from the offsite source or

from the onsite source after an automatic transfer. Based on these statements, the NRC staff has concluded that the DVR protection scheme for WBN, Unit 2, will adequately support operation of safety-related equipment during design-basis events in accordance with requirements of GDC 17.

By letter dated January 30, 2015, the applicant has stated that the WBN offsite power sources and Class 1E bus undervoltage protection scheme fully comply with NRC BTP PSB-1. The NRC staff did not conduct a detailed, line-by-line review and comparison of NRC BTP PSB-1 and the WBN design as part of its review. However, during the course of its review, the NRC staff noted that TVA's approach for addressing degraded voltage protection deviates from the position described in BTP PSB-1 B.1.b. For example, Section B.1.b of BTP PSB-1 states that two separate time delays shall be selected for the degraded voltage protection scheme. By e-mail dated February 25, 2015, TVA stated that TVA's DVR scheme at WBN, Units 1 and 2, includes two separate time delay relays, both of which have the same setpoint. The NRC staff determined that the existing DVR design at WBN deviates from PSB position B.1.b in that the existing design provides only one time delay (10-seconds nominal) and alarms only when separation of the preferred power source occurs due to the DVR timing out (i.e., ESF buses start initiating diesel start and bus transfer from offsite to onsite power source). Nonetheless, the NRC staff has determined that TVA's degraded voltage protection scheme is acceptable, in accordance with the requirements of GDC 17.

The NRC staff reviewed the summary of applicant's analyses provided in the enclosures with TVA letter dated January 30, 2015, to evaluate the adequacy of degraded voltage relay setpoints and functional requirements. Supporting TVA controlled documents were not included in the review.

TVA has established a minimum grid voltage and a corresponding 6.9 kV safeguards bus voltage at or above which the offsite power is capable of supporting plant safe shutdown of WBN, Unit 2. The applicant has established a DVR setpoint at or above which all equipment required for mitigating the consequences of an accident in one unit and concurrent safe shutdown of the other unit is adequately protected from degraded voltage conditions. The applicant has stated that in the event of sustained degraded voltage conditions at or above the DVR setpoint, the onsite or offsite power source is available in a time commensurate with assumptions in the accident analysis. If the safeguards bus voltage degrades to a value below the DVR setpoint, the DVR or the loss of voltage relay will separate the offsite sources from the plant busses to allow the onsite source to support plant shutdown.

Based on the information provided by the applicant, the NRC staff finds the proposed DVR protection scheme provides reasonable assurance that the safety-related equipment will perform its intended safety functions during postulated grid conditions as all safety-related equipment will have adequate starting and running voltage. Therefore, the NRC staff concludes that DVR scheme and offsite power system at WBN, Unit 2, meets the intent of GDC 17 requirements.

Based on the above evaluation, the NRC staff finds the responses acceptable and, therefore, considers **Open Item 30 to be closed**.

13 CONDUCT OF OPERATIONS

13.3 Emergency Preparedness

13.3.1 Introduction

Section 13.3, "Emergency Preparedness," of Supplement 22 to NUREG-0847 (SSER 22) reported on the NRC staff's review and determinations regarding the Tennessee Valley Authority (TVA) Nuclear Radiological Emergency Plan (REP). The TVA REP consists of two portions: (1) a generic REP that is applicable to all TVA-licensed nuclear power reactors and, (2) a series of site-specific appendices for each of the TVA nuclear sites. Appendix C addresses WBN site-specific information. The generic REP and the WBN-specific Appendix C, hereafter referred to in this supplemental safety evaluation report (SSER) as the "WBN-REP," constitutes the "emergency plan" required by Title 10 of the *Code of Federal Regulations* (CFR) Part 50.34(b)(6)(v), 10 CFR 50.47, and 10 CFR Part 50, Appendix E (hereafter Appendix E).

The content in this SSER updates corresponding content in SSER 22. Otherwise, the content of Chapter 13.3 of SSER 22 remains applicable. The two situations that made this update necessary are:

- The NRC staff performed the review documented in SSER 22 using Revision 92xx of the WBN-REP. Although TVA may make changes to its emergency plans for WBN, Unit 1, and the other TVA reactor sites under the provision of 10 CFR 50.54(q)(3), that change process does not apply to WBN, Unit 2, until the issuance of its OL. The NRC identified Confirmatory Item 37 to provide the NRC staff with an opportunity to evaluate whether the changes made by TVA to the WBN-REP since Revision 92xx affected the bases of the NRC staff's findings in SSER 22. The most recent WBN-REP reviewed by the NRC staff was Revision 106X. This confirmatory item is closed in Section 13.3.2.18 of this supplement.

- On November 23, 2011, the NRC issued a final rulemaking that amended existing rules and created new rules on emergency preparedness. This rulemaking became effective on December 23, 2011, with various implementation dates. The rule contained language that specified that WBN, Unit 2, would meet the requirements as applicable to nuclear power reactor licensees. The implementation dates for all but one of the amended and new rules have now expired. The one amended rule that the implementation date has not expired is Appendix E, § IV.f. The NRC staff's evaluation of this amended rule is discussed in SSER Section 13.3.2.14. Although the implementation of these requirements at operating nuclear power reactors is being evaluated through the NRC's Reactor Oversight Process (ROP), the applicant for an OL under 10 CFR Part 50 must demonstrate that it has complied with all regulatory requirements applicable to the facility prior to the issuance of the license. Accordingly, the NRC staff has reviewed Revision 104X of WBN-REP, to evaluate the implementation of the new regulatory requirements with regard to WBN, Unit 2. See the following table for a list of new requirements implemented in this rulemaking, along with the section in this SSER in which the requirement is discussed.

Table 13.3-1

WBN, Unit 2, Compliance with November 2011 Emergency Preparedness Rulemaking

Rule	New requirement topic	Description/Discussion	SSER Section
10 CFR 50.54(q)	Amended Emergency Plan Change Process	These requirements will become a condition of the license if an OL is issued for WBN, Unit 2.	N/A
10 CFR 50, Appendix E, § IV	Evacuation Time Estimate (ETE) Updating	This rule requires licensees to (1) submit an evacuation time estimate (ete) update by December 22, 2012 and (2) Use the ETE results in establishing evacuation strategies.	13.3.2.10 13.3.2.17
10 CFR 50, Appendix E, § IV.A.7	Licensee Coordination with Offsite Response Organizations	This rule requires licensees to identify and describe the assistance expected from appropriate State, local, and Federal agencies, including hostile action at the site.	13.3.2.3
10 CFR 50, Appendix E, § IV.A.9	On-Shift Staffing Analysis	This rule requires licensees to perform a detailed analysis demonstrating adequate on-shift personnel.	13.3.2.2
Appendix E, § IV.B.1	Emergency Action Levels for Hostile Action	This rule was a codification of a previous order. The WBN, Unit 2, EAL scheme was reviewed as described in SSER 22, Section13.3.2.4.	13.3.2.4
10 CFR 50, Appendix E. § IV.C.2	Emergency Declaration Timeliness	This rule requires the licensee to establish and maintain the capability to assess, classify, and declare an emergency condition within 15 minutes.	13.3.2.4
10 CFR 50, Appendix E § IV.D.3	Alert and Notification Backup Means	This rule requires the licensee to provide a backup public alerting means.	13.3.2.5
10 CFR 50, Appendix E § IV.E.8.b	Emergency Operations Facility – Performance Based Approach	This rule is not applicable to TVA as the NRC explicitly approved TVA's Central Emergency Control Center Emergency Operations Facility (EOF). This rule could be applicable if TVA should seek to relocate or modify the approved facility.	N/A
10 CFR 50, Appendix E § IV.E.8.c	Emergency Operations Facility – Performance Based Approach	This rule requires the licensee EOF to have certain capabilities. The exclusion identified above does not apply.	13.3.2.8

Rule	New requirement topic	Description/Discussion	SSER Section
10 CFR 50, Appendix E, § IV.E.8.d	Emergency Response Organization Augmentation and Alternative Facility	This rule requires the licensee to establish an alternative facility that would be accessible even if the site were under threat or experience hostile action. Part of this amended rule is a codification of a previous order. The additional response capabilities identified in the rule were implemented by December 23, 2014.	13.3.2.8
10 CFR 50, Appendix E, § IV.f	Challenging Drills and Exercises	This rule requires the licensee to modify its EP drill and exercise program to make them more effective. Some changes were effective on December 23, 2011. The licensee is required to conduct a hostile action based (HAB) biennial exercise by December 23, 2015. The remaining requirements are indexed to the 8-year exercise cycle that commences with the HAB. TVA has modified the generic REP to reflect these changes once the HAB is conducted.	13.3.2.14
10 CFR 50, Appendix E, § IV.I	Protective Actions for Onsite Personnel	This rule requires the licensee to have a range of protective actions to protect onsite personnel during a hostile action.	13.3.2.10

13.3.1.3 Regulatory Basis

In addition to the regulatory bases identified in Section 13.3.1.3 of SSER 22, the following regulations and regulatory guidance were used in the review described in this supplement:

- "Enhancements to Emergency Preparedness Regulations," Final Rule to 10 CFR Parts 50 and 52," Volume 26 *Federal Register* 72560 – 72600
- "Emergency Preparedness and Response Actions for Security-Based Events," NRC Bulletin 2005-02 (ADAMS Accession No. ML051740058)
- "Interim Staff Guidance: Emergency Planning for Nuclear Power Plants," NSIR/DPR-ISG-01 (hereafter "ISG") (ADAMS Accession No. ML113010523)
- "Criteria for Development of Evacuation Time Estimate Studies," NUREG/CR-7002 (ADAMS Accession No. ML113010515)
- "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants - Guidance for Protective Action Strategies," NUREG-0654 (ADAMS Accession No. ML113010596)
- "Assessment of On-Shift Emergency Response Organization Staffing and Capabilities," Nuclear Energy Institute NEI-10-5, Revision 0 (ADAMS Accession No. ML111751698)

13.3.2 Evaluation of the Emergency Plan

13.3.2.2 Onsite Emergency Organization

Regulatory Basis: 10 CFR 50.47(b)(2) requires that on-shift facility licensee responsibilities for emergency response are unambiguously defined, adequate staffing to provide initial facility accident response in key functional areas is maintained at all times, timely augmentation of response capabilities is available, and the interfaces among various onsite response activities and offsite support and response activities are specified. Supporting requirements are provided in Appendix E § IV.A to 10 CFR 50.

Subsequent to the issuance of SSER 22, the NRC issued a new regulation, Appendix E § IV.A.9 to 10 CFR 50 which requires nuclear power reactor licensees do a detailed analysis by December 24, 2012 demonstrating that on-shift personnel can perform their assigned emergency plan functions is a timely manner in the presence of other assigned responsibilities. The ISG gives guidance on complying with the new requirement.

Technical Evaluation: In Section 13.3.2.2 of SSER 22, the NRC staff described its evaluation of the WBN-REP onsite emergency organization and its finding that the planning standard 10 CFR 50.47(b)(2) was met for WBN, Units 1 and 2.

TVA developed the on-shift staffing analysis (OSA) Revision 1 for WBN, Unit 1, but was not required to submit the WBN, Unit 1, OSA for review, as the NRC staff will evaluate the OSAs of existing licensees as part of routine inspection activities. The WBN, Unit 1, OSA cannot serve as a reference basis for WBN, Unit 2, licensing, as it did not address the additional WBN, Unit 2, staffing, and the NRC staff did not previously approve the WBN, Unit 1, OSA. TVA submitted Revision 2 of the OSA for WBN, Units 1 and 2, on September 12, 2014 (ADAMS Accession No. ML15205A111). This version includes the WBN Unit 2, on-shift staffing in the required analyses for the series of potential events that could occur at either unit.[1]

The NRC staff reviewed the WBN OSA, Revision 2, against the guidance of the ISG. TVA used the analysis methodology in NEI-10-05, which the ISG identified as an acceptable approach. The NRC staff confirmed that the staffing levels assumed in the OSA were consistent with those identified in Revision 104X of the emergency plan. The NRC staff reviewed TVA's identification of events and conditions analyzed and determined it to be reasonable and generally consistent with the guidance in the ISG. Events and conditions not included were appropriately justified in the analysis. The NRC staff reviewed the individual scenario analyses, the task overlap summary, and the time-motion analyses for reasonableness and consistency with the guidance. Because of the design and operational fidelity between the two units, there are no unit-specific events. However, the NRC staff identified differences between the OSA discussion and in the FSAR, which is the licensing basis upon which the OSA is required to be based. By email dated October 20, 2014 (ADAMS Accession No. ML14293A227), the NRC staff issued request for additional information (RAI) 28.a-d to resolve these differences. In its December 15, 2014 (ADAMS Accession No. ML15205A123), response, TVA explained the observed differences with the FSAR and responded to the NRC staff's other requests. As part of this response, TVA submitted Revision 3 of the OSA. The NRC staff reviewed the changes made to the OSA and

[1] Note that this does not address staffing for events occurring simultaneously at both units. This additional staffing is a Fukushima recommendation and is being addressed, along with the other Fukushima lessons learned, in separate SERs.

evaluated the applicant's other responses against the applicable guidance. None of the changes made affected the NRC staff's conclusions of the OSA. Based upon this review and the fidelity between WBN, Units 1 and 2, the NRC staff finds that TVA has met the requirement of Appendix E § IV.A.9 to 10 CFR 50 for WBN.

In its review of Revision 103 of the emergency plan, the NRC staff identified an apparent inconsistency between the Emergency Response Organization (ERO) augmentation time in the generic REP and that in Appendix C. The NRC staff issued RAI 24.c on June 16, 2014 (ADAMS Accession No. ML14168A001). In its August 29, 2014 response (ADAMS Accession No. ML15205A130) TVA stated that it would include the acceptable Appendix C language into the emergency plan. The NRC staff confirmed that TVA incorporated this change in Revision 104X of the emergency plan.

Conclusion: The NRC staff concludes that the WBN-REP meets the requirements of 10 CFR 50.47(b)(2) and § IV.A of Appendix E to 10 CFR Part 50 with regard to onsite emergency response organization. The NRC staff bases its conclusion upon (1) the approval of the WBN-REP for WBN, Units 1 and 2, as described in SSER 22, (2) the NRC staff's review described above, (3) the OSA demonstration of adequate on-shift staffing, and (4) the design and operational fidelity between the two units.

13.3.2.3 Emergency Response Support and Resources

Regulatory Basis: 10 CFR 50.47(b)(3) requires that arrangements for requesting assistance and effectively using resources have been made, arrangements to accommodate various State and local staff at the licensee's near-site emergency operations facility (EOF) have been made, and other organizations capable of augmenting the planned response have been identified. Supporting requirements are provided in Appendix E § IV.A to 10 CFR 50.

Subsequent to the issuance of SSER 22, the NRC amended Appendix E § IV.A.7 to 10 CFR 50 to require that the emergency plan include an identification and description of the assistance expected from appropriate State, local, and Federal agencies with responsibilities for coping with emergencies, including hostile action at the site by June 23, 2014. The ISG provides guidance on complying with the amended requirement.

Technical Evaluation: In Section 13.3.2.3 of SSER 22, the NRC staff described its evaluation of the arrangements for emergency response support and resources as described in the WBN-REP and its finding that the planning standard in 10 CFR 50.47(b)(3) was met for WBN, Units 1 and 2.

In reviewing Revisions 103 and 104X of the WBN-REP, the NRC staff determined that additional information was required to determine whether TVA had adequately complied with Appendix E § V.A.7 to 10 CFR 50. Although WBN-REP § 2.5, § 2.6, and Table 2-1 identify offsite emergency support and resources, and WBN-REP § 16.5 provides a listing of letters of agreement for these resources, the plan is silent regarding the commitment of those offsite resources to provide the expected support and resources during hostile action events that is the primary objective of the amended rule. The NRC staff issued RAI 25.a on June 16, 2014. In its August 29, 2014, response, TVA stated that descriptions of provisions for addressing hostile actions against the plant is maintained on file with site security, with specific details in referenced offsite plans, agreement letters, and memorandum of understanding. The NRC staff evaluated TVA's arrangements during an onsite inspection. The results of the NRC staff's inspection is documented in Inspection Report 05000391/2015605.

Conclusion: The NRC staff concludes that the WBN-REPwill meet the requirements of 10 CFR 50.47(b)(3) and § IV.A of Appendix E to 10 CFR Part 50 with regard to arrangements for emergency response support and resources, including hostile actions. The NRC staff bases its conclusion upon (1) the approval of the WBN-REP for WBN, Units 1 and 2, as described in SSER-22, (2) the NRC staff's review described above, (3) TVA's demonstrated performance in maintaining emergency preparedness at Unit 1, and (4) the design and operational fidelity between the two units.

13.3.2.4 Emergency Classification System

Regulatory Basis: 10 CFR 50.47(b)(4) requires that a standard emergency classification and action level scheme, the bases of which include facility system and effluent parameters, is in use by the nuclear facility licensee, and State and local response plans call for reliance on information provided by the facility licensees for determinations of minimum initial offsite response measures. Supporting requirements are provided in Appendix E § IV.B and § IV.C to 10 CFR 50.

Subsequent to the issuance of SSER 22, the NRC amended Appendix E § IV.B to 10 CFR 50 to require licensees to consider hostile action events in establishing emergency action level (EAL) schemes by June 20, 2012. This amended requirement codifies a corresponding requirement in NRC Bulletin (BL) 2005-02, "Emergency Preparedness and Response Actions for Security-Based Events" (ADAMS Accession No. ML051740058), previously addressed at WBN, Unit 1. The bulletin provided guidance on the EAL schemes.

Subsequent to the issuance of SSER 22, the NRC added a new requirement, Appendix E § IV.C.2 to 10 CFR 50 to require that licensees, by June 20, 2012, establish and maintain the capability to assess, classify, and declare an emergency condition within 15 minutes after the availability of indications to plant operators that an emergency action level has been exceeded and promptly declare the emergency condition as soon as possible following identification of the appropriate emergency classification level. The ISG provides guidance on complying with the new requirements.

Technical Evaluation: In § 13.3.2.4 of SSER-22, the NRC staff described its evaluation of the WBN-REP emergency classification scheme and its finding that the planning standard in 10 CFR 50.47(b)(4) was met for Units 1 and 2. As discussed therein, TVA implemented the security EALs identified in the NRC-endorsed Revision 5 to NEI-99-01 for Unit 1. By letter dated December 18, 2006 (ADAMS Accession No. ML063170443), the NRC staff notified TVA that its response to BL 2005-02 for all three sites (Browns Ferry Nuclear Plant, Sequoyah Nuclear Plant, and WBN) was acceptable, and no further action was required at that time. The WBN, Unit 2, security EALs are identical to those approved for WBN, Unit 1. Accordingly, given the fidelity between the two units, TVA complied with the amended Appendix E § IV.B to 10 CFR 50.

In reviewing Revision 104X of the WBN-REP, the NRC staff identified that Section 4.2.C provided a commitment to maintain the required classification timeliness capability. Section 3.1.C of WBN-EPIP-1, "Emergency Plan Classification Logic" (ADAMS Accession No. ML15205A136), requires the Shift Manager/Station Emergency Director to assess, classify, and declare an emergency condition within 15 minutes after information is first available to plant operators to recognize that an exceeded EAL and to make the declaration promptly upon identification of the appropriate emergency classification level. This procedure provides

guidance regarding the initiation and termination of the 15-minute criterion, the definition of "plant operator" and "promptly," and the role of validation or confirmation of indications and reports. This guidance is consistent with the guidance in the ISG and is, therefore, acceptable.

On April 1, 2015 (ADAMS Accession No. ML15205A226), TVA submitted Revision 106X of Appendix C of the WBN-REP. This revision contained technical and editorial changes to the EAL thresholds associated with certain WBN, Unit 1, effluent radiation monitors installed to replace the existing Unit 1, monitors. TVA also changed the high river level EAL thresholds for consistency with an NRC-approved license amendment for WBN, Unit 1, related to a hydrology analysis. These river water level EAL changes will apply to WBN, Unit 2, on issuance of the WBN, Unit 2, license, as both units share the same river reservoir and the same reference licensing basis. Accordingly, the changes in Revision 106X of WBN-REP do not affect the NRC staff's conclusions drawn in Section 13.3 of SSER 22 for WBN, Unit 2.

Conclusion: The NRC staff concludes that the WBN-REP meets the requirements of 10 CFR 50.47(b)(4) and § IV.B and § IV.C of Appendix E to 10 CFR Part 50 with regard to the emergency classification and action level scheme. The NRC staff bases its conclusion upon (1) the approval of the WBN-REP for Units 1 and 2, as described in SSER 22, (2) the NRC staff's review described above, (3) TVA's demonstrated performance in maintaining emergency preparedness at WBN, Unit 1, and (4) the design and operational fidelity between the two units.

13.3.2.5 Notification Methods and Procedures

Regulatory Basis: 10 CFR 50.47(b)(5) requires that procedures are established for notification by the licensee of State and local response organizations and for notification of emergency personnel by all response organizations; the content of initial and followup messages to response organizations and the public has been established; and means to provide early notification and clear instructions to the populace within the plume exposure pathway Emergency Planning Zone have been established. Supporting requirements are provided in Appendix E § IV.D to 10 CFR 50.

Subsequent to the issuance of SSER 22, the NRC staff amended Appendix E § IV.D.3 to 10 CFR 50 add a new requirement that licensees demonstrate that an administrative and physical means for a backup method of public alerting exists for use in the event the primary method of alerting and notification is unavailable. The rule at 10 CFR Part 50 Appendix E, §IV.D.4 to 10 CFR 50 established different implementation dates dependent on the status of such a capability at a given site. For WBN the date was December 24, 2012. Under the "Memorandum of Understanding between NRC and the Federal Emergency Management Agency (FEMA) Related to Radiological Emergency Planning and Preparedness" (44 CFR Part 353 Appendix A), the NRC relies upon FEMA's findings and determinations regarding public alerting and notification. The ISG provides guidance on complying with the new requirements.

Technical Evaluation: In Section 13.3.2.5 of SSER 22, the NRC staff described its evaluation of the notification methods and procedures in the WBN-REP and its finding that the planning standard 10 CFR 50.47(b)(5) was met for WBN, Units 1 and 2.

Subsequent to the issuance of SSER 22, TVA modified the manner in which external notifications (e.g., to Federal and State officials) would be made. This change has the Shift Manager/Station Emergency Director at the affected unit main control room make all initial notifications to the State and the NRC for all emergency classifications rather than by the TVA

Operations Duty Specialist (ODS) as was stated in SSER 22. As before, the ODS would continue to make other external notifications, including notification of emergency personnel. The NRC staff finds this revision to be acceptable, as TVA retains the capability to make the required notifications within the performance criterion established in § IV.D.3 to Appendix E and to activate the ERO in a manner that supports timely activation of the emergency response facilities.

Subsequent to the issuance of SSER 22, TVA replaced all of the WBN alert and notification system sirens. FEMA's letter dated August 28, 2014 (ADAMS Accession No. ML14247A452), described the upgraded system. The sirens have backup batteries to allow siren operation if local AC power distribution is lost. The Tennessee Emergency Management Agency activates the sirens by radio from the State Emergency Operations Center. Backup activation capability is located in the Rhea County 911 Center. TVA supplemented the sirens by providing schools and other institutions within the emergency planning zone (EPZ) with tone alert radios on the frequencies of the National Oceanic and Atmospheric Administration Weather Radio All Hazards network. In its August 28, 2014, letter, FEMA advised the NRC that the upgraded alert and notification system would continue to comply with program requirements. FEMA also stated that the Tennessee Multi-Jurisdiction REP and the procedures of the affected local counties established an acceptable backup alerting system comprised of route alerting. Based upon its review of the FEMA findings and determinations, the NRC staff finds the updated alert and notification system and the backup alerting means acceptable.

Conclusion: The NRC staff concludes that the WBN-REP meets the requirements of 10 CFR 50.47(b)(5) and § IV.D of Appendix E to 10 CFR Part 50 with regard to notification means and procedures. The NRC staff bases its conclusion upon (1) the approval of the WBN-REP for WBN, Units 1 and 2, as described in SSER 22, (2) the NRC staff's review described above, (3) TVA's demonstrated performance in maintaining emergency preparedness at WBN, Unit 1, (4) FEMA's approval of the primary and backup alerting means, and (5) the design and operational fidelity between the two units.

13.3.2.8 Emergency Facilities and Equipment

Regulatory Basis: 10 CFR 50.47(b)(8) requires that adequate emergency facilities and equipment to support the emergency response are provided and maintained. Supporting requirements are provided in Appendix E § IV.E to 10 CFR 50.

Subsequent to the issuance of SSER 22, the NRC amended Appendix E § IV.E to 10 CFR 50 to add two new requirements. Section IV.E.8.c to 10 CFR 50 Appendix E requires that by June 20, 2012, the licensee have an emergency operations facility that has the capabilities specified in the rule, including for each reactor on a nuclear power reactor site and for each nuclear power reactor site that the facility serves. Section IV.E.8.d to 10 CFR 50 Appendix E requires licensees to have an alternative facility (or facilities) that would be accessible, even if the site were under threat of or experiencing a hostile action. The first phase, a capability for staging ERO personnel, was required by June 20, 2012. The second phase, additional capabilities, is due by December 23, 2014. The ISG provides guidance on complying with the new requirements.

Technical Evaluation: In Section 13.3.2.8 of SSER 22, the NRC staff described its evaluation of the emergency facilities and equipment in the WBN-REP and its finding that the planning standard 10 CFR 50.47(b)(8) was met for WBN, Units 1 and 2.

In reviewing Revision 103 of the WBN-REP, the NRC staff determined that additional information was required for the NRC staff to determine whether TVA had adequately complied with Appendix E § IV.E.8.c and § IV.E.8.d to 10 CFR 50. The NRC staff issued RAIs 25.c and 25.d to request this information on June 16, 2014. In its August 29, 2014, response to RAI 25.c, TVA stated that it had completed staffing capabilities and physical facility modifications to the Central Emergency Control Center (CECC) to meet the new EOF performance requirements. Although TVA has previously used a team-based ERO augmentation approach, it has adopted an approach in which all personnel assigned to the minimum activation CECC positions are called out to respond, enhancing the availability of responders. Several changes have been made to § 3.0 of CECC EPIP-1, "Central Emergency Control Center Operations" (ADAMS Accession No. ML15205A139). This emergency preparedness implementation procedure (EPIP) directs the CECC Director to staff additional ERO positions as deemed necessary for events that warrant extra staffing (e.g., a multi-unit or multi-site event). The EPIP identifies several specific ERO positions that the CECC Director is to consider for augmentation. The CECC Director may also request assistance from other organizations within TVA. TVA expanded the CECC layout to provide working locations for additional Assistant CECC Directors, Radiological Assessment Coordinators, Dose Assessors, and Environs Assessors for additional affected sites. The response also describes modifications made to the Web Emergency Operations Center (WebEOC™) and the TVA Enterprise Emergency Notification System (TEENS) with color-coordinated site-specific capability for display. The NRC staff finds that the existing CECC, modified as described, would meet Appendix E § IV.E.8.c to 10 CFR 50. The NRC staff evaluated the acceptability of TVA's CECC during an onsite inspection. The results of the NRC staff's inspection is documented in Inspection Report 05000391/2015605.

In its August 29, 2014, response to RAI 25.d, TVA identified that it had relocated the Alternate Facility for WBN to meet the new requirements and that the new facility currently meets the June 20, 2012, requirements of § IV.E.8.d to Appendix E of 10 CFR Part 50. TVA stated that this facility would satisfy the new requirements prior to December 3, 2014. TVA revised the ERO augmentation call out messages to include staffing at the new alternative facility. The NRC staff evaluated the acceptability of WBN's Alternative Facility modifications during an onsite inspection. The results of the NRC staff's inspection is documented in Inspection Report 05000391/2015605. The NRC staff finds that the new WBN alternative facility, modified as described, meets the requirements of Appendix E § IV.E.8.d.
Conclusion: The NRC staff concludes the WBN-REP meets the requirements of 10 CFR 50.47(b)(8) and § IV.E of Appendix E to 10 CFR Part 50 with regard to emergency facilities and equipment. The NRC staff bases its conclusion upon (1) the approval of the WBN-REP for WBN, Units 1 and 2, as described in Supplement 22 to the SER, (2) the NRC staff's review described above, (3) TVA's demonstrated performance in maintaining emergency preparedness at WBN, Unit 1, and (4) the design and operational fidelity between the two units.

13.3.2.10 Protective Response

Regulatory Basis: 10 CFR 50.47(b)(10) requires that a range of protective actions has been developed for the plume exposure pathway EPZ for emergency workers and the public. In developing this range of actions, consideration has been given to evacuation, sheltering, and, as a supplement to these, the prophylactic use of potassium iodide, as appropriate. Evacuation time estimates have been developed by applicants and licensees. Licensees shall update the evacuation time estimates on a periodic basis. Guidelines for the choice of protective actions during an emergency, consistent with Federal guidance, are developed and in place, and protective actions for the ingestion exposure pathway EPZ appropriate to the locale have been developed. Supporting requirements are provided in Appendix E §IV and § IV.I to 10 CFR 50.

Subsequent to the issuance of SSER 22, a new regulation, Appendix E § IV.I to 10 CFR 50, was issued to codify actions implemented by licensees, including WBN, Unit 1, in response to BL 2005-02. This new regulation required licensees provide, by June 20, 2012, a range of protective actions to protect onsite personnel during hostile action to ensure that continued ability of the licensee to safely shutdown the reactor and perform the functions of the licensee's emergency plan. BL 2005-02 and the ISG provide guidance on complying with the new requirement.

Subsequent to the issuance of SSER 22, the NRC amended 10 CFR 50.47(b)(10) and issued new regulations in 10 CFR 50, Appendix E § IV with regard to evacuation time estimates (ETE) and the use of those estimates. Section IV.2 to 10 CFR 50 Appendix E requires licensees to provide an ETE analysis. Section IV.3 requires licensees to use the ETE in the formulation of protective action recommendations and to provide the ETE to State and local governmental authorities. Section IV.4 to 10 CFR 50 Appendix E requires licensees to develop an ETE within 365 days of the later of the date of the most recent decennial census data from the U.S. Census Bureau, or by December 23, 2011. Sections IV.5 and IV.6 to 10 CFR 50 Appendix E require licensees to assess changes in population trends and update the ETE as necessary between decennial censuses. The ISG, NUREG/CR-7002, and Supplement 3 to NUREG-0654 provide guidance on complying with these new requirements.

Technical Evaluation: In Section 13.3.2.10 of SSER 22, the NRC staff described its evaluation of the range of protective measures in the WBN-REP and its finding that the planning standard 10 CFR 50.47(b)(10) was met for WBN.

With regard to Appendix E § IV.I to 10 CFR 50, the NRC staff reviewed WBN-REP Revision 104X and related EPIPs and determined that TVA had provided for a range of onsite protective actions for hostile action events. TVA incorporated these actions in multiple EPIPs and in other station procedures. WBN-REP Section 10.2, "Onsite Protective Actions for Hostile Action Events," contains a commitment to provide a range of onsite protective actions for hostile action events. The four EPIPs that address the response to emergencies at each emergency classification level have provisions to delay assembly, accountability, and site evacuation for events involving an on-site security risk as determined by the station emergency director or nuclear security. Above the alert level, these EPIPs also block personnel notifications using the site public address systems. Similar provisions are included the EPIP for personnel accountability and evacuation. TVA satisfactorily demonstrated these protection actions during the hostile action based (HAB) exercises already conducted at the Sequoyah and Browns Ferry sites, and scheduled to be conducted at WBN in the fall of 2015. Based on the above review, the NRC staff has determined that TVA has complied with Appendix E § IV at WBN.

By letter dated December 18, 2012 (ADAMS Accession No. ML123620581), TVA submitted the updated ETEs for the reactors for which it is holder of OLs, including WBN, Unit 1, as required by Appendix E § IV.4 to 10 CFR 50. TVA supplemented this submittal by letters dated March 4, 2013 (ADAMS Accession No. ML13070A024) and August 16, 2013 (ADAMS Accession No. ML13234A356). The NRC staff performed a review of the submitted WBN, Unit 1, ETE and concluded that the updated ETE was complete in accordance with NUREG/CR-7002. The NRC staff documented its review of the updated ETE in WBN, Unit 1, Inspection Report 05000390/2013005 (ADAMS Accession No. ML14038A351).

By letter dated June 5, 2014 (ADAMS Accession No. ML14276A088), TVA submitted an addendum to the WBN ETE on both WBN, Unit 1 and Unit 2, dockets. This submittal addresses

changes to the population in the evacuation zone, the impact of peak construction traffic for WBN, Unit 2, in 2014, and the dual unit normal operating staff during the first operating year of WBN, Unit 2. TVA concluded that the longest ETE value did not increase by more than 25 percent, or 30 minutes, as specified in Appendix E § IV.6 to 10 CFR 50. The 2014 ETE used the same general assumptions, data sources, and methodologies used in the preparation of the 2013 ETE, which had been found to be complete, with the following exceptions:

- The 2013 ETE only considered the worker population associated with normal WBN, Unit 1, operations. The 2014 ETE included the large working population associated with the WBN, Unit 2, construction and evaluated the dual unit population once WBN, Unit 2, goes into commercial service.

- The 2014 ETE models an increase in the projected permanent population from 22,569 to 22,851 in 2014 and 22,983 in 2016.

- The only change in transient population is associated with the WBN, Unit 2, construction force now included in the analysis.

- The offsite emergency response plan remained substantially the same. With the exception of changes associated with WBN traffic, the 2014 ETE used the same road network used in the preparation of the 2013 ETE.

Based on the above, the design and operation fidelity between the two units, the role of WBN, Unit 1, as the reference design basis, and the identical plume exposure EPZs, the NRC staff finds that TVA has demonstrated compliance with the new and amended ETE requirements for WBN. Since the ETE is to be periodically updated, the objective of the NRC staff's review was to verify consistent application of the ETE guidance.

In response to Appendix E § IV.3 to 10 CFR 50, TVA replaced the protective action recommendation logic flowcharts that had been developed based on NUREG-0654, Supplement 3 guidance. These are Figure 10-1 and Figure 10-2 of Revision 104X of the generic portion of the WBN-REP. These charts address the three sites for which TVA holds a license. These charts, while generic to all sites contain site-specific decision criteria based on the site-specific EALs and ETEs. WBN-EPIP-5, "General Emergency," includes facsimiles of these charts. The NRC staff reviewed these replacement charts against the guidance in Supplement 3 to NUREG-0654. The NRC staff found the charts to be consistent with that guidance but identified a concern regarding the alerting of members of the public within the EPZ not addressed by the applicant's protective action recommendation. By email dated October 20, 2014, the NRC staff issued RAI 27 regarding this concern. In its response dated December 15, 2014, TVA submitted an updated WBN EPIP-5, "General Emergency." The NRC staff found that content in the EPIP resolved the concern, and found that TVA has complied with Appendix E § IV.3 to 10 CFR 50 for WBN Units 1 and 2.

Conclusion: The NRC staff concludes the WBN-REP meets the requirements of 10 CFR 50.47(b)(10) and § IV of Appendix E to 10 CFR Part 50 with regard to protective response. The NRC staff bases its conclusion upon (1) the approval of the WBN-REP for WBN, Units 1 and 2, as described in SSER-22, (2) the NRC staff's review described above, (3) TVA's demonstrated performance in maintaining emergency preparedness at WBN, Unit 1, and (4) the design and operational fidelity between the two units.

13.3.2.14 Exercises and Drills

Regulatory Basis: 10 CFR 50.47(b)(14) requires that periodic exercises be conducted to evaluate major portions of emergency response capabilities, that periodic drills be conducted to develop and maintain key skills, and deficiencies identified as a result of exercises or drills be corrected. Appendix E § IV.F to 10 CFR Part 50 provides supporting requirements.

Subsequent to the issuance of SSER 22, the NRC issued amended Appendix E § IV.F.2 to 10 CFR 50 add new requirements for drills and exercises. Appendix E, § IV.F.2.a to 10 CFR 50 was amended to require licensees to submit biennial exercise scenarios for prior NRC review. Appendix E, § IV.F.2.b to 10 CFR 50 was amended to provide an expanded list of principal functional areas of emergency response to be exercised. Appendix E, § IV.F.2.g to 10 CFR 50 was amended to require licensees to correct any weaknesses identified during exercises, drills, or training that provide performance-enhancing opportunities. Appendix E, § IV.F.2.i to 10 CFR 50, a new requirement, requires licensees to use drill and exercise scenarios that minimize preconditioning of players and that include a wide spectrum of events, including hostile actions. Appendix E, § IV.F.2.j, to 10 CFR 50 has two parts. The first part established standards for the conduct of exercises with regard to providing varied opportunities for demonstrating key skills necessary to implement the principal functional areas of emergency response. TVA was required to implement the above requirements by December 23, 2011. The second part of Appendix E, § IV.F.2.j to 10 CFR 50 identified scenario elements, including hostile action, that are to be exercised over an 8-year exercise cycle. The rule requires the conduct of the first HAB exercise before December 31, 2015, and that the first 8-year cycle commences with the completion of the first HAB exercise. The ISG provides guidance on complying with these new requirements.

Technical Evaluation: In Section 13.3.2.14 of SSER 22, the NRC staff described its evaluation of the exercises and drill program described in the WBN-REP and its finding that the planning standard 10 CFR 50.47(b)(14) and the requirements of 10 CFR Part 50 Appendix E § IV.F was met for WBN, Units 1 and 2.

Appendix E § I.6 to 10 CFR 50 states that WBN, Unit 2, would meet the requirements of the final rule as applicable to operating nuclear power licensees (e.g., WBN, Unit 1). The intent of this language was to allow for the licensing of WBN, Unit 2, without the need to meet the regulations that WBN, Unit 1, had not yet been required to meet. Accordingly, TVA does not need to comply with the 8-year exercise cycle requirements until the date of the first HAB exercise or December 31, 2015, whichever is sooner. TVA has scheduled a biennial exercise with a HAB scenario at WBN in the fall of 2015. TVA's drill and exercise program for its sites is described in Section 14.0 of the generic REP. The NRC staff found insufficient information regarding the methods that TVA had and will implement to meet the new requirements of Appendix E § IV.F.2 to 10 CFR 50 and on October 6, 2014 issued RAI 26 (ADAMS Accession No. ML14279A251). In its response dated November 14, 2014, TVA submitted administrative procedure EPDP-3, "Emergency Plan Exercises and Preparedness Drills" (ADAMS Accession No. ML15205A144). This procedure describes TVA's methods for developing and conducting drills and exercises. The NRC staff reviewed the procedure and determined that TVA's drill and exercise program as described in Section 14.0 of the generic REP and EPDP-3 was consistent with the ISG and that the WBN-REP meets the amended and new requirements of Appendix E § IV.F.2 to 10 CFR 50.

Conclusion: The NRC staff concludes the WBN-REP meets the requirements of 10 CFR 50.47(b)(14) and § IV.F.2 of Appendix E to 10 CFR Part 50 with regard to the exercise and drill

program. The NRC staff bases its conclusion upon (1) the approval of the WBN-REP for WBN, Units 1 and 2, as described in SSER 22, (2) the NRC staff's review described above, (3) TVA's demonstrated performance in maintaining emergency preparedness at the existing WBN, Unit 1, and (4) the design and operational fidelity between the two units.

13.3.2.15 Radiological Emergency Response Training

The NRC staff's review of this planning standards and its findings was described in Section 13.3.2.15 of SSER 22. This planning standard was not affected by the regulations issued subsequent to SSER 22.

13.3.2.16 Responsibility for the Planning Effort; Development, Periodic Review, and Distribution of Emergency Plans

The NRC staff's review of this planning standards and its findings was described in Section 13.3.2.16 of SSER 22. This planning standard was not affected by the regulations issued subsequent to SSER 22.

13.3.2.17 Evaluation of Offsite Emergency Preparedness

Note: The discussion and staff's findings on the evacuation time estimates were relocated to Section 13.3.2.10 of this supplement and are updated there.

Regulatory Basis:

Based on the regulatory requirements of 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50, the NRC staff reviewed the application. In accordance with 10 CFR 50.47(a)(1)(i), no initial OL for a nuclear power reactor will be issued under 10 CFR Part 50 unless the NRC finds that there is reasonable assurance that adequate protective measures can and will be taken in a radiological emergency. As provided by 10 CFR 50.47(a)(2), the NRC will base its finding on a review of FEMA's findings and determinations as to whether State and local offsite emergency plans are adequate, and whether there is reasonable assurance that they can be implemented, and on the NRC assessment, documented herein, as to whether TVA's onsite emergency plans are adequate and whether there is reasonable assurance that they can be implemented.

In accordance with 44 CFR Part 353, Appendix A, FEMA is responsible for the findings and determinations as to whether offsite emergency plans are adequate and can be implemented. FEMA regulations for this review appear in 44 CFR Part 350, "Review and Approval of State and Local Radiological Emergency Plans and Preparedness." These regulations require that 10 CFR 50.47, "Emergency Plans," Appendix E to 10 CFR Part 50, and NUREG-0654/FEMA REP-1, Revision 1, be used in evaluating State and local emergency plans and preparedness. FEMA radiological offsite emergency preparedness program documents provide guidance on various topics for use by State and local organizations responsible for radiological emergency preparedness and response.

Technical Evaluation: In Section 13.3.2.17 of SSER 22, the NRC staff described its review of the findings and determinations of FEMA regarding the status of emergency preparedness of the State and local authorities within the WBN EPZ. Included was a discussion of the FEMA Interim Finding Report (IFR) upon which Sections 13.3.2.5 and 13.3.2.17 of SSER 22 were based in part. SSER 22 Section 13.3.2.17 also provided the rationale for basing the evaluation of offsite preparedness using exercises conducted at WBN, Unit 1.

Because of construction delays, nearly four years have passed since FEMA issued the IFR that formed part of the basis of the NRC staff's evaluation in Section 13.3.2.17 of SSER 22. During this period, TVA and the offsite response organizations successfully conducted full participation exercises. Also during this period, TVA upgraded the alert and notification system at all of their sites. The NRC staff's review of this latter modification is described in Section 13.3.2.5 of this supplement.

By letter dated May 19, 2014 (ADAMS Accession No. ML14112A561), the NRC staff asked FEMA to confirm its earlier findings and determinations regarding offsite plans and preparedness. FEMA responded by letter dated August 28, 2014. FEMA stated that it had evaluated the full participation exercises conducted on October 19, 2011, and October 30-31, 2013. FEMA also stated that they reviewed and approved the annual letters of certification for Tennessee relative to WBN for calendar years 2011 through 2013. Based upon these reviews, FEMA determined that the radiological emergency response plans and preparedness for the State of Tennessee and the affected jurisdictions surrounding WBN can be implemented and are adequate to provide reasonable assurance that appropriate measures can be taken offsite to protect the health and safety of the public in the event of a radiological emergency at the site. FEMA further stated that the 44 CFR Part 350 approval of the State of Tennessee's offsite radiological emergency response plans and preparedness site-specific to Watts Bar Nuclear Plan granted on July 3, 1997, would remain in effect.

The NRC staff reviewed the FEMA findings and determinations and found its bases to be understandable and clear. The NRC staff review did not identify any discrepancies in the integration of the WBN-REP with those of State and local authorities.

Conclusion: The NRC staff concludes that the State and local emergency plans for the WBN site provide an adequate planning basis and that there is reasonable assurance that the State and local emergency plans can be implemented. The NRC staff bases it conclusion upon (1) its review of the FEMA findings on the offsite plans discussed above, (2) its review of the FEMA findings on the 2011 and 2013 WBN, Unit 1, full participation exercises for State and local agencies discussed above, and (3) the design and operational fidelity between the two units.

13.3.2.18 Other Matters

Section 13.3.2.18 of SSER 22 addressed the requirement of Appendix E § V that TVA submit its detailed implementing procedures for its emergency plan no less than 180 days before the scheduled issuance of an OL. The NRC staff treated completion of this requirement as Confirmatory Item 43 that must be resolved prior to the issuance of an OL.

By letter dated January 10, 2014, TVA (ADAMS Accession No. ML14010A191) submitted the combined WBN, Units 1 and 2, EPIPs in response to Confirmatory Item 43. These procedures are designated "Unit 0" to signify their applicability to both units. TVA supplemented this submittal in letters dated February 14, 2014; March 7, 2014; April 11, 2014; June 5, 2014; June 16, 2014; June 23, 2014; November 3, 2014; November 7, 2014; and December 15, 2014 (ADAMS Accession Nos. ML15205A150, ML15205A156, ML15205A161, ML15205A163, ML15205A166, ML15205A136, ML14307A851, ML14311A747, and ML15205A123, respectively). The NRC staff's review of these EPIPs was limited to assessing the completeness of the submittal; they remain subject to periodic inspection.

With the exception of the November 5, 2014, submittal (ADAMS Accession No. ML15205A171) of CECC-EPIP-2 and CECC-EPIP-3, TVA did not submit the EPIPs for the Central Emergency Control Center (CECC) that serves as the emergency operations facility for each of the reactors for which TVA is the holder of the OL, including WBN, Unit 1, and will serve WBN, Unit 2, after the issuance of its OL. The CECC EPIPs have been submitted on the dockets of the operating units, including WBN, Unit 1,by letters dated July 13, 2012; October 18, 2013; October 31, 2013; November 8, 2013; December 13, 2013; December 24 (three letters), 2013; July 16, 2014; August 22, 2014; and August 26, 2014 (ADAMS Accession Nos. ML15205A179, ML15205A185, ML15205A188, ML15205A191, ML15205A196, ML15205A201, ML15205A206, ML15205A209, ML14198A536, ML15205A215, and ML15205A139, respectively). The NRC staff accepts these CECC procedures, even though they were not explicitly docketed under WBN, Unit 2, because of (1) the Commission direction that the WBN, Unit 1, licensing basis would serve as the reference basis for WBN, Unit 2, and (2) the design and operational fidelity between both units. The NRC staff review of these EPIPs was limited to assessing the completeness of the submittal.

Accordingly, TVA has complied with the § V of Appendix E to 10 CFR Part 50 and, therefore, **Confirmatory Item 43 is closed**.

Section 13.3.2 of SSER-12 created Open Item 37 (Appendix HH):

> The NRC staff will review the combined WBN, Units 1 and2 Appendix C prior to issuance of the Unit 2 OL to confirm (1) that the proposed Unit 2 changes were incorporated into Appendix C, and (2) that changes made to Appendix C for Unit 1 since Revision 92 and the changes made to the generic REP since Revision 92 do not affect the bases of the NRC staff's findings in this SER supplement (Section 13.3.2).

By letter dated April 16, 2014 (ADAMS Accession No. ML15205A221), TVA submitted Revision 103 of REPlan (generic part of WBN-REP), and REP Appendix C (site-specific part of WBN-REP). The NRC staff performed a line-by-line comparison against Revision 92xx of the WBN-REP. As a result of this review, the NRC staff requested additional information by e-mail dated June 16, 2014. TVA responded by letter dated September 12, 2014. The NRC staff performed a line-by-line comparison against Revision 104 of the WBN-REP. The NRC staff dispositioned any significant changes in Sections 13.3.2.1- 13.3.2.16 of this supplement. Based upon this review, the NRC staff determined that the changes made did not affect the bases of the NRC staff's findings in SSER 22. Therefore, the NRC staff considers **Confirmatory Item 37 to be closed**.

13.3.3 Conclusion

On the basis of its review of the WBN-REP, the results of onsite inspections, and its evaluation of TVA's performance in exercises, the NRC staff concluded in Supplement 22 that the WBN-REP provided an adequate basis for an acceptable state of onsite emergency preparedness, and that the WBN-REP met the requirements of 10 CFR 50.47(b), Appendix E to 10 CFR Part 50, with regard to WBN, Units 1 and 2.

For the present review, the NRC staff evaluated TVA's compliance with the amended and new requirements of the November 2011, Emergency Preparedness rulemaking, which became effective subsequent to the issuance of SSER 22. In addition, the NRC staff evaluated the impact of changes made by TVA under the authority granted by 10 CFR 50.54(q)(3) to the WBN-REP since the issuance of SSER 22. The NRC staff documented its review and its

findings as tabulated in Table 13.3-1 of this supplement. In performing its review, the NRC staff identified three changes that potentially affected offsite preparedness. As described in Sections 13.3.2.5 and 13.3.2.17 of this supplement, FEMA reconfirmed its findings and determinations that formed part of the basis of SSER 22.

On the basis of the foregoing review, the NRC staff concludes that the WBN-REP (i.e., Revision 106X of the site-independent TVA REP and the site-specific WBN, Units 1 and 2, Appendix C, Revision 106X), upon satisfactory completion of the confirmatory items identified above, will provide an adequate planning basis for an acceptable state of onsite emergency preparedness for WBN, Units 1 and 2, is compliant with the planning standards of 10 CFR 50.47(b) and the requirements of Appendix E to Part 50, and there is reasonable assurance that the WBN-REP can be implemented.

FEMA has provided its findings and determinations on the adequacy of offsite emergency planning and preparedness based upon its plan reviews, exercise observations, and analyses. Based on its review of the FEMA findings, the NRC staff concludes, pursuant to 10 CFR 50.47(a)(2), that the WBN offsite emergency plans provide an adequate planning basis and there is reasonable assurance that they can be implemented.

Accordingly, the NRC staff concludes that pursuant to 10 CFR 50.47(a)(1)(i), and subject to the satisfactory completion of the confirmatory items identified above, there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency at either WBN, Units 1 or 2.

13.6 Physical Security

13.6.6 Cyber security Plan

13.6.6.1 Introduction

In NUREG-0847, "Safety Evaluation Report – Related to the Operation of Watts Bar Nuclear Plant, Unit 2, Supplement 24" (ADAMS Accession No. ML11277A148) the NRC staff approved TVA's Cyber security Plan and Implementation Schedule. By letter dated January 9, 2015 (ADAMS Accession No. ML15010A051), supplemented by letter dated April 1, 2015 (ADAMS Accession No. ML15097A523), TVA submitted a revised Cyber security Plan (CSP) Implementation Schedule required by 10 CFR Section 73.54.

13.6.6.2 Regulatory Basis

General Requirements

Consistent with 10 CFR 73.54(a), the applicant must provide high assurance that digital computer and communication systems and networks are adequately protected against cyber attacks, up to and including, the design basis threat as described in 10 CFR 73.1. The applicant shall protect digital computer and communication systems and networks associated with (i) safety-related and important-to-safety functions; (ii) security functions; (iii) emergency preparedness functions, including offsite communications; and (iv) support systems and equipment, which if compromised, would adversely impact safety, security, and emergency preparedness (SSEP) functions. The rule specifies that digital computer and communication systems and networks associated with these functions must be protected from cyberattacks that would adversely impact the integrity or confidentiality of data and software; deny access to

systems, services, or data; or provide an adverse impact to the operations of systems, networks, and associated equipment.

In the October 21, 2010, SRM-COMWCO-10-0001, the Commission stated that the NRC's cyber security rule at 10 CFR 73.54 should be interpreted to include structures, systems, and components (SSCs) in the balance of plant (BOP) that have a nexus to radiological health and safety. The NRC staff determined that SSCs in the BOP that have a nexus to radiological health and safety are those that could directly or indirectly affect reactivity of a nuclear power plant, and are, therefore, within the scope of important-to-safety functions described in 10 CFR 73.54(a)(1). The rule also specifies that each submittal must include a proposed implementation schedule. Implementation of the cyber security program must be consistent with the approved schedule.

13.6.6.3 Technical Evaluation

The NRC staff performed a technical evaluation of the applicant's submittal. The applicant's submittal contains three sections. One section of the submittal requested a delay in the date for completion of Milestone 8 of the implementation schedule. This section conformed to the guidance in a publically available NRC internal memorandum dated October 24, 2013 (ADAMS Ascension No. ML13295A467) containing criteria for evaluating licensee requests to modify cyber security implementation schedules. The NRC staff reviewed the applicant's submittal against the memorandum guidance. One section of the submittal requested revisions to Milestones 6 and 7 and the deletion of the previously proposed license conditions. One section of the submittal proposed a CSP license condition. The NRC staff's evaluation of each section of TVA's submittal is discussed below.

13.6.6.3.1 Delay of Milestone 8

The NRC staff has evaluated the licensee's request for delaying Milestone 8 consistent with guidance in the October 24, 2013, NRC memorandum. The NRC staff's evaluation is below, numbered as the criteria are in the October 24, 2013, NRC memorandum.

1) Identification of the specific requirement(s) of the CSP that the licensee needs additional time to implement.

TVA stated that many of the actions required to address Milestone 8 have been completed for WBN, Unit 2. Among those completed actions are the performance of cyber security assessments for all WBN, Unit 2, critical digital assets (CDAs), excluding the common Security and Corporate Emergency Preparedness systems and the determination of remediation actions for deficient controls. Several remediation actions have already been implemented, and others are in the process of being implemented. However, the additional guidance provided to the industry following Milestone 1 through 7 inspections has caused TVA to re-evaluate work that had previously been completed. This re-evaluation has resulted in an increase in the scope of remediation work, including work that requires the implementation of design changes and the unit to be shutdown. These cyber security remediation actions potentially impact the current WBN, Unit 2, start-up schedule. The additional requested time allows TVA to design, install, and test plant changes without impacting the start-up schedule, consistent with its outage planning milestone schedules, which ensures the scope of all outage work is understood and integrated into the outage schedule and scope for work that must be done with the unit shutdown. The licensee provided a list of remaining remediation actions.

The NRC staff finds that implementation of the listed actions requires the outage as TVA stated.

2) Detailed justification that describes the reason the licensee requires additional time to implement the specific requirement(s) identified.

TVA stated that most of the activities described in response to 1) above require an outage. The requested extension date allows for one additional refueling outage to methodically plan, implement, and test the required additions or changes and allows those additions or changes that require a design change to be performed within TVA milestone dates for refueling outage scope determination. Original schedules for the completion of the cyber security control assessments, and thus the implementation of remediation actions for deficient controls and other program areas as described above in 1), have been delayed in part due to additional actions TVA is taking that were not anticipated when the original schedules were set.

The NRC staff finds there are implementation issues with CSP tasks that were not anticipated when the original schedules were set. Based on the information provided by TVA in its letter, the NRC staff finds that it will not be able to fully implement its CSP prior to startup. The NRC staff recognizes that critical digit assets assessment work is resource intensive and that the licensee has a large number of additional tasks not originally considered. The NRC staff concludes that TVA's explanation of the need for additional time is compelling.

3) A proposed completion date for Milestone 8 consistent with the remaining scope of work to be conducted and the resources available.

TVA proposed a Milestone 8 completion date of March 31, 2017. TVA also stated that changing the completion date of Milestone 8 will encompass one refueling outage to implement the remaining cyber security remediation actions. TVA provided a list of activities that must be performed during an outage and a list of activities that are more safely performed during an outage.

The NRC staff concludes that delaying final implementation of the cyber security program will provide opportunities to get work done safely during the outage.

4) An evaluation of the impact that the additional time to implement the requirements will have on the effectiveness of the licensee's overall cyber security program in the context of milestones already completed.

TVA indicated completion of activities associated with the CSP provides a high degree of protection to ensure that digital computer and communication systems and networks associated with safety, security, and emergency preparedness (SSEP) systems are sufficiently protected against cyber attacks. It detailed activities completed for each milestone and noted several elements of Milestone 8 have already been implemented.

The NRC staff concludes TVA's site is much more secure because the activities the licensee completed mitigate the most significant cyberattack vectors for the most significant CDAs.

5) A description of the licensee's methodology for prioritizing completion of work for critical digital assets associated with significant safety consequences and with reactivity effects in the balance of plant.

TVA stated its methodology for prioritizing completion of cyber security activities associated with significant SSEP consequences and with reactivity effects in the balance of plant focused on competing Milestones 1 through 7 and implementation of remediation actions for Milestone 8 and is consistent with the TVA design change processes. Work is implemented consistent with work management processes and available resources. Prioritization of work was performed per TVA's work scheduling processes and was based on safety significance, required availability of significant systems, and consideration for all aspects and elements of risk management. The remaining actions to be completed for Milestone 8 will be implemented according to the scheduled actions.

The NRC staff finds the licensee's methodology is appropriate.

6) A discussion of the licensee's cyber security program performance.

TVA stated implementation of the requirements of Milestones 1 through 7 provides a high degree of protection against cyberattacks, including radiological sabotage, during full program implementation. In addition to these actions, cyber security assessments for all WBN, Unit 2, CDAs, excluding the common Security and Corporate Emergency Preparedness Systems, have been completed, and remediation actions have been determined for deficient controls. Many of the controls that do not require a design change have already been implemented. A self-assessment of cyber security milestones was completed in June 2014. Deficiencies and learning opportunities identified during the self-assessment have been entered into the Corrective Action Program (CAP). The licensee provided a discussion about ongoing monitoring, logging, and assessment activities and performance monitoring. It closed its discussion by stating that the actions described show good evidence of strong cyber security program performance.

The NRC staff concludes that implementation of Milestones 1 through 7 provides significant protection against cyberattacks. The NRC staff concludes that the licensee program is active and functioning and the licensee is using the tools at its disposal to verify and improve the cyber security program.

7) A discussion of cyber security issues pending in the licensee's CAP.

TVA stated the site and corporate CAP are used to document cyber security issues. The licensee listed cyber security program actions pending in the CAP.

The NRC staffs finds that the discussion reflects a functioning CAP and that the examples reflect the implementation and evolution of the cyber security program and reinforce the licensee discussions above.

8) A discussion of modifications completed to support the cyber security program and a discussion of pending cyber security modifications.

The licensee provided a discussion of completed modifications and pending modifications. These are consistent with the discussions provided above and the licensee CSP.

13.6.6.3.2 Revisions to Milestones

With regard to the revisions to Milestones 6 and 7, the licensee proposed:

1. Deleting the reference to “all CDAs” in Milestones 6a, 6b, and 7 to align with the Nuclear Energy Institute (NEI) Template and WBN, Unit 1;
2. Realigning Milestones 6a and 6b into the NEI Template Milestone 6;
3. Revising Milestone 7 completion date from "Prior to Startup" to “Prior to Fuel Load”; and
4. Deleting the Milestone 6 and 7 exceptions and proposed license conditions associated with the Security System and Corporate Emergency Preparedness System.

The NRC staff has evaluated the license’s proposal regarding Milestones 6a, 6b, and 7. Deleting “all CDAs” focuses the milestones on the target set CDAs. The NRC staff finds this change is acceptable because it focuses the cyber security program on the most significant CDAs. Realignment of Milestones 6a and 6b into a single Milestone 6 results in implementation of all security controls for target set equipment. The NRC staff finds this change is acceptable because it maximizes protection of the most significant CDAs. Revising the Milestone 7 completion date from “Prior to Startup” to “Prior to Fuel Load” results in the milestone being accomplished earlier. The NRC staff finds this change is acceptable because it provides the protection of implementation of Milestones 1 through 7 earlier in the startup schedule. Finally, deleting the Milestone 6 and 7 exceptions and the license conditions associated with the Security System, and Corporate Emergency Preparedness System in NUREG-0847, “Safety Evaluation Report – Related to the Operation of Watts Bar Nuclear Plant, Unit 2,” Supplement 24 (ADAMS Accession No. ML11277A148), removes unnecessary exceptions and license conditions. The NRC staff finds this change is acceptable because it results in complete implementation of the cyber security program in Milestone 8.

13.6.6.3.3 License Condition

The NRC staff has evaluated the licensee’s proposal of including a license condition in the WBN, Unit 2, Facility Operating License. The license condition would be, “The licensee shall fully implement and maintain in effect all provisions of the Commission approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 50.54(p). The licensee CSP was approved by NUREG-0847 Supplement 28.” The NRC staff finds this change is acceptable because it conditions the license on full implementation and maintenance of the CSP, including CSP changes approved by the NRC staff and CSP changes made by the licensee which do not decrease the effectiveness of the cyber security plan.

13.6.6.4 Conclusion

Based on its review of the licensee’s submission, the NRC staff concludes that implementation of Milestones 1 through 7 provides significant protection against cyber attacks; the licensee’s explanation of the need for additional time is compelling, and it is acceptable for TVA to complete implementation of Milestone 8, full implementation of the CSP, by March 31, 2017.

The NRC staff’s review and evaluation of the applicant’s CSP was conducted using the NRC staff positions established in the relevant sections of Regulatory Guide (RG) 5.71. Based on the NRC staff’s review, the NRC finds that the applicant addressed the information necessary to satisfy the requirements of 10 CFR 73.54, 10 CFR 73.55(a)(1), 10 CFR 73.55(b)(8), and 10 CFR 73.55(m), and that the applicant’s CSP provides high assurance that CDAs are adequately protected against cyberattacks, up to and including, the design basis threat as described in 10 CFR 73.1.

Therefore, the NRC staff finds the information contained in this CSP to be acceptable, and upon successful implementation of this program, operation of WBN, Unit 2, will not be inimical to the common defense and security.

19 REPORT OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In SSERs 1, 4, and 14, the NRC staff addressed the concerns raised by the Advisory Committee on Reactor Safeguards (ACRS) in its letter report of August 16, 1982, which was published in Appendix F to SSER 1. In SSER 20, the NRC staff documented the ACRS review of the Watts Bar Nuclear Plant's (WBN), Unit 1, ability to operate at core power levels up to 3411 megawatts thermal.

During the 609th meeting of ACRS from November 7 - 8, 2013, ACRS met with representatives of the Nuclear Regulatory Commission (NRC) staff and the applicant, Tennessee Valley Authority (TVA), to discuss the WBN, Unit 2, operating license (OL) request. By letter to Mr. Mark A. Satorius, Executive Director for Operations, dated November 26, 2013 (ADAMS Accession No. ML13318A154), the ACRS provided its interim conclusions based on its review to date of the WBN, Unit 2, OL request.

During the 621st meeting of the ACRS from February 5-7, 2015, ACRS met with representatives of the NRC staff and TVA to discuss the WBN, Unit 2, OL request. By letter to Chairman Stephen G. Burns, dated February 12, 2015 (ADAMS Accesssion No. ML15039A005), ACRS provided its conclusions and recommendations related to the operation of WBN, Unit 2. The ACRS letter stated there is reasonable assurance that WBN, Unit 2, can operate as the second unit of the dual-unit WBN without undue ruisk to the health and safety of the public and that an OL for WBN, Unit 2, should be approved, following completion of remaining staff inspections and closure of remaining open items. The ACRS letter is provided in Appendix F of this SSER.

APPENDIX A CHRONOLOGY OF RADIOLOGICAL REVIEW OF WATTS BAR NUCLEAR PLANT, UNIT 2, OPERATING LICENSE REVIEW

Public correspondence exchanged between the Nuclear Regulatory Commission (NRC) and TVA during the review of the operating license application for Watts Bar Nuclear Plant (WBN), Units 1 and 2, is available through the NRC's Agencywide Documents Access and Management System (ADAMS) or the Public Document Room (PDR). This correspondence includes that occurring subsequent to TVA's letter notifying the NRC of its decision to reactivate construction of WBN, Unit 2, which had been in a deferred status under the Commission's Policy Statement on Deferred Plants.

Web-based ADAMS (WBA) is the latest interface to ADAMS. This search engine enables searching the ADAMS repository of official agency records (Publicly Available Records System (PARS) and Public Legacy libraries) for publicly available regulatory guides, NUREG-series reports, inspection reports, Commission documents, correspondence, and other regulatory and technical documents written by NRC staff, contractors, and licensees. WBA permits full-text searching and enables users to view document images, download files, and print locally. New documents become accessible on the day they are published, and are released periodically throughout the day. ADAMS documents are provided in Adobe Portable Document Format (PDF).

The NRC PDR reference staff is available to assist with ADAMS. Contact information for the PDR staff is on the NRC Web site at http://www.nrc.gov/reading-rm/contact-pdr.html.

APPENDIX E PRINCIPAL CONTRIBUTORS TO SSER 28

E. Bowman, NRR/JLD
N. DiFrancesco, NRR/JLD/JHMB
S. LaVie, NSIR/DPR
G.S. Matharu, NRR/DE/EEEB
R. Mathew, NRR/DE/EEEB
J. Poole, NRR/DORL/LPWB
J. Rycyna, NSIR/CSD

APPENDIX F REPORT OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

During the 621st meeting of the ACRS from February 5-7, 2015, ACRS met with representatives of the NRC staff and TVA to discuss the WBN, Unit 2, OL request. By letter to Chairman Stephen G. Burns, dated February 12, 2015 (ADAMS Accesssion No. ML15039A005), the Advisory Committee on Reactor Safeguards provided its conclusions and recommendations related to the operation of WBN, Unit 2. A copy of this letter is provided on the following pages of this Appendix.

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

February 12, 2015

The Honorable Stephen G. Burns
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: FINAL ACRS REVIEW OF WATTS BAR NUCLEAR PLANT UNIT 2 OPERATING LICENSE APPLICATION

Dear Chairman Burns:

During the 621st meeting of the Advisory Committee on Reactor Safeguards, February 5-7, 2015, we met with representatives of the NRC staff and the applicant, Tennessee Valley Authority (TVA), to review the current status of the construction completion, inspection, and licensing activities related to the Watts Bar Nuclear Plant, Unit 2 (WBN 2) Operating License (OL) application.

WBN 2 is the second unit of a dual-unit plant consisting of two Westinghouse-designed four-loop pressurized water reactors within ice-condenser containments. TVA received a Construction Permit (CP) for both units in 1973 and suspended construction in 1985. Construction for WBN 1 was resumed in 1989, and WBN 1 received its full-power OL in early 1996.

Construction for WBN 2 remained suspended until 2007 when TVA informed the NRC of its plan to complete the unit under the existing CP. In Staff Requirements Memorandum SRM-SECY-07-0096, dated July 25, 2007, the Commission directed the NRC staff to employ the current licensing basis for WBN 1 for the license review of WBN 2.

Our Plant Operations and Fire Protection Subcommittee held its first meeting concerning completion of WBN 2 on March 31, 2009, and has held nine subsequent meetings. We issued an interim letter dated November 26, 2013, to reflect our review to that date. A final subcommittee meeting was held on January 13, 2015. During these meetings, we had the benefit of discussions with the NRC staff and TVA, as well as comments from several members of the public. We also had the benefit of the documents referenced.

CONCLUSIONS AND RECOMMENDATIONS

1 . There is reasonable assurance that WBN 2 can operate as the second unit of the dual-unit Watts Bar Nuclear Plant without undue risk to the health and safety of the public. The OL for WBN 2 should be approved following completion of remaining staff inspections and closure of remaining open items.

2. The integration of WBN 2 as the second unit in a dual-unit plant which has operated as a single unit for almost 20 years requires specific, detailed planning to ensure against creating challenges to WBN 1 operation. Our review indicates that this planning has been done and necessary preparations for WBN 2 operation have been made.

3. Adequate recirculation core cooling will be assured following a Loss of Coolant Accident, taking debris effects into account, provided high levels of containment cleanliness are maintained.

4. We strongly endorse the development of a methodology for Probabilistic Flooding Hazard Analysis. This is important for future use consistent with risk-informed, performance-based approaches to natural hazard assessment.

BACKGROUND

In our interim letter dated November 26, 2013, we stated that our review to that date had not identified any issue which we did not expect to be resolved satisfactorily prior to OL issuance, and we identified eight specific items for our further review. This included seven items listed in the staff's Supplemental Safety Evaluation Report 26.

Our interim letter also noted that we had focused on the potential for the period of deferral of WBN 2 construction to affect the integration of WBN 2 operation into the dual-unit design. This included both the validation of compliance of structures, systems and components (SSCs) with the current licensing basis, which is to apply for both units, and validation that the process of startup and initial operation of WBN 2 will not adversely affect continued operation of WBN 1. We conclude that this has been satisfactorily achieved.

In SECY-14-0102 dated September 29, 2014, the staff provides a comprehensive summary of the unique construction and licensing history for WBN 2. This summary includes ongoing licensing actions applicable to the current licensing basis for WBN 1, and therefore also to WBN 2 pursuant to SRM-SECY-07-0096.

In a few instances, we have reviewed issues which are being addressed for WBN 2 in advance of their resolution as part of the WBN 1 licensing basis. This is also pursuant to SRM-SECY-07-0096. An example is TVA's response, dated May 17, 2012, to Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors." Resolution prior to initial operation will avoid unnecessary radiation exposure.

DISCUSSION

The results of our review of the items identified in our interim letter are summarized as follows:

Generic Safety Issue (GSI)-191 and GL 2004-02

In a letter dated September 16, 2013, TVA affirmed that a confirmatory inspection for loose debris will be performed on WBN 2 after construction has been completed and the containment has been cleaned. In a letter to TVA dated September 18, 2014, NRC staff describes its closeout of GL 2004-02 for WBN 2 based on the "clean plant" guidelines and methodology developed by the Nuclear Energy Institute.

In support of this closeout, TVA performed a detailed evaluation for both WBN units which included conservative estimates of debris transport within the containment building, of the head loss across the sump strainer, and of vortex formation above the strainer. This evaluation was supported by appropriate testing, which was witnessed by NRC staff.

Because WBN 2 uses containment sump strainers consisting of stacked discs, we reviewed the potential for miscellaneous debris, such as tapes and labels, to block entry into the spaces between the discs and thereby to result in a loss of flow area much greater than for an equivalent mass of fibrous debris. We reviewed in detail the testing performed, the assumptions used, in-vessel debris effects, and the margin remaining in the available pump suction head. We conclude that adequate margin will remain available for recirculation flow, provided that rigorous standards of containment cleanliness, with latent debris loads of less than 100 pounds, are maintained.

Compliance with General Design Criterion (GDC) 5

GDC 5 requires that SSCs important to safety shall not be shared, unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining unit.

TVA documented in the Updated Final Safety Analysis Report (UFSAR) a calculation which shows that the cooling water systems have the capability to bring the non-accident unit to cold shutdown within 72 hours from its entry into the hot standby mode. This assumes that the component cooling system carries all required heat loads for both the accident unit and, later in the event, the non-accident unit.

Cyber Security Confirmatory Testing

Testing was conducted by TVA to verify that the External Communications Interface for the WBN 2 Eagle 21 Process Protection System only allows data flow in one direction (i.e., data out to the non-safety-related Plant Computer System and no data into the Eagle 21 system). We reviewed this testing and its results, and the physical design provisions which ensure it will be maintained. We conclude that these are acceptable.

Calculation of Core Fuel Temperature

The NRC staff noted that the methodology used initially for WBN 2 to determine peak clad temperature, and other variables such as stored energy, following a Large Break Loss of Coolant Accident potentially provided non-conservative results due to lack of a thermal conductivity degradation (TCD) model. TVA performed and the staff approved further analyses which included the effects of TCD. The results have shown adequate peak clad temperature margin to the 10 CFR 50.46(b)(1) limits for the initial WBN 2 core loading. A license condition will be imposed requiring the use of methodologies which include an approved TCD model for subsequent fuel cycles. These methodologies are under staff review.

Site Licensing Basis Hydrology

By letter dated July 19, 2012, TVA submitted a License Amendment Request (LAR) seeking approval to revise the WBN 1 UFSAR to adopt a revised hydrologic analysis for the site. This LAR was later supplemented by 10 letters submitted between March 1, 2013, and December 5, 2014. These letters provided additional information, but did not change the flood elevation or warning time. The revised hydrologic analysis for the site results in changes to the flooding protection requirements for certain WBN 1 SSCs. As the LAR revises the WBN 1 licensing basis, it is applicable to WBN 2 as well. Accordingly, we included the LAR revisions in our review. The LAR was approved and the UFSAR updated by an NRC letter dated January 28, 2015.

The site licensing basis provides for conditions in which the flood level may exceed plant grade. This is termed “Flood Mode Operation”, and SSCs required to maintain plant safe shutdown under this condition are protected or designed for submergence. To prevent floods from exceeding the design basis flood level, temporary measures taken for WBN 1 will be replaced by permanent modifications prior to WBN 2 fuel loading. We have no further questions or concerns following our review.

Fire Protection Procedures Related to Operator Manual Actions

The Watts Bar Fire Protection Program is developed for Unit 1 and Unit 2 in accordance with the requirements in 10 CFR 50, Appendix R, and the guidance in Regulatory Guide 1.189, Revision 2, “Fire Protection for Nuclear Power Plants.” The Watts Bar Fire Protection Report documents the Fire Protection Plan for Unit 1 and Unit 2, the supporting fire hazards analysis, and the strategies to ensure safe shutdown. These are applicable for a fire in any plant location. The Fire Protection Plan identifies numerous operator manual actions that are needed to mitigate the consequences from fire damage and to implement the safe shutdown strategies.

We examined several challenging WBN 2 fire scenarios that require coordinated responses of several Auxiliary Unit Operators to perform local actions in Unit 1 and Unit 2. We questioned whether the feasibility and reliability of these actions were evaluated according to the methods outlined in NUREG-1852, "Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire." TVA explained that the fire response procedures contain detailed guidance for every local action that is required for a fire in each plant location.

TVA also described the design of the Watts Bar fire detection systems, which provide clear indication of the fire location. They explained that a time line was developed for each fire scenario that accounts for fire detection, diagnosis of plant conditions, assembly of personnel in the Main Control Room, supervisory coordination and direction, dispatch of local operators, transit times, access requirements, action implementation times, and communication. Challenging scenarios were evaluated by walkthroughs and timing assessments. The total time required to perform the needed actions was compared with the amount of time that is available, as determined by the identified safe shutdown strategy. A 100% time margin was used to account for uncertainties in the assessments. For example, if it is necessary to complete the actions within 60 minutes, the strategy was determined to be feasible and reliable if the operators demonstrated successful completion in 30 minutes, or less. The staff audited these timing assessments and observed a sample of the walkthroughs.
These activities provide reasonable assurance that the identified operator manual actions have been adequately assessed for their feasibility.

Operational Readiness Preparations

Both TVA and NRC staff are following detailed plans for closeout of remaining inspections and open items prior to each stage of operational readiness, with active management oversight of these activities. The required resources appear to be available and capable of meeting currently scheduled milestones, and emergent inspection findings are being addressed appropriately.

Development of Probabilistic Flood Hazard Assessment Capability

During our review, we noted that the Probable Maximum Flood is a deterministically established value for each plant site. This is increasingly inconsistent with the agency use of risk-informed, performance-based approaches to natural hazard assessment. In response to our questions in this regard, the staff informed us of their consideration of a multi-year Probabilistic Flooding Hazard Analysis (PFHA) Research Plan. We strongly endorse development of a PFHA methodology and would welcome further discussion with the staff.

SUMMARY

There is reasonable assurance that WBN 2 can operate as the second unit of the dual-unit Watts Bar Nuclear Plant without undue risk to the health and safety of the public. The OL for WBN 2 should be approved following completion of remaining staff inspections and closure of remaining open items.

Sincerely,

/RA/

John W. Stetkar
Chairman

REFERENCES

1. Tennessee Valley Authority, Watts Bar Nuclear Plant Unit 2 Final Safety Analysis Report (FSAR), Amendments No. 92 through 112.

   Below is the list of FSAR Amendments that was submitted as part of the Unit 2 review.

   Amendment 92, dated December 18, 2008 (ML090980525)
   Amendment 93, dated April 30, 2009 (ML091400068)
   Amendment 94, dated August 27, 2009 (ML092460758)
   Amendment 95, dated November 24, 2009 (ML093370274)
   Amendment 96, dated December 14, 2009 (ML093570464)
   Amendment 97, dated January 11, 2010 (ML100191426)
   Amendment 98, dated May 7, 2010 (ML101340795)
   Amendment 99, dated May 27, 2010 (ML101610291)
   Amendment 100, dated September 1, 2010 (ML102530216)
   Amendment 101, dated October 29, 2010 (ML103160411)
   Amendment 102, dated December 17, 2010 (ML112210425)
   Amendment 103, dated March 15, 2011 (ML110840665)
   Amendment 104, dated June 3, 2011 (ML111780527)
   Amendment 105, dated August 12, 2011 (ML121700642)
   Amendment 106, dated September 15, 2011 (ML121700412)
   Amendment 107, dated November 17, 2011 (ML121780190)
   Amendment 108, dated March 5, 2012 (ML120830237)
   Amendment 109, dated August 23, 2012 (ML122440027)
   Amendment 110, dated August 14, 2013 (ML13255A164)
   Amendment 111, dated February 13, 2014 (ML14051A680)
   Amendment 112, dated May 30, 2014 (ML14160A901)

2. U.S. Nuclear Regulatory Commission, NUREG-0847, “Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2,” Supplements (SSER) 21 - 27.

   Below is the list of SSERs issued as part of the Unit 2 review.

   SSER 21, dated February 28, 2009 (ML090570741)
   SSER 22, dated January 31, 2011 (ML110390197)
   SSER 23, dated June 30, 2011 (ML11206A499)
   SSER 24, dated September 30, 2011 (ML11277A148)
   SSER 25, dated November 30, 2011 (ML12011A024)
   SSER 26, dated June 30, 2013 (ML13205A136)
   SSER 27, dated January, 31, 2015 (ML15033A041)

3. Staff Requirements Memorandum, SECY-07-0096, “Possible Reactivation of Construction and Licensing Activities for the Watts Bar Nuclear Plant Unit 2,” dated July 25, 2007 (ML072060688)

4. Tennessee Valley Authority, “Watts Bar Nuclear Plant (WBN) Unit 2 – Transmittal of Revised Unit 1/Unit 2 As-Designed Fire Protection Report,” dated March 13, 2013 (ML13081A002, ML13081A003, ML13081A004)

5. Regulatory Guide 1.189, Revision 2, “Fire Protection for Nuclear Power Plants,” dated October, 2009 (ML092580550)

6. NUREG-1852, “Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire,” dated October, 2007 (ML073020676)

7. NRC Generic Letter (GL) 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors”, dated September 13, 2004 (ML042360586)

8. Information Notice 2011-21, “Realistic Emergency Core Cooling System Evaluation Model Effects Resulting from Nuclear Fuel Thermal Conductivity Degradation,” dated December 13, 2011 (ML113430785)

9. Staff Requirements Memorandum, SECY-14-0102, “Construction and Licensing for Watts Bar Nuclear Plant, Unit 2, dated September 29, 2014 (ML14238A672**)**

APPENDIX HH WATTS BAR, UNIT 2, ACTION ITEMS TABLE

This table provides a status of required action items associated of all open items, confirmatory issues, and proposed license conditions that the U.S. Nuclear Regulatory Commission (NRC) staff has identified. Unless otherwise noted, the item references are to sections of this SSER. Items that are still open are listed first, and items that have been closed are listed second. Some numbers were not used in the sequential list. There are **11 items** still open and **117 items** that have been closed as of May 7, 2015.

Open Items				
Item	**Type**	**Action Required**	**Lead**	**Status**
(1)	Confirmatory Issue (CI)	Review evaluations and corrective actions associated with a power assisted cable pull. (NRC safety evaluation, dated August 31, 2009, Agencywide Documents Access and Management System (ADAMS) Accession No. ML092151155)	RII	Open
(16)		Based on the uniqueness of environmental qualification (EQ), the NRC staff must perform a detailed inspection and evaluation prior to fuel load to determine how the WBN, Unit 2, EQ program complies with the requirements of 10 CFR 50.49. (Suppplemental Safety Evaluation Report (SSER) 22, Section 3.11.2)	RII/NRR	Open
(25)		Prior to the issuance of an operating license (OL), the Tennessee Valley Authority (TVA) is required to provide satisfactory documentation that it has obtained the maximum secondary liability insurance coverage pursuant to 10 CFR 140.11(a)(4), and not less than the amount required by 10 CFR 50.54(w), with respect to property insurance, and the NRC staff has reviewed and approved the documentation. (SSER 22, Section 22.3)	NRR	Open
(75)	CI	The NRC staff will verify that the test procedures and qualification testing for auxiliary feedwater initiation and control and flow indication are completed in WBN, Unit 2, before fuel load. (SSER 23, Section 7.8.2)	RII	Open
(79)		TVA should perform a radiated susceptibility survey, after the installation of the hardware but prior to the RM-1000 being placed in service, to establish the need for exclusion distance for the high range containment air radiation (HRCAR) monitors while using handheld portable devices (e.g., walkie-talkie) in the control room, as documented in	NRR	Open

		Attachment 23 to TVA's letter, dated February 25, 2011, and item number 355 of TVA's letter, dated April 15, 2011. (SSER 23, Section 7.5.2.3)		
(83)	CI	TVA should confirm to the NRC staff the completion of the data storm test on the distribution control system. (SSER 23, Section 7.7.1.4)	NRR	Open
(90)	CI	The NRC staff should verify that the essential raw cooling water (ERCW) dual unit flow balance confirms that the ERCW pumps meet all specified performance requirements and have sufficient capability to supply all required ERCW normal and accident flows for dual unit operation and accident response, in order to verify that the ERCW pumps meet GDC 5 for two-unit operation. (SSER 23, Section 9.2.1)	RII/NRR	Open
(140)	CI	TVA to confirm to the staff the completion of the Unit 2, OMA feasibility walkdowns. (SSER 26, Appendix FF, Section 8.0)	NRR	Open
(141)	CI	TVA to confirm to the staff the completion of the multiple spurious operation scenario resolution actions for scenarios that only affect Unit 2. (SSER 26, Appendix FF, Section 8.0)	NRR	Open
(142)	CI	TVA to confirm to the staff the completion of the electrical coordination modifications. (SSER 26, Appendix FF, Section 8.0)	NRR	Open
(143)	CI	TVA to confirm the as-built fire protection report aligns with as-designed fire protection report. Gaps to be submitted to the NRC for approval. (SSER 26, Appendix FF, Section 8.0)	NRR	Open

Closed Items				
(2)	CI	Conduct appropriate inspection activities to verify cable lengths used in calculations and analysis match as-installed configuration. (NRC safety evaluation, dated August 31, 2009, ADAMS Accession No. ML092151155). Closed in Inspection Report 05000391/2013604, dated June 27, 2013, ADAMS Accession No. ML13179A079.	RII	Closed
(3)	CI	Confirm TVA submitted update to FSAR section 8.3.1.4.1. (NRC safety evaluation (SE) dated August 31, 2009, ADAMS Accession No. ML092151155)	NRR	Closed

		Closed in SSER 24, Section 8.1.		
(4)	CI	Conduct appropriate inspection activities to verify that TVA's maximum SWBP criteria for signal level and coaxial cables do not exceed the cable manufacturer's maximum SWBP criteria. (NRC safety evaluation, dated August 31, 2009, ADAMS Accession No. ML092151155) Closed in Inspection Report 0500391/2012602, dated March 27, 2012, ADAMS Accession No. ML12087A324.	RII	Closed
(5)	CI	Verify timely submittal of pre-startup core map and perform technical review. (TVA letter, dated September 7, 2007, ADAMS Accession No. ML072570676). By letter dated July 30, 2012, TVA provided the pre-startup core map. The staff has verified the information and has closed Appendix HH Open Items 5 and 8, which came from the review of BL 1996-01.	NRR	Closed
(6)	CI	Verify implementation of TSTF-449. (TVA letter dated September 7, 2007, ADAMS Accession No. ML072570676). Staff has reviewed Revision I to the proposed TSs and found that TSTF 449 has been incorporated.	NRR	Closed
(7)	CI	Verify commitment completion and review electrical design calculations. (TVA letter dated October 9, 1990, ADAMS Accession No. ML073551056). Closed in Inspection Report 05000391/2013610, dated February 14, 2014, ADAMS Accession No. ML14049A158.	RII	Closed
(8)	CI	TVA should provide a pre-startup map to the NRC staff indicating the rodded fuel assemblies and a projected end of cycle burnup of each rodded assembly for the initial fuel cycle 6-months prior to fuel load. (NRC safety evaluation, dated May 3, 2010, ADAMS Accession No. ML101200035). By letter dated July 30, 2012, TVA provided the pre-startup core map. The staff has verified the information and has closed Appendix HH Open Items 5 and 8, which came from the review of BL 1996-01.	NRR	Closed
(9)	CI	Confirm that education and experience of management and principal supervisory positions down through the shift supervisory level conform to Regulatory Guide 1.8. (SSER 22, Section 13.1.3). Closed in Inspection Report 0500391/2014603, dated May 9, 2014, ADAMS Accession No. ML14129A381.	RII	Closed

(10)	CI	Confirm that TVA has an adequate number of licensed and non-licensed operators in the training pipeline to support the preoperational test program, fuel loading, and dual unit operation. (SSER 22, Section 13.1.3). Closed in Inspection Report 0500391/2014603, dated May 9, 2014, ADAMS Accession No. ML14129A381.	RII	Closed
(11)	CI	The plant administrative procedures should clearly state that, when the Assistant Shift Engineer assumes his duties as Fire Brigade Leader, his control room duties are temporarily assumed by the Shift Supervisor (Shift Engineer), or by another senior reactor operator, if one is available. The plant administrative procedures should clearly describe this transfer of control room duties. (SSER 22, Section 13.1.3) Closed in SSER 25, Section 13.1.3.	NRR	Closed
(12)		TVA's implementation of New Generation Development and Construction PP-20 and Engineering Document Construction Release Appendix J is subject to future NRC audit and inspection. (SSER 22, Section 25.9). Closed in SSER 27, Section 25.9.	NRR	Closed
(13)		TVA is expected to submit an inservice testing program and specific relief requests for WBN, Unit 2, 9 months before the projected date of OL issuance. (SSER 22, Section 3.9.6). Closed in SSER 27, Section 3.9.6.	NRR	Closed
(14)		TVA stated that the Unit 2, Pressure and Temperature Limits Report (PTLR) is included in the Unit 2, System Description for the Reactor Coolant System (WBN2-68-4001), which will be revised to reflect required revisions to the PTLR by September 17, 2010. (SSER 22, Section 5.3.1) Closed in SSER 25, Section 5.3.1.	NRR	Closed
(15)		TVA should confirm to the NRC staff the completion of Primary Stress Corrosion Cracking (PWSCC) mitigation activities on the Alloy 600 dissimilar metal butt welds (DMBWs) in the primary loop piping. (SSER 22, Section 3.6.3) Closed in SSER 24, Section 3.6.3.	NRR	Closed
(17)		The NRC staff should verify the accuracy of the WBN, Unit 2, EQ list prior to fuel load. (SSER 22, Section 3.11.2.1) Closed in Inspection Report 05000391/2014615, dated February 13, 2014, ADAMS Accession No. ML15044A424.	RII/NRR	Closed
(18)		Based on the extensive layup period of equipment within WBN, Unit 2, the NRC staff must review, prior to fuel load, the assumptions used by TVA to re-establish a baseline for the qualified life of	RII/NRR	Closed

		equipment. The purpose of the staff's review is to ensure that TVA has addressed the effects of environmental conditions on equipment during the layup period. (SSER 22, Section 3.11.2.2) Closed in Inspection Report 0500391/2011604, dated June 29, 2011, ADAMS Accession No. ML111810890.		
(19)		The NRC staff should complete its review of TVA's EQ Program procedures for WBN, Unit 2, prior to fuel load. (SSER 22, Section 3.11.2.2.1) Closed in Inspection Report 0500391/2011604, dated June 29, 2011, ADAMS Accession No. ML111810890.	RII/NRR	Closed
(20)	CI	Resolve whether or not routine maintenance activities should result in increasing the EQ of the 6.9 kV motors to Category I status in accordance with 10 CFR 50.49. (SSER 22, Section 3.11.2.2.1; SSER 24, Section 8.1) Closed in Inspection Report 0500391/2011605, dated August 5, 2011, ADAMS Accession No. ML112201418.	RII/NRR	Closed
(21)		The NRC staff should confirm that the electrical penetration assemblies (EPAs) are installed in the tested configuration, and that the feedthrough module is manufactured by the same company and is consistent with the EQ test report for the EPA. (SSER 22, Section 3.11.2.2.1) Closed in Inspection Report 05000391/2011607, dated September 30, 2011, ADAMS Accession No. ML112730197.	RII/NRR	Closed
(22)		TVA must clarify its use of the term "equivalent" (e.g., identical, similar) regarding the replacement terminal blocks to the NRC staff. If the blocks are similar, then a similarity analysis should be completed and presented to the NRC for review. (SSER 22, Section 3.11.2.2.1) Closed in SSER 24, Section 8.1.	NRR	Closed
(23)		Resolve whether or not TVA's reasoning for not upgrading the main steam isolation valve solenoid valves to Category I is a sound reason to the contrary, as specified in 10 CFR 50.49(l). (SSER 22, Section 3.11.2.2.1; SSER 24, Section 8.1). Closed in SSER 27, Section 3.11.2.2.1.	NRR	Closed
(24)		The NRC staff requires supporting documentation from TVA to justify its establishment of a mild environment threshold for total integrated dose of less than $1x10^3$ rads for electronic components such as semiconductors or electronic components containing organic material. (SSER 22, Section 3.11.2.2.1) Closed in SSER 24, Section 8.1.	NRR	Closed

(26)		For the scenario with an accident in one unit and concurrent shutdown of the second unit without offsite power, TVA stated that Unit 2, pre-operational testing will validate the diesel response to sequencing of loads on the Unit 2, emergency diesel generators (EDGs). The NRC staff will evaluate the status of this issue and will update the status of the EDG load response in a future SSER. (SSER 22, Section 8.1). Closed in SSER 27, Section 8.1.	NRR	Closed
(27)		TVA should provide a summary of margin studies based on scenarios described in Section 8.1 for CSSTs A, B, C, and D. (SSER 22, Section 8.2.2) Closed in SSER 24, Section 8.1.	NRR	Closed
(28)		TVA should provide to the NRC staff a detailed discussion showing that the load tap changer is able to maintain the 6.9 kV bus voltage control band, given the normal and post-contingency transmission operating voltage band, bounding voltage drop on the grid, and plant conditions. (SSER 22, Section 8.2.2) Closed in SSER 24, Section 8.1.	NRR	Closed
(29)		TVA should provide information about the operating characteristics of the offsite power supply at the Watts Bar Hydro Plant (for dual-unit operation), including the operating voltage range, postcontingency voltage drops (including bounding values and post-unit trip values), and operating frequency range. (SSER 22, Section 8.2.2) (corrected version of Open Item 29 from SSER 22 Appendix HH) Closed in SSER 24, Section 8.1.	NRR	Closed
(30)		TVA should confirm that all other safety-related equipment (in addition to the Class 1E motors) will have adequate starting and running voltage at the most limiting safety-related components (such as motor-operated valves (MOVs), contactors, solenoid valves or relays) at the degraded voltage relay setpoint dropout setting. TVA should also confirm that the final Technical Specifications are properly derived from these analytical values for the degraded voltage settings. (SSER 22, Section 8.3.1.2) Closed in SSER 28, Section 8.3.1.2.	RII/NRR	Closed
(31)		TVA should clarify the loading sequence as explained in its letter dated December 6, 2010, to the staff. TVA should clarify whether the existing statements in FSAR regarding automatic sequencing logic are correct. If the FSAR description is correct, TVA should explain how the EDG and logic sequencing circuitry will respond to a LOCA followed by a loss-of-offsite power (LOOP) scenario. (SSER 22, Section 8.3.1.11) (corrected	NRR	Closed

		version of Open Item 31 from SSER 22 Appendix HH) Closed in SSER 24, Section 8.1		
(32)		TVA should provide to the NRC staff the details of the administrative limits of EDG voltage and speed range, and the basis for its conclusion that the impact is negligible, and describe how it accounts for the administrative limits in the Technical Specification surveillance requirements for EDG voltage and frequency. (SSER 22, Section 8.3.1.14). Closed in SSER 27, Section 8.3.	NRR	Closed
(33)	CI	TVA stated in Attachment 9 of its letter dated July 31, 2010, that certain design change notices (DCNs) are required or anticipated for completion of WBN, Unit 2, and that these DCNs were unverified assumptions used in its analysis of the 125 volt direct current (VDC) vital battery system. Verification of completion of these DCNs to the NRC staff is necessary prior to issuance of the OL. (SSER 22, Section 8.3.2.3; SSER 24, Section 8.1) Closed in Inspection Report 05000391/2015602, dated March 24, 2015, ADAMS Accession No. ML15083A276.	RII/NRR	Closed
(34)	CI	TVA stated that the method of compliance with Phase I guidelines would be substantially similar to the current Unit 1,program and that a new Section 3.12 will be added to the Unit 2, FSAR that will be materially equivalent to Section 3.12 of the current Unit 1, FSAR. (SSER 22, Section 9.1.4) Closed in SSER 24, Section 9.1.4.	NRR	Closed
(35)		TVA should provide information to the NRC staff that the CCS will produce feedwater purity in accordance with BTP Materials Engineering Branch 5-3 or, alternatively, provide justification for producing feedwater purity to another acceptable standard. (SSER 22, Section 10.4.6). Closed in SSER 27, Section 10.4.6.	NRR	Closed
(36)		TVA should provide information to the NRC staff to enable verification that the SGBS meets the requirements and guidance specified in the SER or provide justification that the SGBS meets other standards that demonstrate conformance to GDC 1 and GDC 14. (SSER 22, Section 10.4.8) Closed in SSER 24, Section 10.4.8.	NRR	Closed
(37)	CI	The NRC staff will review the combined WBN, Unit 1, and 2 Appendix C prior to issuance of the Unit 2, OL to confirm (1) that the proposed Unit 2, changes were incorporated into Appendix C, and (2) that changes made to Appendix C for Unit 1, since Revision 92 and the changes made to the Nuclear	NSIR	Closed

		Power Radiological Emergency Plan (REP) since Revision 92 do not affect the bases of the staff's findings in this SER supplement. (SSER 22, Section 13.3.2) Closed in SSER 28, Section 13.3.2.		
(38)	CI	The NRC staff will confirm the availability and operability of the ERDS for Unit 2, prior to issuance of the Unit 2 OL. (SSER 22, Section 13.3.2.6) Closed in Inspection Report 05000391/2014614, dated December 29, 2014, ADAMS Accession No. ML14363A315.	RII/NSIR	Closed
(39)	CI	The NRC staff will confirm the adequacy of the communications capability to support dual unit operations prior to issuance of the Unit 2 OL. (SSER 22, Section 13.3.2.6) Closed in Inspection Report 0500391/2011609, dated December 16, 2011, ADAMS Accession No. ML11350A229.	RII/NSIR	Closed
(40)	CI	The NRC staff will confirm the adequacy of the emergency facilities and equipment to support dual unit operations prior to issuance of the Unit 2, OL. (SSER 22, Section 13.3.2.8) Closed in Inspection Report 05000391/2014614, dated December 29, 2014, ADAMS Accession No. ML14363A315.	RII/NSIR	Closed
(41)	CI	TVA committed to (1) update plant data displays as necessary to include Unit 2, and (2) to update dose assessment models to provide capabilities for assessing releases from both WBN units. The NRC staff will confirm the adequacy of these items prior to issuance of the Unit 2 OL. (SSER 22, Section 13.3.2.9) Closed in Inspection Report 05000391/2015603, dated May 1, 2015, ADAMS Accession No. ML15124A921.	RII/NSIR	Closed
(42)	CI	The NRC staff will confirm the adequacy of the accident assessment capabilities to support dual unit operations prior to issuance of the Unit 2 OL. (SSER 22, Section 13.3.2.9) Closed in Inspection Report 0500391/2011609, dated December 16, 2011, ADAMS Accession No. ML11350A229.	RII/NSIR	Closed
(43)	CI	Section V of Appendix E to 10 CFR Part 50 requires TVA to submit its detailed implementing procedures for its emergency plan no less than 180 days before the scheduled issuance of an OL. Completion of this requirement will be confirmed by the NRC staff prior to the issuance of an OL. (SSER 22, Section 13.3.2.18) Closed in SSER 28, Section 13.3.2.18	NSIR	Closed
(44)		TVA should provide additional information to clarify how the initial and irradiated RT_{NDT} was determined. (SSER 22, Section 5.3.1) Closed in SSER 25, Section 5.3.1.	NRR	Closed

(45)	CI	TVA stated in its response to RAI 5.3.2-2, dated July 31, 2010, that the PTLR would be revised to incorporate the cold overpressure mitigation system arming temperature. (SSER 22, Section 5.3.2) Closed in SSER 25, Section 5.3.2.	NRR	Closed
(46)	CI	The LTOP lift settings were not included in the PTLR, but were provided in TVA's response to RAI 5.3.2-2 in its letter dated July 31, 2010. TVA stated in its RAI response that the PTLR would be revised to incorporate the LTOP lift settings into the PTLR. (SSER 22, Section 5.3.2) Closed in SSER 25, Section 5.3.2.	NRR	Closed
(47)	CI	The NRC staff noted that TVA's changes to Section 6.2.6 in FSAR Amendment No. 97, regarding the implementation of Option B of Appendix J, were incomplete, because several statements remained regarding performing water-sealed valve leakage tests "as specified in 10 CFR [Part] 50, Appendix J." With the adoption of Option B, the specified testing requirements are no longer applicable; Option A to Appendix J retains these requirements. The NRC discussed this discrepancy with TVA in a telephone conference on September 28, 2010. TVA stated that it would remove the inaccurate reference to Appendix J for specific water testing requirements in a future FSAR amendment. (SSER 22, Section 6.2.6) Closed in SSER 26, Section 6.2.6.	NRR	Closed
(48)	CI	The NRC staff should verify that its conclusions in the review of FSAR Section 15.4.1 do not affect the conclusions of the staff regarding the acceptability of Section 6.5.3. (SSER 22, Section 6.5.3) Closed in SSER 26, Section 6.5.3.	NRR	Closed
(49)	CI	The NRC staff was unable to determine how TVA linked the training qualification requirements of ANSI N45.2-1971 to TVA Procedure Technical Instruciton (TI)-119. Therefore, the implementation of training and qualification for inspectors will be the subject of future NRC staff inspections. (NRC letter dated July 2, 2010, ADAMS Accession No. ML101720050). Closed in Inspection Report 0500391/2014602, dated March 27, 2014, ADAMS Accession No. ML14086A063.	RII	Closed
(50)	CI	TVA stated that about 5 percent of the anchor bolts for safety-related pipe supports do not have quality control documentation, because the pull tests have not yet been performed. Since the documentation is still under development, the NRC staff will conduct inspections to follow-up on the adequate implementation of this construction refurbishment	RII	Closed

		program requirement. (NRC letter dated July 2, 2010, ADAMS Accession No. ML101720050) Closed in Inspection Report 0500391/2013612, dated March 28, 2013, ADAMS Accession No. ML13088A066.		
(51)	CI	The implementation of TVA Procedure TI-119 will be the subject of NRC follow-up inspection to determine if the construction refurbishment program requirements are being adequately implemented. (NRC letter dated July 2, 2010, ADAMS Accession No. ML101720050). Closed in Inspection Report 0500391/2014602, dated March 27, 2014, ADAMS Accession No. ML14086A063.	RII	Closed
(52) through (58)		Not used.		
(59)		The staff's evaluation of the compatibility of the ESF system materials with containment sprays and core cooling water in the event of a LOCA is incomplete pending resolution of Generic Safety Issue-191 for WBN, Unit 2. (SSER 23, Section 6.1.1.4). Closed in SSER 27, Section 6.1.	NRR	Closed
(60)	CI	TVA should amend the FSAR description of the design and operation of the spent fuel pool cooling and cleanup system in FSAR Section 9.1.3 as proposed in its December 21, 2010, letter to the NRC. (SSER 23, Section 9.1.3) Closed in SSER 26, Section 9.1.3.	NRR	Closed
(61)		TVA should provide information to the NRC staff to demonstrate that Performance Analysis and Design (PAD) 4.0 can conservatively calculate the fuel temperature and other impacted variables, such as stored energy, given the lack of a fuel thermal conductivity degradation model. (SSER 23, Section 4.2.2). Closed in SSER 27, Section 4.2.	NRR	Closed
(62)	CI	Confirm TVA's change to FSAR Section 10.4.9 to reflect its intention to operate with each condensate storage tank isolated from the other. (SSER 23, Section 10.4.9) Closed in SSER 24, Section 10.4.9.	NRR	Closed
(63)	CI	TVA should confirm to the NRC staff that testing prior to Unitt 2 fuel load has demonstrated that two-way communications is impossible with the Eagle 21 communications interface. (SSER 23, Section 7.2.1.1). Closed in SSER 27, Section 7.2.	RII	Closed
(64)	CI	TVA stated that, "Post modification testing will be performed to verify that the design change corrects the Eagle 21, Rack 2 resistance temperature detector accuracy issue prior to WBN, Unit 2 fuel load." This issue is open pending NRC staff review of the testing results. (SSER 23, Section 7.2.1.1).	RII	Closed

		Closed in Inspection Report 05000391/2014602, dated March 27, 2014, ADAMS Accession No. ML14086A063.		
(65)		TVA should provide justification to the staff regarding why different revisions of Westinghouse Commercial Atomic Power-13869 are referenced in WBN, Units 1 and 2. (SSER 23, Section 7.2.1.1) Closed in SSER 26, Section 7.2.1.1.	NRR	Closed
(66)	CI	TVA should clarify FSAR Section 9.2.5 to add the capability of the ultimate heat sink to bring the nonaccident unit to cold shutdown within 72 hours. (SSER 23, Section 9.2.5). Closed in SSER 27, Section 9.2.5.	NRR	Closed
(67)	CI	TVA should confirm, and the NRC staff should verify, that the component cooling booster pumps for Unit 2 are above probable maximum flood level. (SSER 23, Section 9.2.2). Closed in SSER 27, Section 9.2.2 and Inspection Report 05000391/2014615, dated February 13, 2014, ADAMS Accession No. ML15044A424.	NRR	Closed
(68)		Not used.		
(69)	CI	The WBN, Unit 2, reactor coolant system (RCS) vent system is acceptable, pending verification that the RCS vent system is installed. (SSER 23, Section 5.4.5) Closed in Inspection Report 05000391/2014614, dated December 29, 2014, ADAMS Accession No. ML14363A315.	RII	Closed
(70)		TVA should provide the revised WBN, Unit 2, preservice inspection program ASME Class 1, 2, and 3 Supports “Summary Tables,” to include numbers of components so that the NRC staff can verify that the numbers meet the reference ASME Code. (Section 3.2.3 of Appendix Z of SSER 23). Closed in SSER 27, Section 3.2.3 of Appendix Z.	NRR	Closed
(71)		By letter dated April 21, 2011 (ADAMS Accession No. ML111110513), TVA withdrew its commitment to replace the Unit 2 clevis insert bolts. TVA should provide further justification for the decision to not replace the bolts to the NRC staff. (SSER 23, Section 3.9.5) Closed in SSER 26, Section 3.9.5.	NRR	Closed
(72)		The NRC staff should complete its review and evaluation of the additional information provided by TVA regarding the inadequate core cooling instrumentation. (SSER 23, Section 4.4.8) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(73)	CI	The NRC staff will inspect to confirm that TVA has completed the WBN, Unit 2, emergency operating procedures (EOPs) prior to fuel load. (SSER 23, Section 7.5.3). Closed in Inspection Report	RII	Closed

		05000391/2014604, dated June 25, 2014, ADAMS Accession No. ML14177A214.		
(74)	CI	The NRC staff will verify installation of the acoustic-monitoring system for the power-operated relief valve (PORV) position indication in WBN, Unit 2, before fuel load. (SSER 23, Section 7.8.1) Closed in Inspection Report 05000391/2015604, dated June 29, 2015, ADAMS Accession No. ML15181A446.	RII	Closed
(76)	CI	The NRC staff will verify that the derivative time constant is set to zero in WBN, Unit 2, before fuel load. (SSER 23, Section 7.8.3) Closed in Inspection Report 05000391/2011607, dated September 30, 2011, ADAMS Accession No. ML112730197.	RII	Closed
(77)		It is unclear to the NRC staff which software verification and validation (V&V) documents are applicable to the HRCAR monitors. TVA should clarify which software V&V documents are applicable, in order for the staff to complete its evaluation. (SSER 23, Section 7.5.2.3) Closed in SSER 26, Section 7.5.2.3.4	NRR	Closed
(78)		TVA intends to issue a revised calculation reflecting that the total integrated dose in the control room is less than 1×10^3 rads, which will be evaluated by the NRC staff. (SSER 23, Section 7.5.2.3) Closed in SSER 25, Section 7.5.2.3.	NRR	Closed
(80)		TVA should provide clarification to the staff on how TVA Standard Specification SS-E18-14.1 meets the guidance of Regulatory Guide (RG) 1.180, and should address any deviations from the guidance of the RG. (SSER 23, Section 7.5.2.3). Closed in SSER 27, Section 7.5.2.3.	NRR	Closed
(81)		The extent to which TVA's supplier, General Atomics (GA), complies with Electric Power Research Institute TR-106439 and the methods that General Atomics used for its commercial dedication process should be provided by TVA to the NRC staff for review. (SSER 23, Section 7.5.2.3) Closed in SSER 26, Section 7.5.2.3.4.	NRR	Closed
(82)		The staff concluded that the information provided by TVA pertaining to the in-containment loose part monitoring system equipment qualification for vibration was incomplete. TVA should provide (item number 362 of ADAMS Accession No. ML111050009), documentation that demonstrates the loose part monitoring system in-containment equipment has been qualified to remain functional in its normal operating vibration environment, per RG	NRR	Closed

		1.133, Revision 1. (SSER 23, Section 7.6.1) Closed in SSER 24, Section 7.6.1.4.5.		
(84) through (89)		Not used.		
(91)		TVA should update the FSAR with information describing how WBN, Unit 2, meets GDC 5, assuming the worst case single failure and a LOOP, as provided in TVA's letter dated April 13, 2011. (SSER 23, Section 9.2.1). Closed in SSER 27, Section 9.2.1.	NRR	Closed
(92)		Not used.		
(93)		TVA should confirm to the staff that testing of the Eagle 21 system has sufficiently demonstrated that two-way communication to the ICS is precluded with the described configurations. (SSER 23, Section 7.9.3.2). Closed in SSER 27, Section 7.9.	RII	Closed
(94)		TVA should provide to the staff either information that demonstrates that the WBN, Unit 2, Common Q post-accident monitoring system (PAMS) meets the applicable requirements in Institute of Electrical and Electronics Engineers (IEEE) Std. 603-1991, or justification for why the Common Q PAMS should not meet those requirements. (SSER 23, Section 7.5.2.2.3) Closed in SSER 26, Section 7.5.2.2.	NRR	Closed
(95)		TVA should update FSAR Table 7.1-1, "Watts Bar Nuclear Plant NRC Regulatory Guide Conformance," to reference IEEE Std. 603-1991 for the WBN, Unit 2, Common Q PAMS. (SSER 23, Section 7.5.2.2.3) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(96)		TVA should (1) update FSAR Table 7.1-1 to include RG 1.100, Revision 3, for the Common Q PAMS, or (2) demonstrate that the Common Q PAMS is in conformance with RG 1.100, Revision 1, or provide justification for not conforming. (SSER 23, Section 7.5.2.2.3) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(97)		TVA should demonstrate that the WBN, Unit 2, Common Q PAMS is in conformance with RG 1.153, Revision 1, or provide justification for not conforming. (SSER 23, Section 7.5.2.2.3) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(98)		TVA should demonstrate that the WBN, Unit 2, Common Q PAMS is in conformance with RG 1.152, Revision 2, or provide justification for not conforming. (SSER 23, Section 7.5.2.2.3) Closed in SSER 26, Section 7.5.2.2.3.	NRR	Closed

(99)		TVA should update FSAR Table 7.1-1 to reference IEEE 7-4.3.2-2003 as being applicable to the WBN, Unit 2, Common Q PAMS. (SSER 23, Section 7.5.2.2.3; SSER 25, Section 7.5.2.2) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(100)		TVA should update FSAR Table 7.1-1 to reference RG 1.168, Revision 1; IEEE 1012-1998; and IEEE 1028-1997 as being applicable to the WBN, Unit 2, Common Q PAMS. (SSER 23, Section 7.5.2.2.3) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(101)		TVA should demonstrate that the WBN, Unit 2, Common Q PAMS application software is in conformance with RG 1.168, Revision 1, or provide justification for not conforming. (SSER 23, Section 7.5.2.2.3) Closed in SSER 26, Section 7.5.2.2.	NRR	Closed
(102)		TVA should update FSAR Table 7.1-1 to reference RG 1.209 and IEEE Std. 323-2003 as being applicable to the WBN, Unit 2, Common Q PAMS. (SSER 23, Section 7.5.2.2.3) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(103)		TVA should demonstrate that the WBN, Unit 2, Common Q PAMS conforms to RG 1.209 and IEEE Std. 323-2003, or provide justification for not conforming. (SSER 23, Section 7.5.2.2.3) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(104)	CI	The NRC staff will review the Westinghouse Electric Corporation self-assessment to verify that it the WBN, Unit 2, PAMS is compliant to the V&V requirements in the software program manual or that deviations from the requirements are adequately justified. (SSER 23, Section 7.5.2.2.3.4.2) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(105)		TVA should produce an acceptable description of how the WBN, Unit 2, Common Q PAMS System Requirements Specification and software requirements specification (SRS) implement the design-basis requirements of IEEE Std. 603-1991 Clause 4. (SSER 23, Section 7.5.2.2.3.4.3.1) Closed in SSER 26, Section 7.5.2.2.	NRR	Closed
(106)		TVA should produce a final WBN, Unit 2, Common Q PAMS SRS that is independently reviewed. (SSER 23, Section 7.5.2.2.3.4.3.1) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(107)	CI	TVA should provide to the NRC staff documentation to confirm that the final WBN, Unit 2, Common Q PAMS software design descriptions that are independently reviewed. (SSER 23, Section 7.5.2.2.3.4.3.2) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed

(108)		TVA should demonstrate to the NRC staff that there are no synergistic effects between temperature and humidity for the Common Q PAMS equipment. (SSER 23, Section 7.5.2.2.3.5.2) Closed in SSER 26, Section 7.5.2.2.	NRR	Closed
(109)		TVA should demonstrate to the NRC staff acceptable data storm testing of the Common Q PAMS. (SSER 23, Section 7.5.2.2.3.7.1.8) Closed in SSER 25, Section 7.5.2.2.	NRR	Closed
(110)		TVA should provide information to the NRC staff describing how the WBN, Unit 2, Common Q PAMS design supports periodic testing of the RVLIS function. (SSER 23, Section 7.5.2.2.3.9.2.6) Closed in SSER 26, Section 7.5.2.2.	NRR	Closed
(111)		TVA should confirm to the staff that there are no changes required to the TSs as a result of the modification installing the Common Q PAMS. If any changes to the TSs are required, TVA should provide the changes to the NRC staff for review. (SSER 23, Section 7.5.2.2.3.11) Closed in SSER 26, Section 7.5.2.2.	NRR	Closed
(112)	CI	TVA should provide an update to the FSAR reflecting the radiation protection design features descriptive information provided in its letter dated October 4, 2010. (SSER 24, Section 12.4) Closed in SSER 26, Section 12.4.	NRR	Closed
(113)	CI	TVA should provide an update to the FSAR reflecting the justification for the periodicity of the channel operability test frequency for WBN non-safety-related area radiation monitors. (SSER 24, Section 12.4) Closed in SSER 26, Section 12.4.	NRR	Closed
(114)	CI	TVA should update the FSAR to reflect that WBN meets the radiation monitoring requirements of 10 CFR 50.68. (SSER 24, Section 12.4) Closed in SSER 26, Section 12.4.	NRR	Closed
(115)	CI	TVA should update the FSAR to reflect the information regarding design changes to be implemented to lower radiation levels as provided in its letter to the NRC dated June 3, 2010. (SSER 24, Section 12.5). Closed in SSER 27, Section 12.5	NRR	Closed
(116)	CI	TVA should update the FSAR to reflect the qualification standards of the radiation protection manager as provided in its letter to the NRC dated October 4, 2010. (SSER 24, Section 12.6) Closed in SSER 26, Section 12.6.	NRR	Closed
(117)	CI	TVA should update the FSAR to reflect the calculational basis for access to vital areas as provided in its letter dated February 25, 2011. (SSER 24, Section 12.7.1). Closed in SSER 27, Section 12.7.1	NRR	Closed

(118)		TVA should provide to the NRC staff a description of how the other vanadium detectors within the in-core instrumentation thimble assembly (IITA) would be operable following the failure of a self-powered neutron detector (SPND). (SSER 24, Section 7.7.1.9.2) Closed in SSER 26, Section 7.7.1.9.	NRR	Closed
(119)		TVA should submit WNA-CN-00157-WBT, Revision 0, to the NRC by letter. The NRC staff should confirm by review of WNA-CN-00157-WBT, Revision 0, that no credible source of faulting can negatively impact the CETs or PAMS train. (SSER 24, Section 7.7.1.9.5) Closed in SSER 25, Section 7.7.1.9.	NRR	Closed
(120)		TVA must confirm to the NRC staff that the maximum over-voltage or surge voltage that could affect the system is 264 VAC, assuming that the power supply cable to the signal processing system (SPS) cabinet is not routed with other cables greater than 264 VAC. (SSER 24, Section 7.7.1.9.5; SSER 25, Section 7.7.1.9) Closed in SSER 26, Section 7.7.1.9.	NRR	Closed
(121)		TVA should submit the results to the NRC staff of a 600 VDC dielectric strength test performed on the IITA assembly. (SSER 24, Section 7.7.1.9.5) Closed in SSER 26, Section 7.7.1.9.	NRR	Closed
(122)		TVA should confirm to the NRC staff that different divisions of safety power are supplied to the in-core instrumentation system SPS cabinets, with the power cables routed in separate shielded conduits. (SSER 24, Section 7.7.1.9.5) Closed in SSER 25, Section 7.7.1.9.	NRR	Closed
(123)		TVA should provide an explanation to the NRC staff of how the system will assign a data quality value to notify the power distribution calculation software to disregard data from a failed SPND. (SSER 24, Section 7.7.1.9.5) Closed in SSER 26, Section 7.7.1.9.	NRR	Closed
(124)		While the BEACON datalink on the Application server can connect to either BEACON machine, only BEACON A is used for communication. TVA should clarify to the NRC staff whether automatic switchover to the other server is not permitted. (SSER 24, Section 7.7.1.9.5) Closed in SSER 25, Section 7.7.1.9.	NRR	Closed
(125)		TVA should provide clarification to the NRC staff of the type of connector used with the MI cable in Unit 2, and which EQ test is applicable. (SSER 24, Section 7.7.1.9.5) Closed in SSER 26, Section 7.7.1.9.	NRR	Closed

(126)		To enable the NRC staff to evaluate and review the IITA EQ, TVA should provide the summary report of the EQ for the IITA. (SSER 24, Section 7.7.1.9.5) Closed in SSER 26, Section 7.7.1.9.	NRR	Closed
(127)		TVA should provide a summary to the NRC staff of the electro-magnetic interference/radio-frequency interference testing for the MI cable electro-magnetic compatibility (EMC) qualification test results. (SSER 24, Section 7.7.1.9.5) Closed in SSER 26, Section 7.7.1.9.	NRR	Closed
(128)		TVA should submit the seismic qualification test report procedures and results for the SPS cabinets to the NRC staff for review. (SSER 24, Section 7.7.1.9.5) Closed in SSER 25, Section 7.7.1.9.	NRR	Closed
(129)		TVA should verify to the NRC staff resolution of the open item in WNA-CN-00157-WBT for the Quint power supply (to be installed in the SPS cabinet) to undergo EMC testing of 4 kV to validate the assumptions made in the Westinghouse analysis. (SSER 24, Section 7.7.1.9.5) Closed in SSER 26, Section 7.7.1.9.	NRR	Closed
(130)		TVA should provide a summary to the NRC staff of the EMC qualification test results of the SPS cabinets. (SSER 24, Section 7.7.1.9.5) Closed in SSER 25, Section 7.7.1.9.	NRR	Closed
(131)		TVA should review the EOP action level setpoint to account for the difference between core exit temperature readings for Units 1 and 2, and confirm the EOP action level setpoint to the NRC staff. (SSER 24, Section 7.7.1.9.5). Closed in SSER 27, Section 7.7.	NRR	Closed
(132)		TVA must provide the NRC staff with analyses of the boron dilution event that meet the criteria of Standard Review Plan (SRP) Section 15.4.6, including a description of the methods and procedures used by the operators to identify the dilution path(s) and terminate the dilution, in order for the staff to determine that the analyses comply with GDC 10. (SSER 24, Section 15.2.4.4) Closed in SSER 26, Section 15.2.4.4.	NRR	Closed
(133)		In order to confirm the stability analysis of the sand baskets used by TVA in the WBN, Unit 2, licensing basis, TVA will perform either a hydrology analysis without crediting the use of the sand baskets at the Fort Loudoun Dam for the seismic dam failure and flood combination, or TVA will perform a seismic test of the sand baskets, as stated in TVA's letter dated April 20, 2011. TVA will report the results of this analysis or test to the NRC by	NRR	Closed

		October 31, 2011. (SSER 24, Section 2.4.10). Closed in SSER 27, Section 2.4.10.		
(134)		TVA should provide to the NRC staff supporting technical justification for the statements in Amendment No. 104 of FSAR Section 2.4.4.1, "Dam Failure Permutations," page 2.4-32 (in the section "Multiple Failures") that, "Fort Loudoun, Tellico, and Watts Bar have previously been judged not to fail for the operating basis earthquake (OBE) (0.09 g). Postulation of Tellico failure in this combination has not been evaluated but is bounded by the SSE [safe shutdown earthquake] failure of Norris, Cherokee, Douglas and Tellico." (SSER 24, Section 2.4.10) Closed in SSER 28, Section 2.4.10	NRR	Closed
(135)		TVA has not provided the analysis required by 10 CFR Part 50, Appendix I, subsection II.D. TVA must demonstrate with a cost-benefit analysis that a sufficient reduction in the collective dose to the public within a 50-mile radius would not be achieved by reasonable changes to the design of the WBN gaseous effluent processing systems. (SSER 24, Section 11.3) Closed in SSER 25, Section 11.3.	NRR	Closed
(136)	CI	The joinst frequency distribution summary for the data from 1991 through 2010 provided by letter dated November 7, 2011, and a discussion of the long-term representativeness of these data should be provided in the WBN, Unit 2, FSAR. Upon receipt of the UFSAR, the NRC staff will confirm that these updates have been made by TVA. (SSER 25, Section 2.3.3) Closed in SSER 26, Section 2.3.3.	NRR	Closed
(137)	CI	The NRC staff will confirm, upon receipt, that TVA integrated the updated control room atmospheric diversion estimate (χ/Q) values from its letter dated September 15, 2011, into a future amendment of the FSAR. (SSER 25, Section 2.3.4) Closed in SSER 26, Section 2.3.4.	NRR	Closed
(138)	CI	Upon receipt of the updated Offsite Dose Calculation Manual (ODCM), the NRC staff will confirm that corresponding revisions related to the updated annual average χ/Q and deposition factor values have been made to the ODCM. (SSER 25, Section 2.3.5) Closed in SSER 26, Section 2.3.5.	NRR	Closed
(139)	CI	The results of the cost-benefit analysis required by 10 CFR Part 50, Appendix I, subsection II.D, should be provided in the WBN, Unit 2, FSAR. Upon receipt of the UFSAR, the NRC staff will confirm that the update has been made by TVA. (SSER 25, Section 11.3). Closed in SSER 27, Section 11.3	NRR	Closed

APPENDIX II COMPLIANCE WITH TITLE 10 OF THE *CODE OF FEDERAL REGULATIONS* 50.54(hh)(2) REQUIREMENTS

II.1 Introduction

II.1.1 Purpose

This appendix documents the U.S. Nuclear Regulatory Commission (NRC) staff's regulatory assessment of the adequacy of the actions taken by Tennessee Valley Authority (TVA) to meet the requirements of paragraph (i) of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.34, "Contents of applications; technical information," regarding the guidance and strategies required by paragraph (hh)(2) of 10 CFR 50.54, "Conditions of licenses." This appendix describes the basis for finding TVA's strategies adequate.

II.1.2 Background

The NRC issued EA-02-026, "Order for Interim Safeguards and Security Compensatory Measures" (Interim Compensatory Measures (ICM) Order), which imposed interim compensatory measures on power reactor licensees. ICM Order, Section B.5.b, "Mitigative Measures," required the development of, "specific guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities using existing or readily available resources (equipment and personnel) that can be effectively implemented under the circumstances associated with loss of large areas of plant due to explosions or fire." These actions were to be implemented by the end of August 2002. Inspections of the implementation of the B.5.b requirements were conducted in 2002 and 2003 (Temporary Instruction (TI) 2515/148). The inspections identified large variability in scope and depth of the enhancements made by licensees. As a result, the NRC determined that additional guidance and clarification was needed for nuclear power plant licensees.

Subsequent to the conduct of the inspections, the NRC Office of Nuclear Regulatory Research (RES) conducted engineering studies, which provided insights into the implementation of mitigation strategies to address the loss of large areas of a plant due to explosions or fire, including those that an aircraft impact might create. The NRC actions resulting from those studies included (1) NRC inspections of licensee actions that address plant-specific consequences, (2) NRC advisories distributed to the industry that involve processes and protocols for licensee notification of an imminent aircraft threat, and (3) the identification of mitigative measures to enhance spent fuel cooling and to prevent or ameliorate fuel damage for events in which significant SFP damage may occur. The spent fuel cooling and damage mitigative measures were described in an NRC letter to licensees.

The NRC issued a letter to licensees providing information on the Commission's phased approach for enhancing reactor mitigative measures and strategies for responding to Section B.5.b of the ICM Order. The NRC subsequently issued guidance (the "Guidance Document") to more fully describe the NRC staff's expectations for implementing Section B.5.b of the ICM Order.

The Guidance Document relied upon lessons learned from RES studies involving plant assessments, as well as industry best practices. These best practices were identified during the inspections conducted in 2002 and 2003. The Guidance Document also incorporated industry comments made at two B.5.b-related workshops held on January 14, 2005, and February 2, 2005.

II.2 Regulatory Evaluation

II.2.1 Three Phase Concept

Section B.5.b of the ICM Order required licensees to develop specific guidance and strategies to maintain or restore core cooling, containment, and SPF cooling capabilities, using existing or readily available resources (equipment and personnel) that can be effectively implemented under the circumstances associated with loss of large areas of the plant due to explosions or fire. Determination of the specific strategies required to satisfy the ICM Order elaborated on by the Guidance Document was termed Phase 1.

The NRC determined that differences in plant design and configuration warranted independent assessments to verify that the likelihood of damage to the reactor core, containment, and SFPs, and the release of radioactivity, is low at each nuclear power plant to assure public health and safety. The Commission directed the NRC staff to conduct site-specific security and safety assessments to further identify and implement enhanced mitigating capabilities. The scope of these site-specific assessments included a broad range of pre-determined, non-threat-specific damage footprints that encompassed a spectrum of potential threats (e.g., land attack, vehicle or waterborne bombs, and impact of a large commercial aircraft). The effort involving site-specific assessments of SFPs is referred to as Phase 2 and that for site-specific assessments of reactor core and containments is referred to as Phase 3.

SRM-M050421B-SUPP stated that the goals of the Phase 2 and 3 assessments were for the NRC and licensees to achieve a new level of cognition of safety and security through a comprehensive understanding of the capabilities and limitations of the plants under normal, abnormal, and severe circumstances (from whatever cause) and that based on this improved understanding, licensees have taken reasonable steps to strengthen their capabilities and reduce their limitations. The Commission expected that safety and security will be well-served by further enhancing the licensee's severe accident management strategies for mitigating a wide spectrum of events through the use of readily available resources and by identifying potential practicable areas for the use of beyond-readily-available resources.

During 2005, the NRC staff performed inspections to determine licensees' compliance with B.5.b (Phase 1). Subsequent meetings were held with licensees to resolve identified open issues. Confirmatory B.5.b Phase 1 inspections were conducted during the period of July to December 2006. The NRC staff conducted site visits as part of the Phase 2 assessments during 2005. In 2006, the NRC staff observed licensee Phase 3 studies and conducted independent Phase 3 assessments.

The Nuclear Energy Institute (NEI) submitted a letter describing an industry proposal for resolving ("closing") Phase 2. The industry proposed high level functional mitigating strategies for a spectrum of potential scenarios involving postulated damage to SPFs. In a letter to all holders of licenses for operating power reactors, the NRC accepted the Phase 2 proposal, pending review of site-specific details of its application and implementation. In arriving at this

conclusion, the NRC staff placed significant weight on portions of the proposal that rely on industry commitments to provide beyond readily available measures not previously available. These additions will significantly enhance licensees' mitigating strategies capabilities.

NEI proposed language to clarify Phase 1, expectation B.2.m.1, regarding spent fuel dispersal. The proposal stated that where feasible and practical, consistent with safe fuel handling practices, licensees would make every attempt to pre-configure the SPF to enable direct placement of the expended assemblies from the vessel to the final distributed fuel pattern. Further, the proposal stated that where this is not feasible or practical, licensees would distribute the fuel into the final pattern as soon as possible but no later than 60 days after subcriticality absent extenuating circumstances. By letter dated March 16, 2006, the NRC staff agreed with the NEI proposal, including the stated considerations involving extended outages for major component replacement. The letter also noted the NRC staff's concern that it is important to minimize the time that fuel is not in a favorable configuration and each licensee's efforts to achieve a favorable configuration in the shortest time is an appropriate goal that provides for improved safety for the storage of spent fuel.

NEI submitted two letters, one of which proposed a license condition to capture the B.5.b requirements and addressed items deferred from Phase 1 to 2. The license condition included 14 items in the same broad categories as the February 2005 Guidance Document; firefighting response strategy, plant operations to mitigate fuel damage, and actions to minimize releases. The proposal suggested that implementing details found to be acceptable means of meeting the license condition would be treated as commitments and managed in accordance with NEI 99-04, "Guidelines for Managing NRC Commitment Changes." The other letter proposed generic strategies for closure of Phase 3. The required strategies for all three phases would be covered by the license condition, and all implementing details would be managed by NEI 99-04.

The Guidance Document included 34 expectations. Two of these items were deferred to Phase 2 and seven items (i.e., six expectations and one element of a seventh expectation) were deferred to Phase 3. The NRC staff reached agreement with licensees on the non-deferred items under Phase 1.

The two items deferred to Phase 2 were:

B.2.m.4 Enhanced air circulation
B.2.m.5 Emergency pool makeup, leak reduction/repair

One of the two NEI letters discussed above provided a generic response to B.2.m.4 and the leak reduction/repair aspect of B.2.m.5. The response stated that these two items did not add value, given the significantly greater benefits of the proposed strategies; however, NEI committed to work with the industry to ensure that damage control measures would be incorporated in plant procedures and guidance. This was apparent from review of the subsequent licensee submittals. Regarding building ventilation, the NRC staff believes that it would be beneficial for some scenarios, but that, on balance, fuel dispersal and the internal and external spray strategies are sufficient to meet the goals stated in SRM-M050421B-SUPP. The emergency pool makeup aspect was the prime focus of the Phase 2 assessments. Thus, these two items were satisfied by accomplishing the Phase 2 assessments.

The items deferred to Phase 3 were:

B.2.c Procedures for firefighting and recovery operations,
B.2.d Evaluation of vulnerable buildings and equipment,
B.2.g Best practice for use of plant equipment (portable diesel and transformer element only),
B.2.f Industry best practice for compensatory function,
B.2.i Best practice involving plant areas potentially affected by fire or explosions,
B.2.j Best practice for use of plant equipment - portable generator and transformer, and
B.3.c Dose projection.

These items were intrinsic to the Phase 3 licensee studies and the NRC's independent assessments. Most of the plant-specific and generic strategies fall into one or more of these categories. None of the generic strategies mapped directly to B.2.i or B.3.c, but equipment survivability and dose projection were inseparable from the process of identifying the strategies and evaluating their confidence level.

SRM-M060607 states, "The staff should work expeditiously with appropriate stakeholders to establish an effective method of capturing the February 25, 2002 B.5.b. order requirements (i.e., those reasonable, evident strategies that fall within the scope of the B.5.b. guidance issued on February 25, 2005) in each plant's license, security plan, or other appropriate regulatory document. Other strategies are to be considered for voluntary implementation and managed in accordance with the licensee's commitment management program." By letter dated June 29, 2006, the NRC staff conditionally accepted NEI's proposed license condition and strategies (ADAMS Accession No. ML061790306). The letter reiterated that mitigation strategies in NEI's proposals that were identified during the Phases 2 and 3 assessments, which utilize reasonable, evident, readily available measures (as identified in the February 25, 2005, guidance document) are required pursuant to Section B.5.b of the order. The implementing details of the required strategies would be implemented by commitment and managed in accordance with the NEI commitment management guideline, NEI 99-04. The NRC staff believes the NEI proposal reasonably justifies excluding from formal regulatory controls those additional strategies identified during the site-specific Phases 2 and 3 assessments that the NRC previously deemed required under Section B.5.b of the order, but not identified in NEI's proposals. Inherent in this conclusion is recognition of the addition of beyond readily available measures included in the proposals. The implementing details of mitigation strategies included in the proposal, including those that utilize beyond readily available resources, would be treated as commitments, which become part of the licensing basis of the plant. Additional strategies identified during site-specific assessments, which licensees deem acceptable and valuable to promote diversification and survivability, would be incorporated into licensees' Severe Accident Management Guidelines, Extreme Damage Mitigation Guidelines, or appended to other site implementation guidance. Acceptance for individual facilities was conditional upon staff evaluation of site-specific implementation and documentation of the proposed Phases 2 and 3 mitigating strategies that this safety evaluation (SE) provides for Watts Bar Nuclear Plant, Unit 2.

By publishing new requirements in the *Federal Register* dated March 27, 2009 (74 FR 13926), the NRC amended 10 CFR Part 50, 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," and 10 CFR Part 73, "Physical Protection of Plants and Materials." This rulemaking added paragraph (i) to 10 CFR 50.34, "Contents of Applications; Technical Information," and paragraph (d) to 10 CFR 52.80 " Contents of Applications; Additional Technical Information," to require submittal of a "description and plans for implementation of the guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities under the circumstances associated with the loss of large areas of the plant due to explosions or fire as required by § 50.54(hh)(2) of this chapter." This rulemaking also

added 10 CFR 50.54(hh)(2) to impose the same mitigating strategies requirements on all reactor applicants and licensees as those imposed by the ICM Order and associated license conditions. The Statement of Considerations for this rulemaking specifically notes that "[n]ew reactor licensees are required to employ the same strategies as current reactor licensees to address core cooling, SFP cooling, and containment integrity" (74 FR 13926).

II.3 Technical Evaluation

The implementing details of the mitigating strategies required by 10 CFR 50.54(hh)(2) and identified in TVA submittals constituting the description and plans for implementation required by 10 CFR 50.34(i), will be implemented by commitment and managed in accordance with the NEI commitment management guideline, NEI 99-04. The NRC staff concludes this provides reasonable controls for mitigating strategy implementation and for subsequent evaluation of identified changes.

Because the 3 items required by 10 CFR 50.54(hh)(2) correlate to the items in the Phase 1 guidance and the mitigating strategies within NEI's Phase 2 and 3 proposals, and because the implementing details will be managed under NEI 99-04, the NRC staff is satisfied that there will be sufficient controls to ensure that the strategies are adequately maintained.

II.4 Conclusion

Based on the NRC staff's review, TVA's description and plans for implementation of the guidance and strategies intended to maintain or restore core cooling, containment, and SPF cooling capabilities under the circumstances associated with the loss of large areas of the plant due to explosions or fire, meet the requirements of 10 CFR 50.34(i). The NRC staff concludes that full implementation of TVA's enhancements constitutes satisfactory compliance with the 10 CFR 50.54(hh)(2), and represents reasonable measures to enhance TVA's effectiveness in maintaining core and SPF cooling and containment integrity under circumstances involving the loss of large areas of the plant due to fires or explosions.

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) issuance of the operating license will not be inimical to the common defense and security or to the health and safety of the public with respect to compliance with 10 CFR 50.54(hh)(2).

APPENDIX JJ FUKUSHIMA ACTIONS

JJ.1 Introduction

Following the events on March 11, 2011, at the Fukushima Dai-ichi nuclear power plant in Japan, the Nuclear Regulatory Commission (NRC) has taken significant actions to enhance the safety of reactors in the United States based on the lessons learned from this accident. In March 2011, the NRC established a senior-level agency task force referred to as the Near-Term Task Force (NTTF). The NTTF conducted a systematic and methodical review of the NRC regulations and processes in order to determine if the agency should make additional improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a comprehensive set of recommendations, documented in the enclosure to SECY-11-0093 (Agencywide Document Access & Management System (ADAMS) Accession No. ML111861807).

Based on these recommendations, the NRC issued three orders and a request for information under 10 CFR 50.54(f) (the 50.54(f) letter) on March 12, 2012.

JJ.2 Regulatory Evaluation

As part of implementing the NTTF recommendations, the NRC issued the applicable orders and a 10 CFR 50.54(f) letter to operating reactors and construction permit (CP) holders, including Watts Bar Nuclear Plant (WBN), Unit 2. WBN, Unit 2, to support receiving the operating license (OL) is required to be in compliance with the orders and responsive to the 50.54(f) requests. The NRC staff notes that Recommendation 2.3 for flooding and seismic walkdowns was included in the 50.54(f) letter. As discussed in the 50.54(f) letter, this Recommendation is not applicable to WBN, Unit 2.

JJ.2.1 NRC Orders to Enhance Safety for Beyond Design Basis Events

On March 12, 2012, the NRC issued orders to OL and CP holders requiring them to take actions that the NRC determined would provide a substantial increase in protection to public health and safety based on the events that occurred at the Fukushima Dai-ichi power plant in Japan. Of these three orders issued on March 12, 2012, two are applicable to the design of WBN, Unit 2 (EA-12-051, “Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (effective immediately)” (ADAMS Accession No. ML12056A044), and EA-12-049, “Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design Basis External Events” (ADAMS Accession No. ML12054A736)). The orders state that the holder of a CP must complete full implementation before issuance of an OL, and that the holder shall report to the Commission when full compliance is achieved. Attachment 1 of the orders provides a list of licensees and CP holders that the orders apply to, which includes WBN, Unit 2. Attachment 2 of the orders describes specific requirements that licensees and CP holders must follow to achieve full compliance.

On August 21, 2012, the Nuclear Energy Institute (NEI) submitted document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0 (ADAMS Accession No. ML12242A378) to the NRC to provide specifications for an industry-developed methodology for the development, implementation, and maintenance of guidance and strategies in response to the mitigation strategies order. The NRC staff reviewed NEI 12-06 and on August 29, 2012, issued its final version of Japan Lessons-Learned Directorate

(JLD)-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," (ADAMS Accession No. ML12229A174) endorsing NEI 12-06, Revision 0, with comments as an acceptable means of meeting the requirements of Order EA-12-049, and published a notice of its availability in the Federal Register (77 FR 55230).

On August 24, 2012, the NEI submitted document NEI 12-02, “Industry Guidance for Compliance with NRC Order EA-12-051, ‘To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,’” Revision 1 (ADAMS Accession No. ML12240A307) to the NRC to provide specifications for an industry-developed methodology for compliance with Order EA-12-051. On August 29, 2012, the NRC staff issued its final version of JLD-ISG-2012-03, “Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation” (ADAMS Accession No. ML12221A339) endorsing NEI 12-02, Revision 1, as an acceptable means of meeting the requirements of Order EA-12-051 with certain clarifications and exceptions, and published a notice of its availability in the *Federal Register* (77 FR 55232).

JJ.2.2 Requests for Information Related to Re-evaluated Seismic and Flooding Hazards

On March 12, 2012, the NRC issued a 10 CFR 50.54(f) letter to CP holders, which, in part, requested that licensees re-evaluate the seismic and flooding hazards at their sites using updated seismic and flooding hazard information and present-day regulatory guidance and methodologies (NTTF Recommendation 2.1). The 50.54(f) letter stated that information provided in response would then be used to determine if a license should be suspended, revoked or modified.

The 50.54(f) letter noted that NRC regulations and associated regulatory guidance provide a robust regulatory approach for the evaluation of site hazards associated with natural phenomena. However, this framework has evolved over time as new information regarding site hazards and the potential consequence has become available. As a result, the licensing basis, design, and level of protection from natural phenomena differ among the existing operating reactors in the U.S., depending on when the plant was constructed and licensed for operation. Additionally, the assumptions and factors that were considered in determining the level of protection necessary at these sites vary depending on a number of contributing factors.

JJ.2.3 Request Regarding Emergency Preparedness

The March 12, 2012, 50.54(f) letter also requested information related to NTTF Recommendation 9.3. The letter requested that licensees assess their Emergency Preparedness (EP) communications and staffing requirements with the objective of ensuring the capability to implement effective measures to mitigate the consequences of a radiological emergency. Specifically, the letter requested that licensees assess their current staffing levels and determine if enhancements were needed to fill all positions necessary to respond to a multi-unit event during a beyond design-basis natural event. The letter also requested licensees to assess their current communications systems and equipment and any appropriate enhancements, and to consider the means to power this communications equipment needed to communicate onsite and offsite during a prolonged station blackout.

JJ.3 Technical Evaluation

JJ.3.1 Orders EA-12-049 and EA-12-051

TVA informed the NRC that it was in compliance with the requirements of the Fukushima Order for SPF instrumentation by letters dated October 29 and December 19, 2014 (ADAMS Accession Nos. ML14303A561 and ML15002A202, respectively). On March 12, 2015 (ADAMS Accession No. ML15072A116), TVA informed the NRC that it was in compliance with the Fukushima Order EA-12-049 regarding mitigating strategies for beyond-design-basis events. The NRC staff reviewed TVA's strategies for the WBN site and issued a safety evaluation (SE) on March 27, 2015(ADAMS Accession No. ML15078A193), describing that the integrated plans at the WBN site, if implemented appropriately, would adequately address the requirements of both Fukushima Orders, EA-12-049 and EA-12-051. On March 30, 2015, the NRC performed an inspection per Temporary Instruction (TI) 191, "Implementation of Mitigation Strategies and Spent Fuel Pool Instrumentation Orders and Emergency Preparedness Communications/Staffing/Multi-Unit Dose Assessment Plans" (ADAMS Accession No. ML14273A444). The inspection results are documented in Inspection Report 2015616 (ADAMS Accession No. ML15173A317).

JJ.3.2 Recommendation 2.1 - Reevaluated Seismic and Flooding Hazards

By letters dated March 31, 2014 (ADAMS Accession No. ML14098A478), and March 12, 2015 (ADAMS Accession No. ML15071A262), TVA submitted the reevaluated seismic and flooding hazards, respectively, for WBN, Units 1 and 2, in response to the 50.54(f) letter. NRC assessments of the seismic and flood hazard reevaluations being performed pursuant to the 50.54(f) letter remains under staff review. By letter dated June 24, 2015 (ADAMS Accession No. ML15169A904), TVA revised its flooding hazard report, which resulted in a reduction of the flooding level and compensatory actions are no longer necessary.

On December 30, 2014 (ADAMS Accession No. ML14365A072), TVA submitted the expedited seismic evaluation process report, which evaluated the safe shutdown lineup credited in the WBN, Units 1 and 2, mitigating strategies against the reevaluated hazard. A review level earthquake of 2.0 times the design and licensing basis safe shutdown earthquake was used in analysis to assess equipment robustness. The review level earthquake effectively bounds the probabilistic ground motion response spectra determined for the site in the 1 to 10 hertz (hz) spectral acceleration range. The licensee reported that no modifications to plant equipment were required based on the assessment.

JJ.3.3 Recommendation 9.3 - Emergency Preparedness during a Beyond Design Basis Natural Event

In accordance with NTTF Recommendation 9.3, the March 12, 2012 50.54(f) letter requested licensees and CP holders to assess: (1) the number of emergency staff needed to respond to a large accident that may affect multiple reactors at their site, and make changes as necessary; and (2) their capability to power communications equipment for emergency response during a multi-unit, beyond-design-basis natural event.

These assessments were performed in accordance with NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities." (ADAMS

Accession No. ML12125A412), which was endorsed by the NRC staff by letter dated May 15, 2012 (ADAMS Accession No. ML12131A043).

By letter dated October 31, 2012 (ADAMS Accession No. ML12311A297), TVA submitted its communication assessment for WBN, Units 1 and 2, and by letter dated February 22, 2013 (ADAMS Accession No. ML13058A067), TVA provided additional information regarding generic technical issues for resolution regarding its communications assessment. TVA assessed its current communications systems and equipment used during an emergency event and identified several enhancements in order for the emergency plan (EP) equipment to survive a beyond-design-basis external event.

On July 3, 2013, the NRC staff issued its safety assessment regarding the communications information submitted for Watts Bar (ADAMS Accession No. ML13142A348). This assessment concluded that TVA's assessment for communications was reasonable, and the interim measures, analyzed existing systems, and proposed enhancements will help to ensure that communications are maintained during a beyond design-basis event. On October 15, 2014 (ADAMS Accession No. ML14295A103), TVA submitted revised commitment dates for implementing the communications enhancements committed to in its assessment. The NRC staff verified that WBN has implemented the identified enhancements identified in the response to NTTF Recommendation 9.3 by inspection using NRC Inspection Manual Temporary Instruction (TI)-191, “Inspection of the Implementation of Mitigation Strategies and Spent Fuel Pool Instrumentation Orders and Emergency Preparedness Communication/Staffing/Multi-Unit Dose Assessment Plan.” The inspection results are documented in Inspection Report 2015616 (ADAMS Accession No. ML15173A317).

The 50.54(f) letter in part, required licensee responses pertaining to onsite and augmented staff availability to implement the strategies discussed in the EP and/or plant operating procedures, including new staff or functions resulting from the assessment, any identified collateral duties, an implementation schedule to perform the assessments, any identified modifications, and any changes that have been made or will be made to the EP regarding on-shift or augmented staffing. In addition, NTTF Recommendation 9.3 has a dependency on the implementation of NTTF Recommendation 4.2 (mitigating strategies). As a result of this dependency, licensees responded to the 50.54(f) letter request for staffing information in two phases. The Phase 1 staffing assessment requested licensees to evaluate their ability to respond to a multi-unit extended loss of AC power event utilizing existing processes and procedures. TVA did not provide a Phase 1 staffing assessment for WBN because at the time WBN, Unit 1, was considered a single-unit site and only multi-unit sites were requested to provide a Phase 1 staffing assessment.

The Phase 2 responses provided assessments of the staffing necessary to perform the functions related to the strategies developed in response to NTTF Recommendation 4.2 and the resulting Order EA-12-049. TVA submitted its Phase 2 staffing assessment for WBN, Units 1 and 2, on October 6, 2014 (ADAMS Accession No. ML14280A258). The NRC staff evaluated this staffing assessment and provided its response by letter dated December 17, 2014 (ADAMS Accession No. ML14329A036). The NRC staff found that that the proposed emergency response resources, as described in the WBN EP, are sufficient to perform the required plant actions and EP functions, and implement the multi-unit event response strategies that were developed in response to NRC Order EA-12-049 without the assignment of collateral duties that would impact the performance of assigned emergency plan functions. The NRC staff concluded

that TVA's Phase 2 staffing submittal adequately addresses the response strategies needed to respond to a beyond-design-basis external event using procedures and guidelines at WBN.

In response to NTTF Recommendation 9.3, the U.S. nuclear power plant licensees provided information to the NRC staff regarding their capabilities to perform multi-unit dose assessments and explanation of how this capability would be implemented, if not already in place. By letter dated June 28, 2013 (ADAMS Accession No. ML13183A070), TVA submitted its assessment of multi-unit/multi-source dose assessment capabilities. The NRC staff responded by letter dated January 29, 2014 (ADAMS Accession No. ML13233A205) and concluded that WBN had appropriate plans to have this capability in place by December 31, 2014.

JJ.4 Conclusion

As discussed above, coincident with the issuance of the mitigating strategies order, on March 12, 2012, the NRC staff issued a 50.54(f) letter, which requested that licensees evaluated emergency preparedness and reevaluate the seismic and flooding hazards at their sites using updated hazard information and current regulatory guidance and methodologies.

TVA's compliance with the mitigating strategies order provides additional protection against beyond design-basis events. The NRC inspection activities have verified licensee compliance with Orders EA-12-049 and EA-12-051.

Based on the ongoing review of the information received in response to the 50.54(f) letter, the NRC staff finds that new hazard information does not impact conclusions reached, that WBN, Unit 2, is in compliance with the orders. The NRC staff will continue to review the reevaluated hazard information in accordance with agency established processes and take any appropriate actions, if necessary.

NRC FORM 335
(12-2010)
NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER
(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

NUREG-0847
Supplement No. 28

2. TITLE AND SUBTITLE
Safety Evaluation Report
Related to the Operation of
Watts Bar Nuclear Plant Unit 2
Docket No. 50-391

3. DATE REPORT PUBLISHED

MONTH	YEAR
August	2015

4. FIN OR GRANT NUMBER

5. AUTHOR(S)
J. Poole, et al.

6. TYPE OF REPORT
Technical

7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)
Same as above.

10. SUPPLEMENTARY NOTES
Docket No. 50-391

11. ABSTRACT (200 words or less)

This report supplements the safety evaluation report (SER), NUREG-0847 (June 1982), with respect to the application filed by the Tennessee Valley Authority (TVA), as applicant and owner, for a license to operate Watts Bar Nuclear Plant (WBN) Unit 2 (Docket No 50-391).

In its SER and Supplemental SER (SSER) Nos. 1 through 20 issued by the U.S. Nuclear Regulatory Commission (NRC), the NRC staff documented its safety evaluation and determination that WBN Unit 1 met all applicable regulations and regulatory guidance. Based on satisfactory findings from all applicable inspections, on February 7, 1996, the NRC issued a full-power operating license (OL) to WBN Unit 1, authorizing operation up to 100-percent power.

In SSER 21, the NRC staff addressed TVA's application for a license to operate WBN Unit 2, and provided information regarding the status of the items remaining to be resolved, which were outstanding at the time that TVA deferred construction of WBN Unit 2, and were not evaluated and resolved as part of the licensing of WBN Unit 1. SSERs 22 to 27 documented the NRC staff's ongoing evaluation and closure of open items in support of TVA's application for a license to operate WBN Unit 2. In this and future SSERs, the NRC staff continues its documentation of its review of open items in support of TVA's application for an operating license for WBN Unit 2.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)
Safety Evaluation Report (SER)
Watts Bar Nuclear Plant
Docket No. 50-391

13 AVAILABILITY STATEMENT
unlimited

14 SECURITY CLASSIFICATION
(This Page)
unclassified
(This Report)
unclassified

15. NUMBER OF PAGES

16. PRICE

Federal Recycling Program

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

OFFICIAL BUSINESS

NUREG-0847
Supplement 28

Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2

August 2015