**UNITED STATES**
**NUCLEAR REGULATORY COMMISSION**
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

May 4, 2018

Mr. Joseph W. Shea
Vice President, Nuclear Regulatory Affairs
and Support Services
Tennessee Valley Authority
1101 Market Street, LP 4A
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT - NRC EVALUATION OF CHANGES, TESTS, AND EXPERIMENTS REPORT NUMBER 05000390/2018010 AND 05000391/2018010

Dear Mr. Shea:

On March 23, 2018, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Watts Bar Nuclear Plant Units 1 and 2, and the NRC inspectors discussed the results of this inspection with Mr. Gordon Arent and other members of your staff. The results of this inspection are documented in the enclosed report.

The NRC inspectors did not identify any finding or violation of more than minor significance.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at http://www.nrc.gov/reading-rm/adams.html and at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

***/RA/***

Marvin D. Sykes, Chief
Engineering Branch 1
Division of Reactor Safety

Docket Nos. 50-390, 50-391
License Nos. NPF-90, NPF-96

Enclosure:
Inspection Report 05000390/2018010 and 05000391/2018010,

cc: Distribution via ListServ

SUBJECT: WATTS BAR NUCLEAR PLANT - NRC EVALUATION OF CHANGES, TESTS, AND EXPERIMENTS REPORT NUMBER 05000390/2018010 AND 05000391/2018010 dated May 4, 2018

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ADAMS: ☒ Yes ACCESSION NUMBER: **ML 18124A180** ☒ SUNSI REVIEW COMPLETE ☒ FORM 665 ATTACHED

| OFFICE | RII:DRS/EB1 | RII:DRS/EB1 | RII:DRS/EB1 | RII:DRS/EB1 | |
|---|---|---|---|---|---|
| SIGNATURE | TNF1 | RNP1 | CAF4 | MDS1 | |
| NAME | TFANELLI | RPATTERSON | CFRANKLIN | MSYKES | |
| DATE | 5/3/2018 | 5/3/2018 | 5/3/2018 | 5/ 4 /2018 | |
| E-MAIL COPY? | YES NO | YES NO | YES NO | YES NO | YES NO |

OFFICIAL RECORD COPY DOCUMENT NAME: S:\DRS NEW\ENG BRANCH 1\BRANCH INSPECTION FILES\2017-2018-2019 CYCLE INSPECTION FOLDER FOR ALL SITES\50.59 INSPECTIONS\WATTS BAR 2018\FINAL REPORT AND ATTACHMENTS\WBN 50.59 INSPECTION FINAL REPORT 2018010.DOCX

**U.S. NUCLEAR REGULATORY COMMISSION**
**Inspection Report**

| | |
|---|---|
| Docket Number(s): | 05000390, 05000391 |
| License Number(s): | NPF-90, NPF-96 |
| Report Number(s): | 05000390/2018010, 05000391/2018010 |
| Enterprise Identifier: | I-2018-010-0053 |
| Licensee: | Tennessee Valley Authority (TVA) |
| Facility: | Watts Bar Nuclear Plant, Units 1 and 2 |
| Location: | Spring City, TN 37381 |
| Inspection Dates: | March 19 to March 23 |
| Inspectors: | T. Fanelli, Senior Reactor Inspector (Lead),<br>R. Patterson, Reactor Inspector,<br>C. Franklin, Reactor Inspector |
| Approved By: | Marvin D. Sykes, Chief<br>Engineering Branch 1<br>Division of Reactor Safety |

Enclosure

## SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring TVA's performance at Watts Bar Nuclear Plant, Units 1 and 2 by conducting a 10 CFR 50.59 inspection in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to https://www.nrc.gov/reactors/operating/oversight.html for more information.

### List of Findings and Violations

No findings or more-than-minor violations were identified.

### Additional Tracking Items

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|---|---|---|
| Unresolved Item (Open) | "Potential Failure to Request NRC Approval to Increase the OPΔT and OTΔT Response Times"<br>URI 05000390/2018010-01 | 71111.17T- Evaluation of Changes, Tests, and Experiments |

| | | |
|---|---|---|
| Unresolved Item (Open) | "Potential Failure to Perform an 50.59 Evaluation for Auxiliary Building and Containment Isolation"<br>URI 05000390/2018010-02 | 71111.17T- Evaluation of Changes, Tests, and Experiments |

| | | |
|---|---|---|
| Unresolved Item (Open) | "Potential Failure to Maintain Design Requirements of RTDs<br>URI 05000390/2018010-03 | 71111.17T- Evaluation of Changes, Tests, and Experiments |

## INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedure (IP) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspectors reviewed selected procedures and records, observed activities, performed walk downs, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

## REACTOR SAFETY

71111.17T - Evaluations of Changes, Tests and Experiments (19 Samples)

The inspectors evaluated the following samples for compliance with Title 10, Code of Federal Regulations (CFR) 50.59, "Changes, tests, and experiments," from March 19, to March 23, 2018.

10 CFR 50.59 Evaluations

(1) DCN 57326, Replace Station Air Compressors & Associated Equipment
(2) DCN 65097, Install New Backdraft Dampers for Smoke Mitigation Between the 6.9 kV B-Train Shutdown Board Room and the 480vac Shutdown Board Room
(3) DCN 66453, Unit 1 ECCS Gas Accumulation
(4) DCN 65534, Incorporate Revised Containment Integrity Analysis into Design Basis to Accommodate Dual-Unit Configuration of the GDC 5 Systems
(5) DCN 66576, Revise Design and Licensing Bases to Incorporate the Westinghouse Cobra/Trac Analysis Methodology as the Large-Break LOCA Containment Integrity Analysis of Record
(6) DCN 66577, Update MCR Dose Due to Fuel Handling Accident Caused By Increased Isolation Damper Stroke Time
(7) DCN 66327, Increased Narrow Range RTD Response Time from 8 To 9 Seconds

10 CFR 50.59 Screening/Applicability Determinations

(1) DCN 60939, Remove the ERCW Discharge Header Air Release Valves 0-ARV-67-1108, -1109, 0-TV-67-1112, -1113
(2) DCN 64044, Replace Time Delay Relays for Containment Spray Pump 1A-A AND 1B-B
(3) DCN 64501, Replace Centrifugal Charging Pump Room Cooler Coil with ASME Section III COIL
(4) DCN 65421, Valve Failed Leak Check
(5) DCN 65448, Determine the Throttle Positions for VALVES 0-FCV-067-0360 and -0362 That Limit the Flow Out of a Potential Failure of the TVA Class H ERCW Discharge Headers A and B to Acceptable Levels
(6) DCN 66557, Change Setpoint of Building Heat Expansion Tank Nitrogen Pressure Regulators

(7) DCN 66570, Create Second Architectural Opening in Unit 2 TDAFW Pump Room
(8) DCN 61035, Post-Loca Shutdown Margin Recovery
(9) DCN 65527, Replace Obsolete Valve for WBN-1-DRV-062-0521-A
(10) DCN 66387, Install Various Vent/Drain/Test Valves in System 26 and 67
(11) DCN 66508, Reduce Flow Requirements of the Boric Acid Transfer Pumps
(12) DCN 66459, Install Relays & Cable to Modify U1 Containment Purge Isolation Logic

**INSPECTION RESULTS**

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|---|---|---|
| Unresolved Item (Open) | "Potential Failure to Request NRC Approval to Increase the OPΔT and OTΔT Response Times"<br>URI 05000390/2018010-01 | 71111.17T- Evaluation of Changes, Tests, and Experiments |

Description: The reactor trips that protect from fuel damage that could result from departure from nucleate boiling around the fuel are identified as over-temperature-change-in-temperature (OTΔT) and over-power-change-in-temperature (OPΔT). The trips use the temperature from the reactor coolant systems hot legs as inputs into complex equations. In 1991, the licensee requested a license amendment to upgrade the Temperature Averaging System (TAS) and protection system to digital technology (Eagle 21 protection system). The Westinghouse topical reports (TR) for the TAS and Eagle 21 was reviewed and the TAS was approved with conditions for the RTD response times, electronic delay times, and surveillance test uncertainties in NUREG 847, the Safety Evaluation Report (SER), Supplement 8 dated January 1992.

The SER specified, that "the overall response time (RTD response time plus electronics delay) for the new RdF RTDs is 0.5 second longer (6.5 vs. 6.0 seconds) than the former Rosemount RTDs. This leaves a margin of 0.5 second (7.0-6.5) between the analysis and overall RTD response time. The breakdown of components used to arrive at the overall response time is 5.5 seconds for the RTD/thermowell and a conservative electronics delay of 1.0 second. The applicant stated that it will use the loop current step response (LCSR) test to measure RTD response time. A 10-percent allowance for LCSR test uncertainty will be used to ensure an overall channel response time of 7.0 seconds or less. …During initial startup testing, actions will be taken to correct any resistance temperature detector (RTD) channel with an overall response time of greater than 7.0 seconds including electronics delay and a 10-percent allowance for loop current step response test uncertainty. After any such corrective action, the channel will be retested to verify an overall response time of 7.0 seconds or less (the value assumed in pertinent safety analyses)."

In 1997, licensee Design Change Notice (DCN) 39293 was implemented to increase the RTD response time. It stated, "the response time requirement for OPΔT reactor trip was increased from 7 seconds to 8 seconds. This time includes RTDs, electronic processing, and trip circuit delays. As a result, the allowance for the sensor response time can be increased from 5.5 to 6.5 seconds. The Reactor Protection System Description, N3-99-1003, and the Technical Requirements Manual (TRM) were revised to reflect the change in response time for this channel." The change appeared to account for the 1.0 second electronic delay, but did not appear to account for the 10-percent allowance for LCSR test uncertainty, which would be derived from the RTD/thermowell delay. The uncertainty margin would appear to increase from 0.5 to 0.6 seconds. This change was implemented without NRC review and approval.

In 2015, during hot functional testing of Unit 2 TAS RTDs, the RTD/thermowell delay did not meet the 6.5s required by the TRM from the change in 1997. On May 23, 2015, DCN 66327 was implemented to increase the response time again. The DCN stated, "this DCN increases the total Narrow Range RTD response time from 8 to 9 seconds while changing the sensor response time from 6.5 to 8 seconds. Westinghouse has evaluated this change in letter WBT-D-5476 and determined that existing analyses are not impacted by this change." In this new response time the 1.0 second electronic delay and 8 second RTD/thermowells delay appeared to be accounted for, but not the margin for LCRS test uncertainty. If the 10-percent allowance for LCSR test uncertainty were accounted for, the total response time would appear to increase to 9.8 seconds.

Westinghouse used a total response time of 9.0 seconds for their analyses at the direction of TVA, per WBT-TVA-3027, Revision 0, "(5.10) PIN ELICB-055 Evaluation to Support a 9.0-second Total RTD Response Time," August 2015. The 10 percent LCSR uncertainty does not appear to have been included. Westinghouse letter LTR-TA-15-92, "Transient Analysis Evaluation of an Increased RTD Delay Time for Watts Bar Unit 2," Rev. 0, stated, in part, "due to the limiting nature of the [Steam Line Break] SLB w/ [Rod Withdrawal at Power] RWAP event, in which no margin currently exists to the departure from nucleate boiling ratio (DNBR) safety analysis limit (SAL), the inclusion of a 9.0-second total RTD response time resulted in a 0.55% DNBR penalty." For the feed water event, defined as a reduction in feedwater temperature, the Westinghouse letter stated, in part, "key event results for both of the multiple-loop cases were impacted by the delay in receiving the OPΔT trip. While substantial margin was maintained to the DNBR limit of 1.38, the peak core heat flux values slightly exceeded the limit value of 121%." The letter concluded that "the slower responding RTDs did not significantly impact the non-LOCA transient analyses and that the acceptance criteria for the events continued to be met, with the exception of the SLB w/ RWAP. However, generic DNB margin will be allocated to offset the 0.55% DNBR penalty associated with the evaluation. As such, the non-LOCA transient analyses can support operation of Watts Bar Unit 2 with a total RTD delay time of up to 9.0 seconds."

The inspectors questioned the licensee to understand why the 10-percent allowance for LCSR test uncertainty was not accounted for in the Westinghouse analyses, and to what extent it could have affected the results. In addition, the inspectors questioned whether the 10-percent uncertainty was adequate in the current installation configuration. The inspectors also questioned how the LCSR test could account for increased thermal resistance between the RTDs and the thermowells. The test may not measure the actual delay time from the hot leg across the thermowell thermal resistance to RTD. The original installations relied on specific RTD thermowell bonding to establish a predictable thermal resistance and initial response time. It is unclear how this was performed for this installation to determine the actual response time.

The 10 CFR 50.59 evaluation was performed May 22, 2016. This issue has been captured in the Corrective Action Program (CAP) as CR 1398934, "Potential failure to request lic. amendment to change OPdT/OTdT response time"

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| Unresolved Item (Open) | "Potential Failure to Perform a 50.59 Evaluation for Auxiliary Building and Containment Isolation" URI 05000390/2018010-02 | 71111.17T- Evaluation of Changes, Tests, and Experiments |

Description: DCN 66459 added relays and wiring to change the actuation system that initiated the Auxiliary Building Isolation (ABI) and Containment Ventilation Isolation (CVI) protective functions. The new control elements (relay contacts and wiring) bypassed the Unit Solid State Protection System (SSPS) circuitry. The intent was to actuate the CVI function on an ABI actuation from the opposite unit while it was at full power operation and the other unit was in refueling mode. By bypassing the refueling units' protection system and controlling the components in the refueling unit, the modification in effect made the protection systems (CVI) a shared system. The CVI was classified as part of the Engineered Safeguards Protection Systems (ESFAS). The ESFAS was not listed in the UFSAR Chapter 3.1.2 "WBNP Conformance with GDCs [General Design Criteria]," as shared systems under GDC 5. The UFSAR compliance with GDC 5 "Sharing of Structures, Systems, and Components," specified "all shared systems are sized for all credible initial combinations of normal and accident states for the two units, with appropriate isolation to prevent an accident condition in one unit from carrying into the other." The new control elements integrated in the ESFAS logic, apparently on both units. The licensee did not perform a failure modes and effects analysis to determine the negative effects that could degrade the ESFAS isolation functions when they are required to operate. The inspectors are concerned that the integration of the two ESFAS circuitry could have a detrimental effect. Additional failure modes appear to have been introduced into these systems.

The inspectors need to determine the extent to which each units protection system and CVI were exposed to additional failures including common cause failures to determine whether there could be more than a minor issue and a potential failure to perform an adequate 50.59 evaluation in accordance with NPG-SPP-09.3 "Plant Mods and Engineering Change Control," Section III, was a performance deficiency. This URI, is being opened to determine whether the PD is more than minor.

This modification was complete on June 16, 2017. This issue was captured in CR 1398935, "Potential violation of 10 CFR 50.59(d)(1) via DCN 66459."

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| Unresolved Item (Open) | "Potential Failure to Maintain Design Requirements of RTDs" URI 05000390/2018010-03 | 71111.17T- Evaluation of Changes, Tests, and Experiments |

Description: The TAS RTD receipt documents specified design criteria identified in EQOP-ESE-7 in WCAP 8587 and the EQTR WCAP-8687 Supp. 2-E07A. The installed condition of the RTDs did not appear to meet the qualification performance specifications.

Testing performed indicated that a gap existed between the RTDs and installed thermowells creating a large thermal resistance. Westinghouse document FDR-WBT-2015-01, "Field Deviation Notice for Watts Bar Unit 2," indicated that the RTD/thermowell fit for the tip was "outside the maximum tolerance listed in design drawing 1847E83 Rev. 4." The performance specifications were to ensure that the RTD time response across the thermowells thermal resistance was within tolerance. The higher thermal resistance increased the response time. The deviation appeared to be accepted as is.

The Westinghouse equipment qualification data package, WCAP 8587/EQOP-ESE-7 Supplement 1 Rev. 7, page D1-5 Rev. 21, specified, in part that the performance requirements for the RTDs must meet "+0.2"F repeatability; first order time response 5 seconds with well for step change of at least 20°F with a water flow of 7 ft/sec. … Time response testing has been successfully performed via type testing on a sample model of this RTD." The performance requirement appears to require a 5-second RTD/thermowell response time for qualification directly measured across the thermowell medium. The inspectors are concerned that the installed RTD/thermowell configuration was not verified to meet the performance requirements for qualification.

It appeared that, due to the installation issues, the RTD response time increased, as measured by LCSR testing methods, the total delay time of 9.8 seconds. However, Westinghouse used a total response time of only 9.0 seconds for their analyses at the direction of TVA specification per WBT-TVA-3027, Revision 0, "PIN ELICB-055 Evaluation to Support a 9.0-second Total RTD Response Time," August 2015. The analyses determined that some accident margins were impacted at 9.0 seconds. The inspectors questioned what the impact of the additional delay would have on the accident analyses and qualification.

The inspectors questioned how the LCSR test method could accurately account for increased thermal resistance between the RTDs and the thermowells and whether the original 10-percent uncertainty for LCSR testing was adequate in the currently installed configuration. The validity of the LCSR method depends on how well the temperature sensor design satisfies LCSR test assumptions. The original installations relied on specific RTD thermowell bonding to establish a predictable thermal resistance and initial response time. It is unclear how the actual response time was determined this installation.

This URI is being opened to determine if a PD exists. A review of documents and specifications provided by licensee indicated that new information requests would be likely. This issue has existed since September 2015. This issue was captured in CR 1398936, "RCS Narrow Range RTDs Design and Qualification Requirements."

**EXIT MEETINGS AND DEBRIEFS** The inspectors confirmed that proprietary information was controlled to protect from public disclosure. On March 23, 2018, the inspector presented the inspection results to Mr. Gordon Arent, and other members of the licensee staff.

**LIST OF DOCUMENTS REVIEWED**

**CORRECTIVE ACTION DOCUMENTS WRITTEN AS A RESULT OF THE INSPECTION**
CR 1397855, Clean & recoat of hot tapped ERCW branch piping
CR 1398318, Metal Coffee Cup Found in 6.9 KV Board Room
CR 1398934, Potential failure to request lic. amendment to change OPΔT OTΔT response time
CR 1398935, Potential violation of 10 CFR 50.59(d)(1) via DCN 66459
CR 1398936, RCS Narrow Range RTDs Design and Qualification Requirements

**PROCEDURES**
1-SI-62-902-A, Boric Acid Transfer Pump 1A-A Quarterly Performance Test, Rev. 22
1-SI-62-914-A, Boric Acid Transfer Pump 1A-A Comprehensive Pump Test, Rev. 4
1-SI-62-915-A, Boric Acid Transfer Pump 1A-A Preservice Pump Test, Rev. 1
1-SI-63-10.1-A, ECCS Discharge Pipes Venting Train A Inside Containment, Rev. 23
1-SI-63-10-B, ECCS Pumps Venting-Train B, Rev. 29
1-SI-63-10.2-A, ECCS Pumps and Discharge Pipes Venting Outside Containment, Rev. 17
99-0653, Fusible Link Test, Rev. 0
IP-ENG-001, Standard Design Process, Rev. 0
MEL datasheets associate with the SG Intellisys Controller
NPG-SPP-03.15, FSAR Management, Rev. 2
NPG-SPP-06.3, Pre-/Post-Maintenance Testing, Rev. 2
NPG-SPP-09.3, Plant Modifications and Engineering Change Control, Rev. 27
NPG-SPP-09.4, 10 CFR 50.59 Evaluations of Changes, Tests, and Experiments, Rev. 12
PR WB2-15-0005, Procurement of Backdraft Dampers, Rev. 1
Signaline Time Delay Relay Specifications for Model 330 and 360
TI627, Failure Modes and Effects Analysis, Rev. 35
V&V documentation associated with SG Intellisys Controller
WB-DC-40-31.5, Analysis of Buried Piping, Rev. 5
WBN-SDD-N3-67-4002, ERCW Filled Piping Bases, Rev. 35

**DRAWINGS**
0-47W450-41, ERCW Mechanical drawing, Rev. 1
0-47W450-41, Mechanical Essential Raw Cooling Water, Rev.1
0-47w611-30-5 Units 1 & 2 Electrical Logic Diagram Ventilation System, Rev. 0
0-47w611-30-6 Units 1 & 2 Electrical Logic Diagram Ventilation System, Rev. 0
0-47w611-30-7 Units 1 & 2 Electrical Logic Diagram Ventilation System, Rev. 0
0-47W611-30-8 Units 1 & 2 Electrical Logic Diagram Ventilation System, Rev. 0
0-47W845-1, Mechanical Flow Diagram-Essential Raw Cooling Water System, Rev. 9
0-47W845-2, Mechanical Flow Diagram-Essential Raw Cooling Water System, Rev. 9
0-47W850-2, Flow Diagram Fire Protection Raw Service Water, Rev. 6
0-47W859-1, Mechanical Flow Diagram Component Cooling System, Rev. 7
0-47W859-2, Mechanical Flow Diagram Component Cooling System, Rev. 43
0-47W859-4, Mechanical Flow Diagram Component Cooling System, Rev. 1
0-47W866-3, HVAC Air Flow Diagram, Rev. 0
1-47w611-30-1 Units 1 & 2 Electrical Logic Diagram Ventilation System, Rev. 15
1-47W611-30-10 Units 1 & 2 Electrical Logic Diagram 5th Diesel Gen. Ventilation System, Rev. 2
1-47W611-30-3 Units 1 & 2 Electrical Logic Diagram Ventilation System, Rev. 9
1-47W611-30-4 Electrical Logic Diagram Ventilation System, Rev. 25
1-47w611-88-1 Units 1 & 2 Electrical Logic Diagram Containment Isolation, Rev. 28
1-47W845-3, Mechanical Flow Diagram-Essential Raw Cooling Water, Rev. 36

1-47W845-5, ERCW System Flow Diagram, Rev. 45
1-47W846-1, Control and Service Air System Flow Diagram, Rev. 40
1-47W859-2, Mechanical Flow Diagram Component Cooling System, Rev. 41
17W302-1, ERCW Control Air & HPFP Piping, Rev. 17
17W302-6, ERCW Control Air & HPFP Piping, Rev. 22
17W302-7, ERCW Control Air & HPFP Piping, Rev. 16
2-47W611-30-1 Unit 2 Electrical Logic Diagram Ventilation System, Rev. 10
2-47W611-30-3 Unit 2 Electrical Logic Diagram Ventilation System, Rev. 7
2-47W611-30-4 Unit 2 Electrical Logic Diagram Ventilation System, Rev. 11
2-47W611-88-1 Unit 2 Electrical Logic Diagram Containment Isolation, Rev. 10
2-47W859-3, CCW System Flow Diagram, Rev. 34
2-47W859-3, Mechanical Flow Diagram Component Cooling System, Rev. 34
47W611-30-11 Units 1 & 2 Functional Control Logic Diagram Heating, Ventilation, and Air Conditioning, Rev. 4
47W611-30-12 Units 1 & 2 Functional Control Logic Diagram Heating, Ventilation, and Air Conditioning, Rev. 1
47W611-30-13 Units 1 & 2 Functional Control Logic Diagram Heating, Ventilation, and Air Conditioning, Rev. 1
47W611-30-9 Units 1 & 2 Electrical Logic Diagram Ventilation System, Rev. 2
N2014-24x48-WBD-2-SUB, TVA Wing Blade Damper Submittal Drawing, Rev. 3

**CALCULATIONS**

B18 900511256, Demonstrated Accuracy Calculation for Main Control Room Air Intake Radiation Monitor 0-RE-90-125, 126, and Emergency Air Intake Radiation Monitor 0-RE-90-205, 206, Rev. 19
B18 910321251, WBN AFW System – Pump Net Positive Suction Head (NPSH) Available Calculation
B18910123255, Analysis and Qualification of Buried ERCW Piping, Rev. 3
B18930304762, Seismic Qualification of System 030 Equipment, Rev. 11
B26 860514023, ERCW System Flow Requirements, Rev. 31
B26 890127016, ERCW System (67) Return Line Operating Mode Temperatures and Pressures, Rev. 11
B26 890302008, Control Room Operator and Offsite Doses from a Fuel Handling Accident, Rev. 16
B26 901220303, Design Pressures and Temperatures for the Auxiliary Feedwater System, Rev. 13
B26 970806306, Boric Acid Concentration Analysis for BAT RWST, Rev. 11
CDQ0002902015000693, Smoke Damper Mounting Design, Rev. 0
EPMJKJ011191, AFW NPSH Analysis, Rev. 11
MDQ00106320110182, Effects of Gas Accumulation in ECCS Piping, Rev. 4
T93 090323001, Essential Raw Cooling Water (ERCW) System Pressure Drop Calculation, Rev. 29
T93 100518008, Component Cooling System (CCS) Pressure Drop Calculation, Rev. 14
WCG1682, Analysis and Qualification of ERCW Buried Piping, Rev. 3

**CORRECTIVE ACTION DOCUMENTS**

| | | |
|---|---|---|
| 663870 | 979323 | 1233104 |
| 665760 | 989876 | 1303037 |
| 665770 | 1007686 | 1307833 |
| 864803 | 1099357 | 1361911 |
| 925819 | 1159195 | |
| 967466 | 1198057 | |

**WORK ORDERS**

| | | |
|---|---|---|
| 112645542 | 116869731 | 118606099 |
| 112645542 | 116869745 | 118672229 |
| 116734468 | 117433680 | 118740235 |
| 116869301 | 118353594 | 118919488 |

**SELF-ASSESSMENT REPORTS**

WBN-ENG-SSA-18-002, 50.59 Safety Assessment/Safety Evaluation Program, Rev. 0

**MISCELLANEOUS DOCUMENTS**

0-TI-100.011, IST Program Bases Document, Rev. 1
SDD-N3-62-4001, Chemical and Volume Control System Unit 1/ Unit 2, Rev. 38
WBN-DCD-40-36, The Classification of Piping, Pumps, Valves, and Vessels Unit 1/ Unit 2, Rev. 24
WCAP-17721-P, Westinghouse Containment Analysis Methodology – PWR LOCA Mass and Energy Release Calculation Methodology, Rev. 0
WCAP 8587/ EQDP-ESE-7, “Equipment Qualification Data Package Supplement 1,” Rev. 7