NUREG–0847
Supplement No. 20

Safety Evaluation Report

related to the operation of
Watts Bar Nuclear Plant,
Units 1 and 2

Docket Nos. 50–390 and 50–391

Tennessee Valley Authority

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

February 1996

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ABSTRACT

This report supplements the Safety Evaluation Report (SER), NUREG-0847 (June 1982), Supplement No. 1 (September 1982), Supplement No. 2 (January 1984), Supplement No. 3 (January 1985), Supplement No. 4 (March 1985), Supplement No. 5 (November 1990), Supplement No. 6 (April 1991), Supplement No. 7 (September 1991), Supplement No. 8 (January 1992), Supplement No. 9 (June 1992), Supplement No. 10 (October 1992), Supplement No. 11 (April 1993), Supplement No. 12 (October 1993), Supplement No. 13 (April 1994), Supplement No. 14 (December 1994), Supplement No. 15 (June 1995), Supplement No. 16 (September 1995), Supplement No. 17 (October 1995), Supplement No. 18 (October 1995), and Supplement No. 19 (November 1995) issued by the Office of Nuclear Reactor Regulation of the U.S. Nuclear Regulatory Commission with respect to the application filed by the Tennessee Valley Authority, as applicant and owner, for licenses to operate the Watts Bar Nuclear Plant, Units 1 and 2 (Docket Nos. 50-390 and 50-391). The facility is located in Rhea County, Tennessee, near the Watts Bar Dam on the Tennessee River. This supplement provides recent information regarding resolution of some of the issues identified in the SER.

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ABBREVIATIONS

ACRS	Advisory Committee on Reactor Safeguards
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CAP	corrective action program
CFR	*Code of Federal Regulations*
CNPP	Corporate Nuclear Performance Plan
EPZ	emergency planning zone
ERCW	essential raw cooling water
ETE	evacuation time estimate
FEMA	Federal Emergency Management Agency
FSAR	final safety analysis report
GDC	general design criteriom
GL	generic letter
IST	inservice testing
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
ODCM	Offsite Dose Calculation Manual
PIG	particulate iodine and gas
REP	radiological emergency plan
RERP	radiological emergency response plan
SER	safety evaluatiion report
SP	special program
SRP	standard review plan
SSER	supplement to safety evaluation report
TAC	technical assignment control
TI	temporary instruction
TMI	Three Mile Island
TVA	Tennessee Valley Authority
WBN	Watts Bar Nuclear Plant
WBNPP	Watts Bar Nuclear Performance Plan

1 INTRODUCTION AND DISCUSSION

1.1 Introduction

In June 1982, the Nuclear Regulatory Commission staff (NRC staff or staff) issued a Safety Evaluation Report, NUREG-0847, regarding the application by the Tennessee Valley Authority (TVA) for licenses to operate the Watts Bar Nuclear Plant, Units 1 and 2. The Safety Evaluation Report (SER) was followed by SER Supplement No. 1 (SSER 1, September 1982), Supplement No. 2 (SSER 2, January 1984), Supplement No. 3 (SSER 3, January 1985), Supplement No. 4 (SSER 4, March 1985), Supplement No. 5 (SSER 5, November 1990), Supplement No. 6 (SSER 6, April 1991), Supplement No. 7 (SSER 7, September 1991), Supplement No. 8 (SSER 8, January 1992), Supplement No. 9 (SSER 9, June 1992), Supplement No. 10 (SSER 10, October 1992), Supplement No. 11 (SSER 11, April 1993), Supplement No. 12 (October 1993), Supplement No. 13 (SSER 13, April 1994), Supplement No. 14 (SSER 14, December 1994), Supplement No. 15 (SSER 15, June 1995), Supplement No. 16 (SSER 16, September 1995), Supplement No. 17 (SSER 17, October 1995), Supplement No. 18 (SSER 18, October 1995), and Supplement No. 19 (SSER 19, November 1995).

The staff has completed its review of the applicant's Final Safety Analysis Report (FSAR) up to Amendment 91, the final amendment. Concurrent with the issuance of SSER 19 on November 9, 1995, the staff also issued an operating license, authorizing operation up to 5-percent power (hence, TVA is also addressed as "licensee" in this SSER).

The requirements that must be met before a plant can be licensed are defined in NRC regulations. Over the years, the staff has prepared a number of guidance documents, such as regulatory guides and the Standard Review Plan (SRP, NUREG-0800) that define methods that are acceptable to the staff for meeting various requirements in the regulations. However, except for a few regulatory guides that are specifically referenced in a regulation, these guidance documents are not requirements. Specifically, every regulatory guide contains the following statement:

> Regulatory guides are issued to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

Similarly, every SRP section contains the following:

> Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required.

In addition to NRC staff guidance documents, the industry has developed numerous documents, such as ANSI standards, some of which describe methods for meeting certain requirements contained in the regulations. To varying degrees, the staff has endorsed these documents as an acceptable method for meeting the regulations.

As an applicant or licensee develops the design of a system, it may choose to "commit" to one or more of these NRC or industry reference documents. If an applicant or licensee commits to a guidance document, then it must meet all of the guidelines contained in the document, or it must request that the NRC staff authorize a deviation. The staff must specifically approve each deviation requested. However, an applicant or licensee may choose not to commit to a specific staff guidance document, but may instead choose an alternative approach to meeting a regulatory requirement. When this happens, the NRC must evaluate the alternative approach to determine if it meets the regulations.

A staff reviewer will often use the guidelines contained in a regulatory guide or industry standard as a measure of whether the application meets the regulatory requirements. This does not mean that the regulatory guide or industry standard becomes a requirement or even a commitment, and it does not mean that the application must meet every guideline in the standard to be found acceptable.

The SER and its supplements were written to agree with the format and scope outlined in the Standard Review Plan (NUREG-0800). Issues raised by the SRP review that were not closed out when the SER was published were classified into outstanding issues, confirmatory issues, and proposed license conditions. All issues were acceptably resolved for Unit 1, as reported in Sections 1.7, 1.8, and 1.9 of SSER 19.

In addition to the guidance in the SRP, the staff issues generic requirements or recommendations in the form of technical reports, bulletins, and generic letters. Each of these documents carries its own applicability, work scope, and acceptance criteria; some are applicable to Watts Bar. The review and implementation status of applicable generic issues are addressed in Appendix EE of SSER 16.

Each of the following sections and appendices of this supplement is numbered the same as the section or appendix of the SER that is being updated, and the discussions are supplementary to, and not in lieu of, the discussion in the SER, unless otherwise noted. Accordingly, Appendix A continues the chronology of the safety review. Appendix E lists principal contributors to this supplement. Appendix F, originally published in SSER 1, is supplemented in this SSER. Appendix G, which last appeared in SSER 9, corrects some errors in SSER 19. The other appendices are not changed by this supplement.

The staff concludes that, on the basis of its determination that Watts Bar Unit 1 has met all applicable regulations and guidance as stated in the SER and supplements, and satisfactory findings from all applicable inspections, an operating license can be granted to authorize operation up to 100-percent power.

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1.12 Approved Technical Issues for Incorporation in the License as Exemptions

The licensee applied for exemptions from certain provisions of the regulations. These have been reviewed by the staff and approved in appropriate sections of the SER and SSERs. These exemptions were granted in the low-power operating license and will be granted in the full-power operating license:

(1) Airlock seal leakage test instead of full-pressure test, schedular exemption (Section 6.2.6, SSERs 4 and 19) (TAC M63615)

(2) Criticality monitor (Section 9.1, SSER 5) (TAC M63615)

(3) Schedule to implement the vehicle bomb rule (Section 13.6.9, SSER 15) (TAC M90696)

In addition to these, the staff granted the following two exemptions to the applicant on December 15, 1994, and October 17, 1995, respectively:

(4) Issuance, storage, and retrieval of badges for personnel (TAC M90729)

(5) Participation by States within the ingestion exposure pathway emergency planning zone in the emergency preparedness exercise (TAC M92943)

In SSER 14, the staff reevaluated three technical issues previously approved for exemption from various provisions of Appendix G to 10 CFR Part 50. As a result, Section 5.3.1.1 of SSER 14 reports that these exemptions are no longer needed.

1.13 Implementation of Corrective Action Programs and Special Programs

On September 17, 1985, the NRC sent a letter to the applicant, pursuant to Title 10 of the Code of Federal Regulations, Section 50.54(f), requesting that the applicant submit information on its plans for correcting problems concerning the overall management of its nuclear program as well as on its plans for correcting plant-specific problems. In response to this letter, TVA prepared a Corporate Nuclear Performance Plan (CNPP) that identified and proposed corrections to problems concerning the overall management of its nuclear program, and a site-specific plan for Watts Bar entitled "Watts Bar Nuclear Performance Plan" (WBNPP). The staff reviewed both plans and documented results in two safety evaluation reports, NUREG-1232, Vol. 1 (July 1987) and NUREG-1232, Vol. 4 (January 1990).

In a letter of September 6, 1991, the applicant submitted Revision 1 of the WBNPP. In SSER 9, the staff concluded that Revision 1 of the WBNPP does not necessitate any revision of the staff's safety evaluation report, NUREG-1232, Vol. 4.

In NUREG-1232, Vol. 4, the staff documented its general review of the corrective action programs (CAPs) and special programs (SPs) through which the applicant would effect corrective actions at Watts Bar. When the report was published, some of the CAPs and SPs were in their initial stages of implementation. The staff stated that it would report its review of the implementation of all CAPs and SPs and closeout of open issues in future supplements to the licensing SER, NUREG-0847; accordingly, the staff prepared Temporary Instructions (TIs) 2512/016-043 for the Inspection Manual and adhered to the TIs to perform inspections of the CAPs and SPs. This new section was introduced in SSER 5 to be updated in subsequent SSERs.

As reported in SSER 19, all CAPs and SPs were acceptably implemented by the licensee. SSER 19 also listed all applicable safety evaluations and inspection reports for each CAP or SP. There is no new or revised information; Sections 1.13.1 and 1.13.2 of SSER 19 are thus incorporated by reference.

3 DESIGN CRITERIA - STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

3.2 Classification of Structures, Systems, and Components

In Sections 3.2.1 and 3.2.2 of SSER 3, the staff found that the seismic classification of the emergency raw cooling water system (ERCWS) was acceptable pending verification that TVA made certain modifications to it. In Section 3.2 of SSER 5, the staff referenced Inspection Report 50-390/84-37, dated July 13, 1984, where such verification was documented. Subsequently, the applicant completed implementation of the Corrective Action Program on Equipment Seismic Qualification (see Section 1.13.1 of SSER 19). In Inspection Report 50-390/93-79 (March 4, 1994), the staff re-verified the modifications and found them acceptable. This update does not change the staff's conclusions in SSER 3 and SSER 5 regarding Confirmatory Issues 5 and 6.

The staff tracked this effort by TAC M94025.

3.9 Mechanical Systems and Components

3.9.6 Inservice Testing of Pumps and Valves (Unit 1)

In SSER 14, the staff reviewed the licensee's pump and valve inservice testing (IST) program and authorized a number of alternative testing requirements. In SSER 18, the staff supplemented its evaluation. By a letter dated August 25, 1994, the staff commented on 13 issues regarding the licensee's IST program. By letter dated November 20, 1995, the licensee responded.

The staff has reviewed the licensee's response to the 13 issues and determined that the licensee has addressed each in a manner that complies with the staff's position as stated in the August 25, 1994, letter. Where provisional relief was granted in SSER 14, the licensee has modified applicable relief requests to reflect the actions taken to address the specific provisions. All actions are subject to further review through future inspections in accordance with the staff's existing inspection program. Each of the 13 issues is discussed below. The staff tracked this effort by TAC M90252.

Issue 1

The licensee has adequately described the process for including components in the IST program and for determining the applicable tests. However, the scope of the IST program for pumps could be further narrowed by including only those pumps that are provided with an emergency power source as discussed in paragraph 1.1 of American Society of Mechanical Engineers (ASME)/American National Standards Institute (ANSI) Operations and Maintenance Standards Part 6 (OM-6)].

Issue 2

(1) The overpressure protection devices that are in the scope of OM-1 are those that protect a system that has a function to shut down the reactor to a safe-shutdown condition, maintain safe shutdown, or mitigate the

consequences of an accident. That is, the scope of OM-1 includes valves that provide overpressure protection for systems that function to shut down the reactor to a safe-shutdown condition, maintain safe shutdown, or mitigate the consequences of an accident, whether the valves themselves perform such functions or only provide overpressure protection. The Working Group of the ASME Operations and Maintenance Committee has been working to better clarify which overpressure protection devices are within the scope of OM-1. The licensee should monitor the code activities; however, the scope of the IST program currently being implemented must comply with the requirements of the 1987 edition of OM-1 which appears to be a broader scope than that defined by the licensee. The licensee's response states that the IST program "includes within its scope those pressure-relief devices that are required to function during accident conditions, those required to function to shut down the reactor, and those require to function to maintain the cold shutdown condition." Therefore, the response to this issue may not fully address the correct scope. The licensee should determine if there are pressure relief devices which protect ASME Code Class 1, 2, or 3 (or equivalent) systems that function in an accident and include those devices in the IST program.

(2) The staff commented that the licensee defined a "Category C Passive" for certain valves listed in the IST program, but that the code does not specify such a category and function combination (see Table 1 of OM-10). The licensee indicates that it considers this category applicable to the self-actuating devices that have no function to change obturator position, but only to function as a pressure boundary (i.e., to not rupture). Valves that function in response to a system characteristic are generally considered active unless the flow is blocked or the valves are otherwise locked in position. The valves may respond to a system parameter, possibly inadvertently if they are not functioning or set properly, without operator awareness and thereby compromise the function of the system under a condition where the valves do not return to the position required to maintain the pressure boundary integrity. Whether any of the valves designated as Category C-Passive should be "active" valves is subject to future staff inspection.

Issue 3

The staff noted that the corrective actions specified for valves which exhibit an increasing stroke time (paragraph 4.2.1.9(b)) consist of two elements: (1) limiting values or (2) multiples of the reference values. The combination can result in limiting values for some valves that are more restrictive than the multiples of the reference values (and vice versa). The IST program stated that the Technical Specifications were more restrictive than the code, which the staff pointed out is a misleading statement. The licensee must ensure that if the stroke time of a valve exceeds a Technical Specification limit, or exceeds the acceptance criteria and is not immediately retested, it will be declared inoperable. If retested, a period of 96 hours is allowed for evaluation of the test data. The licensee's response references paragraph 6.2 of both OM-6 and OM-10 and is confusing. Paragraph 6.2 of OM-10 refers to documentation in the test plans and is unrelated to this issue. Paragraph 6.2 of OM-6 discusses a 96-hour evaluation of the test data for pumps, similar to the 96 hours specified in paragraph 4.2.1.9(b) of OM-10. The licensee should ensure that it conforms to the requirements of paragraph 4.2.1.9 of OM-10.

The intent of the staff was to clarify that the 96-hour period is available for determining operability if the specified requirements are otherwise met. If a valve stroke time exceeds a limiting value, or if it exceeds an acceptance criterion and is not retested, it must be declared inoperable immediately. If the valve stroke time exceeds an acceptance criterion, but the limiting value has not been exceeded, it may be immediately retested and a period of 96 hours is available for evaluating the test results to determine operability. The licensee's response to this issue appears to be conservative.

Issue 4

This issue is concerned with the exclusion of the emergency diesel generator pumps and valves and that even if they are considered skid-mounted, they may be within the scope of the IST program if they are classified as ASME Code Class 3. The licensee revised the IST program to indicate that the components are non-Code and are included in the Augmented IST Program. This action is consistent with the staff's guidance in Section 3.4 of NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," April 1995.

Issue 5

The staff noted that Category A passive valves have leakage rate testing requirements. The licensee has revised the IST program to indicate that seat leakage testing is required for Category A passive valves.

Issue 6

The licensee has revised the IST program to note that check valve disassembly and inspection may, under some circumstances, be used for verification of a check valve's capability to close. This conforms with the provisions in OM-10 related to verification of obturator movement.

Issue 7

The staff noted that valves other than containment isolation valves or pressure isolation valves, as listed in the IST program, may have leakage rate limits that would need to be tested in the IST program. The licensee responded that no other such valves have been identified at the Watts Bar Nuclear Plant, but the applicable section of the IST program has been revised so that it will not be misleading in the future if modifications include such valves.

Issue 8

The staff recommended that the licensee investigate the use of nonintrusive methods for testing check valves. The licensee responded that the use of such methods is being pursued.

Issue 9

This issue identified incorrect references which the licensee has corrected.

Issue 10

(1) The licensee's request to set a minimum limit for the vibration acceptance criteria of smooth-running pumps was approved with the provision that it be used only on a case-by-case basis where it is determined appropriate, including consideration of any manufacturers' recommendations. The licensee has revised Relief Request PV-01 to include such a requirement.

(2) The approval of the alternative was also interim until the ASME OM Committee has issued requirements for acceptance criteria applicable to smooth-running pumps. The licensee has revised the relief request to address the interim requirement for future changes as applicable.

Issue 11

The staff gave interim approval until the first refueling outage to use temporary flow instrumentation for the boric acid transfer pumps. The licensee indicates that the pumps will be tested during refueling outages using a flow path that contains instrumentation meeting OM-6 requirements for range and accuracy. The pumps will be tested quarterly using instrumentation that is available but that does not meet the code range and accuracy requirements. The testing meets or exceeds the provisions of Position 9 of Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," for testing pumps that cannot be tested with measured flow during quarterly testing; therefore, the revised relief request is acceptable for long-term use in accordance with the provisions of GL 89-04.

Issue 12

Relief Request PV-06 was not approved in SSER 14, and the licensee has withdrawn the request.

Issue 13

Relief Request PV-13 is concerned with the open function of a check valve; the alternative discussed verification of the valve's capability to properly backseat. The relief request has been revised to correct the discrepancy.

3.9.6.1 Pump Test Program

The staff authorized a number of alternative testing requirements in SSER 14. In its November 20, 1995, letter, the licensee proposed a new alternative.

Relief Request PV-15

The request applies to Code Class 3 essential raw cooling water valves 0-FSV-67-1221-A and 0-FSV-67-1223-B (System 67 valves) and Code Class 1 reactor coolant system valves 1-FSV-68-396-B and 1-FSV-68-397-A (System 68 valves). The valves function to admit cooling water to the jackets of the auxiliary air compressors and to vent noncondensable gases and hydrogen from the reactor vessel head following accidents, respectively. The licensee has determined that it is impractical to stroke time the valves using conventional methods (i.e., position indication).

The licensee states:

> The System 67 valves are totally enclosed, solenoid actuated valves that are not provided with position indicators. The only means of cycling the valves is by starting and stopping the auxiliary air compressors. The valves open when the compressor starts and close after the compressor stops. Additionally, the valves are installed in series with a thermostat that will not pass flow until the jacket water temperature reaches a predetermined level some time after starting of the air compressor. Therefore, the valve cannot be timed by observing flow through the valve since flow will not begin when the valve opens, but when the air compressor water jacket reached a preset temperature. WBN [Watts Bar Nuclear Plant] has attempted to detect valve operation via an accelerometer mounted on the valve, a stethoscope, and by using ultrasonic test equipment to determine and observe valve obturator position as discussed in the paper presented by Joseph Ondish at the Second NRC/ASME Symposium on Pump and Valve Testing and contained in section 2A of NUREG/CP-0123 ["Proceedings of the Second NRC/ASME Symposium on Pump and Valve Testing," published by NRC in July 1992]. None of these methods have been capable of determining valve stroke time.
>
> The System 68 valves are totally enclosed, solenoid actuated Target Rock valves. The only means of cycling these valves is by a hand-indicating controller located in the main control room. This controller has a variable setpoint that is actuated by a thumbwheel. Additionally, the valves are administratively limited to a stroke time of not less than 5 seconds to prevent the introduction of a water hammer event to the system. Since the stroke time is totally dependent upon the rapidity with which the operator operates the thumbwheel and is administratively limited to not less than 5 seconds, the stroke time measured is not indicative of valve condition. Rather it is indicative of the time the operator takes to run up the thumbwheel. Therefore, stroke time testing is not practicable.

The licensee proposes:

> Exercise the System 67 valves through a full cycle of travel once per quarter, and exercise the System 68 valves through a full cycle of travel during shutdowns and replace [all] the valves once every five years. This alternative is discussed in paragraph 4.2.8 of NUREG-1482.

The code provisions for stroke timing power-operated valves allow for monitoring degrading conditions so that valves may be repaired or replaced before they fail. When stroke timing is impractical, other means for monitoring degrading conditions, or for precluding degradation to the point of failure, may be acceptable alternatives. The staff recommends the use of diagnostic or nonintrusive test methods where feasible, or enhanced maintenance or periodic replacement as alternatives to stroke time testing (see Section 4.2.8 of NUREG-1482).

The subject valves are totally enclosed solenoid valves which should have been designed with position indication to enable inservice testing; however, the

provisions for IST had not become part of the code or the NRC regulations when the construction permit for Watts Bar Nuclear Plant, Unit 1, was issued on January 23, 1973. Therefore, an alternative to the code requirements may be considered because of the impractical design limitations. If the code requirements were imposed, the licensee would have to install position indication or would have to purchase a device that would monitor the valves and measure the stroke times, either of which would be a burden.

The licensee discusses various methods attempted for monitoring the stroke time of the valves, resulting in discounting all of the methods. Though there are methods that might provide a measure of the stroke time, such as diagnostic testing devices now available for testing solenoid and air-operated valves, these are not yet in wide use for testing valves such as the cooling water valves and head vent valves. In the future, the licensee may determine such methods are preferable to periodic valve replacement as an alternative to monitoring the stroke times. If so, such methods may be used without further review by the staff because the methods are considered acceptable for meeting the requirements of the code for stroke timing of valves. The licensee has selected a five-year period for periodic replacement, with a periodic full cycle of the valves to ensure there is no binding, as recommended by the staff (see NUREG-1482, Section 4.2.8, referencing NUREG-1275, Volume 6). Because the valves are generally specified for a life of 40 years, a five-year replacement frequency should be acceptable; however, if experience indicates that a more frequent replacement is needed, the licensee must evaluate and establish a more appropriate period.

Because there are no provisions for position indication, the design of the valves and actuating systems limit the licensee's ability to monitor for degradation by periodic measurement of the stroke times. The alternative will provide an acceptable means of assuring the operational readiness of the valves in consideration of the impracticality of meeting the code requirements. Therefore, in accord with 10 CFR 50.55a(f)(6)(i), relief is granted based on the impractical code requirements. The burden on the licensee if the code requirements were imposed has been considered in the staff's evaluation.

8 ELECTRICAL POWER SYSTEMS

8.3 Onsite Electric Power System

8.3.1 Onsite AC Power System Compliance With GDC 17

8.3.1.2 Low and/or Degraded Grid Voltage Condition

In SSER 13, the staff stated that Confirmatory Issue 28 was resolved on the basis of a preoperational test documented in Inspection Report 50-390/84-90, dated February 11, 1985. However, the staff stated that the results obtained from that test were no longer valid since TVA was reperforming the preoperational tests.

The preoperational test was conducted by TVA and reviewed by the staff in Inspection Reports 50-390/95-22 (September 8, 1995) and 50-390/95-77 (December 6, 1995). This update does not change the staff's conclusion regarding Confirmatory Issue 28.

The staff tracked this effort by TAC M94025.

11 RADIOACTIVE WASTE MANAGEMENT

The staff tracked the following review by TACs M84429, M90253, and M91523.

11.5 Process and Effluent Radiological Monitoring and Sampling System

11.5.1 System Description and Review Discussion

In SSER 16, Section 11.5.1, the staff stated:

> Additionally, the applicant has explained how the radiation monitoring program conforms with the intent of RG [Regulatory Guide] 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operation)-Effluent Steams and Environment," with respect to quality assurance provisions for the system. The staff finds that the radiation monitoring system for Watts Bar Unit 1 meets the intent and purpose of RG 4.15, with respect to quality assurance provisions for the system.

In SSER 16, Section 11.5.2, the staff included a paraphrased version of this statement. Specifically, the staff stated:

> On the basis of its review, the staff concludes that the process and effluent radiological monitoring and sampling system for Watts Bar Unit 1 complies with 10 CFR 20.1302 and GDCs [General Design Criteria] 60, 63, and 64. The staff also concludes that the system design conforms to the guidelines of NUREG-0737 (TMI Action Plan Item II.F.1, Attachments 1 and 2), RGs 1.21 and 4.15, and applicable guidelines of RG 1.97 (Rev. 2). Thus, the system meets the acceptance criteria of SRP [Standard Review Plan] Section 11.5 and is, therefore, acceptable.

It is clear from the first quote (above) that the licensee is not formally committed to RG 4.15. Further, on the basis of its review of the Final Safety Analysis Report (FSAR), the staff finds that the licensee is not formally committed to ANSI Standards N13.1-1969 and N13.10-1974, which are standards referenced in RG 4.15. In its July 21, 1995, submittal (referenced on page 11-1 of SSER 16), the licensee stated that Watts Bar is not committed to RG 4.15, Revision 1 and that, however, the radiation monitoring system generally agrees with and satisfies the intent of the RG 4.15 except for specific calibration techniques and frequencies. The staff has verified that calibration frequencies are in accordance with the staff's guidance contained in NUREG-1301 (see Watts Bar Offsite Dose Calculation Manual (ODCM), Revision 3). Further, the staff has verified that the ODCM has identified the requirements for (1) reference radionuclide standards used for calibration and recalibration of radiation monitors, (2) periodic grab sampling and analysis for specific radionuclides in the samples from applicable release paths to establish periodic correlations between monitor readings and concentrations and/or release rates of radionuclides in the monitored release path, and (3) calibration and periodic recalibration of flow-rate measuring devices. Also, the staff notes that FSAR Section 11.4.4 states that built-in check sources can be remotely actuated. The staff finds these features consistent

with the corresponding guidelines of RG 4.15 and NUREG-1301 ("Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors: Generic Letter 89-01," April 1991).

Regarding the licensee's calibration technique for the radiation monitors, the staff recognizes that the technique deviates from the guidance provided in ANSI Standard N13.10-1974, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents" referenced in RG 4.15. This is because the licensee conducted primary detector calibrations for Watts Bar effluent radiation monitors at an approved vendor's facility instead of in-place as recommended in the standard. NRC inspectors concluded (Inspection Report 50-390, 391/95-65 dated December 8, 1995, on special preoperational inspection of radiation monitoring) that the calibration of the radiation monitors as conducted by the licensee was acceptable. The inspectors stated that:

> Primary detector calibrations originally were conducted at an approved vendor's facility. From review of vendor manuals, the inspector determined that the primary calibrations for the liquid and airborne PIG [particulate, iodine and gas] detectors were conducted using either the installed or identical prototypes of detectors, sample chambers and associated electronics, thereby maintaining appropriate sample geometry and system operation characteristics....No violations or deviations were identified.

The inspectors further determined that the guidance provided in the applicable design and technical basis documents (listed in the inspection report) generally followed the criteria documented in ANSI Standard N13.1-1969, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities" and ANSI Standard N13.10-1974. For these reasons, the staff finds the licensee's calibration technique acceptable.

Additionally, in its July 21, 1995, submittal, the licensee elaborated how the radiation monitoring program meets the intent of RG 4.15. Specifically, the licensee stated that radiological monitoring is controlled in accordance with established site procedures and instructions and is implemented by personnel qualified to perform the required functions. The licensee further stated that process controls, including laboratory analysis and techniques, materials control, sampling methodology, performance monitoring and corrective actions, are implemented within program requirements. FSAR Section 11.4.4 references the ODCM for Watts Bar and maintenance instructions for information on response checks, calibration checks, and electronic calibration.

On the basis of the preceding discussion, the staff reiterates its earlier finding stated in SSER 16, Section 11.5.1, namely, that the radiation monitoring system for Watts Bar Unit 1 meets the intent and purpose of RG 4.15, with respect to quality assurance provisions for the system.

11.5.2 Conclusion

In SSER 16 the staff concluded that the process and effluent radiological monitoring and sampling system design for Watts Bar Unit 1 conforms with the guidelines of RG 4.15. On the basis of the preceding discussion in Section 11.5.1, the staff revises the second sentence in SSER 16 to read:

The staff also concludes that the system design conforms to the guidelines of NUREG-0737 (TMI Action Plan II.F.1, Attachments 1 and 2), RG 1.21, and applicable guidelines of RG 1.97 (Revision 2). The staff further concludes that the system design meets the intent and purpose of RG 4.15.

The staff's other conclusions given in SSER 16, Section 11.5.2, continue to be valid.

13 CONDUCT OF OPERATIONS

13.3 Emergency Preparedness

13.3.1 Introduction

In SSER 13, the staff evaluated Watts Bar's onsite emergency preparedness. Offsite emergency preparedness was then pending evaluation by the Federal Emergency Management Agency (FEMA). The Watts Bar Nuclear Plant Radiological Emergency Plan (REP), which is Appendix C to the Tennessee Valley Authority (TVA) REP, was discussed in Section 13.3.2 of SSER 13 and is discussed in this SSER. Offsite plans are discussed in Section 13.3.2.17, and include the State of Tennessee Multi-Jurisdictional Radiological Emergency Response Plan (RERP). The findings and determination of FEMA are also presented in Section 13.3.2.17.

The description of responsibilities and capabilities of the onsite emergency response organization were evaluated in SSER 13. The licensee has defined a plume exposure pathway emergency planning zone (EPZ) that is about 10 miles in radius. The actual boundaries of the zone have been determined to take into account local conditions, primarily the jurisdictional boundaries of those communities that are within about 10 miles of the Watts Bar site.

The plume EPZ lies entirely within the State of Tennessee. Emergency plans for Tennessee and the local governments (McMinn, Meigs, and Rhea counties) within the State of Tennessee and the plume exposure EPZ are contained in the State of Tennessee Multi-Jurisdictional RERP. The ingestion exposure pathway EPZ is about 50 miles in radius and includes the State of Tennessee and portions of the States of Georgia and North Carolina.

13.3.2 The Emergency Plan

The staff has reviewed the Watts Bar Nuclear Plant onsite REP (Appendix C to the TVA REP), through Revision 9 (dated November 11, 1995) and the TVA REP, through Revision 26 (dated December 4, 1995). The results of earlier staff reviews of the adequacy of onsite emergency preparedness are documented in Section 13.3 of the SER and SSER 13.

The Watts Bar public alert and notification system is described in the Watts Bar onsite REP (a detailed description of the public alert and notification system is given in the "Evaluation and Analysis of the Alert and Notification System, FEMA-REP-10 Design Report," for Watts Bar, which was submitted to FEMA for review on April 26, 1993). Primary public alerting within the plume exposure EPZ will be accomplished through the activation of pole-mounted sirens and tone alert radios. The onsite portion of this system was reviewed by the staff and found to be adequate in SSER 13. The offsite portion was reviewed by FEMA and is discussed in Section 13.3.2.17 (new section added in this SSER) below.

Over the course of the licensing process, the staff conducted and documented 12 inspections involving the evaluation of the onsite emergency preparedness, including three emergency preparedness exercise evaluations. The staff's

assessment included a 2-week onsite emergency preparedness appraisal conducted March 27-April 6, 1984, with followup appraisals in September and December 1984, March 1985, March 1993, and January-March 1994. These team inspections provided an in-depth evaluation of the licensee's emergency preparedness program and form the bases for part of the staff's routine emergency preparedness inspection program following authorization for full-power operation.

The staff observed and evaluated the onsite emergency response organization during the conduct of emergency preparedness exercises on November 15, 1995, October 26, 1994, and October 6, 1993. The results of these observations are documented in inspection reports. Results of the staff's evaluation of the most recent exercise are documented in Inspection Report 50-390/95-78. In that report, the staff concluded that the licensee's performance during the exercise demonstrated the ability to implement the plan and procedures in a manner that would provide reasonable assurance that the public health and safety would be protected.

On the basis of its previous conclusions (as documented in SSER 13) and its continued technical review, inspections, and exercise evaluations, the staff finds that the Watts Bar onsite REP complies with NRC requirements and is acceptable for a full-power operating license.

13.3.2.17 Evaluation of Offsite Emergency Preparedness

The staff's evaluation of offsite emergency preparedness in this supplement is based primarily on FEMA's findings of adequacy, as reported by FEMA to the NRC. FEMA provided its findings and determinations regarding offsite emergency preparedness for in a report dated December 15, 1995. This supplement provides the staff's conclusions on offsite emergency preparedness, following the staff's review of FEMA's findings and determination in regard to State and local government emergency response plans and preparedness.

The licensee has submitted offsite plans for the State of Tennessee. In accordance with the NRC/FEMA Memorandum of Understanding (58 *FR* 47996), the staff gave these plans to FEMA for FEMA's review and determination about offsite emergency preparedness. For its review and evaluation of these offsite plans, FEMA used the evaluation criteria and standards of NUREG-0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," November 1980.

The licensee submitted the "Evaluation and Analysis of the Alert and Notification System, FEMA REP-10 Report," for Watts Bar to FEMA for review on April 26, 1993. On December 15, 1995, as part of the interim findings and determination, FEMA provided a report entitled, "Watts Bar Nuclear Plant Site-Specific Offsite Radiological Emergency Preparedness Alert and Notification System Quality Assurance Verification," final report dated November 30, 1995, which summarizes the engineering design review; incorporates the results of the public telephone survey conducted immediately following full activation of the alert and notification system on May 5, 1994; and confirms the adequacy of the applicable evaluation criteria from NUREG-0654/FEMA-REP-1, Revision 1, and FEMA-REP-10.

On April 22, 1993, FEMA asked the staff to analyze the evacuation time estimates (ETEs) for Watts Bar and provide FEMA with a determination on the adequacy of the ETE against the criteria contained in Appendix 4 of NUREG-0654/FEMA-REP-1, Revision 1. On February 1, 1995 (letter, R. L. Spessard to D. H. Kwaitkowski of FEMA), the staff concluded that the revised report "Evacuation Time Estimates Within the Plume Exposure Pathway Emergency Planning Zone" (Annex H to the State of Tennessee Multi-Jurisdictional RERP) for Watts Bar, dated March 3, 1994, is consistent with the guidance of NUREG-0654/FEMA-REP-1, Rev. 1, and determined that the Watts Bar ETE is adequate.

As part of the interim finding process, FEMA headquarters and Region IV staff, and the Regional Assistance Committee completed plan reviews on June 10-11, 1993, August 15, 1994, and June 27, 1995. The State of Tennessee Multi-Jurisdictional RERP includes plans for each of the three local governments within the Watts Bar EPZ. This RERP is intended to provide the State with the capability for a rapid and coordinated response to nuclear power plant emergencies in the State of Tennessee. Two qualifying exercises were also evaluated. The first exercise was conducted on October 6-7, 1993, with a remedial drill, demonstrating the correction of an identified deficiency, conducted on November 15, 1993, and findings submitted to the NRC on May 22, 1995. The second qualifying exercise was conducted on November 15, 1995. No deficiencies were noted.

FEMA interim findings and determinations were submitted to the NRC on December 15, 1995. In that report, FEMA stated that there is reasonable assurance that the State of Tennessee and local radiological emergency response plans site specific to Watts Bar can be implemented and are adequate to provide reasonable assurance that appropriate measures can be taken off site to protect the health and safety of the public in the event of a radiological emergency at Watts Bar.

On the basis of its review of FEMA's findings and determination as summarized above, the staff concludes that the State of Tennessee plans and preparedness provide reasonable assurance that adequate protective measures can and will be taken, and the State of Tennessee Multi-Jurisdictional RERP is acceptable for full-power operation of Watts Bar.

13.3.3 Conclusion

On the basis of its review of the Watts Bar onsite REP and the TVA REP for conformance with the criteria in NUREG-0654/FEMA-REP-1, Revision 1; the results of onsite inspections; and its evaluation of the performance of the onsite emergency response organization in implementing the plans during exercises, the staff concludes the TVA REP and the Watts Bar onsite REP provide an adequate planning basis for an acceptable state of onsite emergency preparedness and meet the requirements of 10 CFR 50.47, including the 16 planning standards for onsite emergency plans, and the requirements of 10 CFR Part 50, and Appendix E thereto.

FEMA has provided its findings and determinations on the adequacy of offsite emergency planning and preparedness, based on its plan reviews, exercise observations, and analyses. On the basis of the staff's review of these findings, the staff concludes that the Watts Bar offsite emergency plans provide an adequate planning basis for an acceptable state of offsite

emergency preparedness and meet the requirements of 10 CFR Part 50 and Appendix E thereto.

The staff concludes that the overall state of onsite and offsite emergency preparedness provides reasonable assurance that, pursuant to 10 CFR 50.47(a), adequate protective measures can and will be taken in the event of a radiological emergency at Watts Bar and, therefore, emergency preparedness at Watts Bar is adequate to support full-power operations. The staff bases its conclusions on its assessment of the adequacy and implementability of the onsite plan and on its review of the FEMA findings and determinations regarding the adequacy and implementability of the State and local offsite plans. The staff's assessment included (1) NRC and FEMA reviews of emergency plans, (2) NRC and FEMA evaluations of emergency preparedness exercises, and (3) NRC onsite inspections of the applicant's emergency preparedness program.

The staff tracked this effort by TAC M89154.

13.6 Physical Security Plan

13.6.9 Land Vehicle Bomb Control Program

The staff has evaluated the licensee's vehicle bomb control program in SSER 15. The staff will require implementation of 10 CFR 73.55(c)(7) and (8), the surface vehicle bomb rule, by February 17, 1996. In addition, the staff will add a license condition that during implementation of the approved power ascension phase of the initial program, TVA shall not exceed 50% power until the requirements of 10 CFR 73.55(c)(7) and (8) have been fully implemented.

This review was tracked by TAC M90696.

19 REPORT OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In SSER 1, SSER 4, and SSER 14, the staff addressed the concerns raised by the Advisory Committee on Reactor Safeguards (ACRS) in its letter report of August 16, 1982, which was published as Appendix F to SSER 1. During the 426th meeting of the ACRS (November 2-4, 1995), it revisited TVA's application for an operating license. On November 1, 1995, the ACRS Subcommittee on Watts Bar discussed the same subject.

By letter dated November 8, 1995, the ACRS transmitted to NRC Chairman Shirley Jackson its review results of the Watts Bar Nuclear Plant, Unit 1, application for an operating license. The November 8, 1995, letter, reproduced here as Appendix F to this supplement, updates the previous ACRS letter report dated August 16, 1982.

In the subject letter, the ACRS states that there is reasonable assurance that Watts Bar Nuclear Plant Unit 1 can be operated at core power levels up to 3411 MWt without undue risk to the health and safety of the public, subject to resolution of two fire protection issues. These are concerned with fire barrier penetration seals and emergency lighting inside the reactor building. These two open issues were acceptably resolved and documented in Appendix FF to SSER 19.

APPENDIX A

CHRONOLOGY OF RADIOLOGICAL REVIEW OF WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2, OPERATING LICENSE REVIEW

Most of the following documents are referenced in this SSER. In no way is this an exhaustive list of all correspondence exchanged between the staff and the applicant during this period. The reader may obtain an exhaustive list through the NRC document control system (NUDOCS), the Public Document Room, or the local Public Document Room.

NRC Letters and Summaries

November 7, 1995	Letter, P. S. Tam to TVA, advising that the October 23, 1995, letter regarding actions undertaken by TVA as a result of Department of Labor case 95-ERA-20 will not be withheld from the public if TVA cannot furnish additional justification.
November 8, 1995	Letter, R. P. Zimmerman to TVA, informing that utility actions in response to administrative law judge's decision is sufficient to allow the staff to proceed with licensing.
November 8, 1995	Letter, J. P. Jaudon to TVA, summarizing November 6, 1995, management meeting regarding readiness of Watts Bar, Unit 1 for operating license.
November 8, 1995	Letter, T. S. Kress (Advisory Committee for Reactor Safeguards, ACRS) to NRC Chairman Shirley Jackson, finding reasonable assurance that Watts Bar Unit 1 can be operated at full power without undue risk to the health and safety of the public.
November 9, 1995	Letter, S. A. Varga to TVA, transmitting low-power operating license NPF-20 for Watts Bar Nuclear Plant, Unit 1.
November 9, 1995	Letter, P. S. Tam to TVA, transmitting safety evaluation regarding revised core operating limits report for Watts Bar Nuclear Plant, Unit 1.
November 28, 1995	Letter, J. M. Taylor to T. S. Kress (ACRS), informing that two open issues mentioned in the ACRS's November 8, 1995, letter have been resolved in SSER 19.

TVA Letters

November 6, 1995	Letter, P. P. Carier to NRC, notifying that TVA decided to use modified procedures to satisfy objectives of seismic portion of individual plant examination.

November 7, 1995	Letter, P. P. Carier to NRC, providing TVA response to Parts 2, 3, and 4 of Generic Letter 92-01, Revision 1, Supplement 1, "Reactor Vessel Structural Integrity."
November 9, 1995	Letter, R. R. Baron to NRC, submitting emergency response data system implementation plan attribute list and data point library.
November 9, 1995	Letter, R. R. Baron to NRC, submitting information required by 10 CFR Part 50, Appendix E, Section VI, regarding emergency response data system.
November 20, 1995	Letter, R. R. Baron to NRC, submitting additional information on inservice testing of pumps and valves.
December 15, 1995	Letter, K. C. Goss of Federal Emergency Management Agency to D. Crutchfield of NRC, stating that all open issues regarding offsite emergency preparedness are closed.
February 3, 1996	Letter, J. A. Scalice to NRC, submitting additional information on radiation monitors and the vehicle bomb control program.

APPENDIX E

PRINCIPAL CONTRIBUTORS

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APPENDIX F*

REPORT OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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* Supplement F first appeared in SSER 1. It is updated in SSER 20.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

November 8, 1995

The Honorable Shirley Ann Jackson
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Chairman Jackson:

SUBJECT: APPLICATION FOR OPERATING LICENSE FOR WATTS BAR NUCLEAR PLANT UNIT 1

During the 426th meeting of the Advisory Committee on Reactor Safeguards, November 2-4, 1995, we reviewed the application of the Tennessee Valley Authority (TVA) for a license to operate the Watts Bar Nuclear Plant Unit 1. The Watts Bar Subcommittee also discussed this matter at a meeting on November 1, 1995. During the meetings, we had the benefit of discussions with representatives of the NRC staff and the TVA staff, and several members of the public. We also had the benefit of the documents referenced. Several ACRS members visited the site on October 3, 1995. The Committee previously reported on the TVA application on August 16, 1982.

Watts Bar Nuclear Plant Unit 1 is located in eastern Tennessee. The unit employs a Westinghouse nuclear steam supply system with a rated core power level of 3411 MWt and has an ice-condenser containment. The design is similar to that of the Sequoyah Nuclear Plant Units 1 and 2, which received their operating licenses in September 1980 and September 1981, respectively.

In its August 16, 1982 report, the Committee concluded that the Watts Bar units could be operated without undue risk to the health and safety of the public subject to the satisfactory completion of construction, staffing, and preoperational testing, as well as to the resolution of the following concerns: a serious quality assurance breakdown, flow-induced vibration in the steam generators, the integrity of the cement lining of the essential raw cooling water system piping, and the acceptability of the hydrogen control system.

There has been a long history of construction quality problems leading to a number of work stoppages at Watts Bar. With the restart of construction in December 1991, TVA's corrective actions have resulted in improvements in its quality assurance program. The staff has concluded that current performance indicates that TVA

has overcome significant weaknesses identified in the past and that TVA's recent performance is satisfactory. Plant construction is now essentially complete and TVA has conducted a successful hot functional test.

We discussed the status of the concerns noted above during our 415th meeting of November 3-4, 1994, and our 426th meeting of November 2-4, 1995. We believe that TVA and the staff have adequately addressed these concerns. During our discussions, the Watts Bar management expressed its commitment to operational excellence and to establishing an effective safety culture. It is our view that TVA's commitment is genuine, but that achieving and maintaining an effective safety culture will require continued senior management involvement.

The NRC staff stated, in Supplement 18 to the Watts Bar Safety Evaluation Report, that all licensing issues have been resolved with the exception of those related to fire barrier penetration seals and emergency lighting inside the reactor building. As a result of our review, we have not identified any new safety concerns.

We believe that, subject to resolution of the open issues to the satisfaction of the staff, there is reasonable assurance that Watts Bar Nuclear Plant Unit 1 can be operated at core power levels up to 3411 MWt without undue risk to the health and safety of the public.

Sincerely,

T. S. Kress

T. S. Kress
Chairman

References:

1. U. S. Nuclear Regulatory Commission, NUREG-0847, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2," through Supplement 18, issued October 1995
2. U. S. Nuclear Regulatory Commission, NUREG-1528, "Reconstitution of the Manual Chapter 2512 Construction Inspection Program for Watts Bar Unit 1," issued September 1995
3. Letter dated August 16, 1982, from Paul Shewmon, ACRS Chairman, to Nunzio J. Palladino, NRC Chairman, Subject: ACRS Report on Watts Bar Nuclear Plant, Units 1 and 2
4. Letter dated October 26, 1995, from Paul Gunter, Nuclear Information and Resource Service, to Noel Dudley, ACRS, Subject: Public Concerns With Fire Protection Issues At Watts Bar Nuclear Power Station

5. Additional documents submitted to the Committee by members of the public at ACRS meetings November 1-2, 1995

APPENDIX G

ERRATA TO WATTS BAR SAFETY EVALUATION REPORT SUPPLEMENT 19

Section	Page	Change
Appendix FF	13	Paragraph at the bottom: references to "A4" and "M4" should be deleted. The sentence now reads "Watts Bar penetration seal details H1 and L1 are 3-hour fire-rated....."
Appendix FF	15	Paragraph at bottom of page: should be "8-foot" instead of "8-inch". The sentence should read "The test assembly consists of a 8-foot x 13-foot x 12-inch-thick concrete slab with...."
Appendix FF	24	Sentence that contains the word "foam" is corrected to "elastomer". The sentence now reads "Since the 3-hour rated configuration with 6 inches elastomer was structurally stable....."
Appendix FF	27	Several references to "foam" are changed to "elastomer".

NRC FORM 335 (2-89) NRCM 1102, 3201, 3202

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. 20

2. TITLE AND SUBTITLE

Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2

3. DATE REPORT PUBLISHED

MONTH	YEAR
February	1996

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

Peter S. Tam 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 Reactor Projects - I/II
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 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 8. above.

10. SUPPLEMENTARY NOTES

Docket Nos. 50-390 and 50-391

11. ABSTRACT (200 words or less)

Supplement No. 20 to the Safety Evaluation Report for the application filed by the Tennessee Valley Authority for license to operate Watts Bar Nuclear Plant, Units 1 and 2, Docket Nos. 50-390 and 50-391, located in Rhea County, Tennessee, has been prepared by the Office of Nuclear Reactor Regulation of the Nuclear Regulatory Commission. The purpose of this supplement is to update the Safety Evaluation with (1) additional information submitted by the applicant since Supplement No. 19 was issued, and (2) matters that the staff had under review when Supplement No. 19 was issued.

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 Nos. 50-390/50-391

13. AVAILABILITY STATEMENT

Unlimited

14. SECURITY CLASSIFICATION

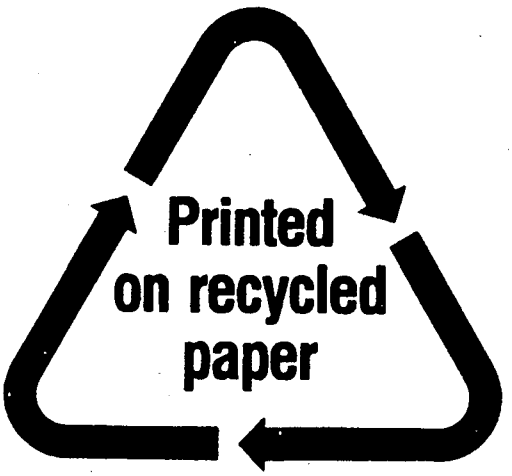
(This Page) Unclassified

(This Report) Unclassified

15. NUMBER OF PAGES

16. PRICE

NRC FORM 335 (2-89)



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