UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

August 10, 2005

Tennessee Valley Authority
ATTN: Mr. Karl W. Singer
Chief Nuclear Officer and
Executive Vice President
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR POWER PLANT - NRC SUPPLEMENTAL INSPECTION REPORT NO. 05000390/2005011

Dear Mr. Singer:

We indicated in our Assessment Follow-up Letter dated May 31, 2005, that we planned to conduct NRC Supplemental Inspection Procedure 95001 at your Watts Bar Unit 1 facility in accordance with the NRC's Action Matrix response to a White inspection finding. On July 15, 2005, the NRC completed this supplemental inspection at your Watts Bar Nuclear Power Plant. The enclosed report documents the inspection results which were discussed on July 15, 2005, with Mr. M. Skaggs and other members of your staff.

This supplemental inspection was an examination of the root cause analysis, extent of condition and cause determinations, and corrective actions associated with the White finding identified in the Mitigating Systems Cornerstone. The finding involved the failure to promptly implement corrective actions for silt blockage of Essential Raw Cooling Water piping.

Based on this inspection, we have concluded that your root cause evaluation was thorough and effectively identified the primary and contributing causes. The completed and proposed corrective actions, including actions to prevent recurrence, appropriately addressed the results of your root cause evaluation and your implementation schedule was consistent with the overall safety significance of the problem. As such, the inspection objectives of Inspection Procedure 95001, "Inspection For One Or Two White Inputs In A Strategic Performance Area," have been satisfied. Given your acceptable performance in addressing the corrective action weaknesses and silting problems, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program."

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Stephen J. Cahill, Chief
Reactor Projects Branch 6
Division of Reactor Projects

Docket No.: 50-390
License No.: NPF-90

Enclosure: NRC Supplemental Inspection Report 05000390/2005011
w/Attachment: Supplemental Information

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OFFICE	RII:DRS	RII:DRP											
SIGNATURE	PKV	SJC											
NAME	KVanDoorn	SCahill											
DATE	08/03/2005	08/10/2005											
E-MAIL COPY?	YES NO	YES NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES NO

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U.S. NUCLEAR REGULATORY COMMISSION
REGION II

Docket No:	50-390
License No:	NPF-90
Report No:	05000390/2005011
Licensee:	Tennessee Valley Authority (TVA)
Facility:	Watts Bar Nuclear Plant, Unit 1
Location:	1260 Nuclear Plant Road Spring City TN 37381
Dates:	July 13-15, 2005
Inspector:	K. VanDoorn, Senior Reactor Inspector
Approved by:	Stephen J. Cahill, Chief Reactor Projects Branch 6 Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000390/2005011; 07/13/2005 - 07/15/2005; Watts Bar, Unit 1 and 2; Supplemental inspection for a White finding related to the failure to promptly initiate corrective actions for silt blockage of Essential Raw Cooling Water system piping.

This inspection was conducted by a Senior Reactor Inspector from NRC/Region II. No findings of significance were identified. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

Cornerstone: Mitigating Systems

This supplemental inspection was performed by the NRC to assess Tennessee Valley Authority's evaluation and corrective actions associated with a White finding related to the failure to promptly initiate corrective actions for silt blockage of Essential Raw Cooling Water system piping. The performance issue for the finding was previously characterized as having low to moderate risk significance (White) in the NRC Final Significance Determination letter (IR 05000390/2005008), dated April 11, 2005.

During this supplemental inspection, which was performed in accordance with Inspection Procedure 95001, "Inspection for One or Two White Inputs In a Strategic Performance Area," the NRC concluded that the licensee's problem identification and root cause analyses were thorough and acceptable. The licensee determined that the root causes of the event were attributable to less than adequate sensitivity to silt, failure to use a systematic process for non-design engineering output products, and the lack of a systematic program and capability for flushing. The completed and proposed corrective actions, including actions to prevent recurrence, have adequately addressed the results of the root cause evaluations.

Given the licensee's acceptable performance in addressing the silting problems, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in IMC 0305, "Operating Reactor Assessment Program." Implementation of the licensee's corrective actions will be reviewed during future routine inspections.

Report Details

01 **Inspection Scope**

This supplemental inspection was performed by the NRC to assess the Tennessee Valley Authority's evaluation and corrective actions associated with a low-to-moderate risk significant (White) finding applicable to Unit 1. The White finding was in the Mitigating Systems Cornerstone in the reactor safety strategic performance area. The performance issues associated with this finding were previously characterized in NRC Inspection Report (IR) 05000390/2005007 as preliminarily White, and later characterized as White in the NRC Final Significance Determination letter (IR 05000390/2005008), dated April 11, 2005. The inspection involved a review of the licensee's problem identification, root cause analysis, and corrective actions associated with this White finding.

The inspector assessed the adequacy of the licensee's root cause analyses, determined if appropriate corrective actions were specified and scheduled commensurate with risk, and determined if the proposed actions were sufficient to prevent recurrence. This assessment included a review of the licensee's Problem Evaluation Reports (PERs), root cause analyses, completed and scheduled corrective actions, procedures, additional related documents, and interviews with key plant personnel.

This supplemental inspection was conducted in accordance with the requirements of NRC Inspection Procedure (IP) 95001. Consequently, the following report details are organized by the specific inspection requirements of IP 95001, which are noted in italics.

02 **Evaluation of Inspection Requirements**

02.01 Problem Identification

a. Determination of who identified the issue and under what conditions.

The licensee failed to identify the significance of potential silt blockage, despite multiple opportunities, and take appropriate corrective actions. Subsequently, the licensee found the Essential Raw Cooling Water (ERCW) line to the 1A Centrifugal Charging Pump (CCP) motor cooler completely blocked. The NRC identified that the licensee failed to recognize the significance of the ERCW to 1A-CCP blockage and failed to identify the prior opportunities to take appropriate corrective actions. Contributing to the problem was the fact that the licensee's Maintenance Rule and Probabilistic Risk Assessment (PRA) information had not identified this line as risk significant due to an outdated PRA.

b. Determination of how long the issue existed, and prior opportunities for identification.

The licensee had identified multiple problems with silt buildup in raw water lines for several years, beginning as early as 1999. Then, in 2003 and 2004, a marked increase in rainfall contributed to an increase in silting. Multiple instances of silting were handled as individual problems in the corrective action program without identifying a trend or conducting a thorough review for appropriate broad corrective actions. The blockage to

the 1A-CCP was identified by the licensee on 11/23/2004. In December, 2004, the NRC identified that the licensee had not recognized the significance of this event (identified in licensee PER 72620) and had not recognized a potential adverse trend for silt blockage.

The licensee then issued PER 74391 to evaluate a potential trend for silting. Subsequent to the White finding, the licensee issued PER 78378 to conduct a root cause evaluation of the failure to properly address the silting problem. Later, PER 78261 was initiated to capture all actions associated with the technical aspects of foreign material in raw water systems, incorporating actions from PERs 72620 and 74391.

c. Determination of the plant-specific risk consequences and compliance concerns associated with the issue.

The NRC IR 05000390/2005007 dated March 2, 2005, stated that the change in core damage frequency for this finding was calculated to be approximately 5.3E-6 for a 251-day interval; i.e., half of the time since the line was known to have been blocked, using a modified Simplified Plant Analysis Risk (SPAR) PRA model under a Phase III Significance Determination Process analysis. Therefore, based on the risk increase over the base case being greater than 1E-6, the finding was characterized as White. The licensee concurred with the results of the PRA risk analysis performed by the NRC's Senior Risk Analysts.

d. Assessment

The licensee had initially failed to initiate timely corrective actions leading to the finding. However, subsequent licensee actions were considered to be appropriate.

02.02 Root Cause, Extent of Cause, and Extent of Condition Evaluation

a. Evaluation of methods used to identify root causes and contributing causes.

The inspector reviewed the methodology and results of the licensee's root cause analyses as documented in the PER 78378, "Potential White Finding due to Silt Blockage," and PER 78261, "Raw Water Foreign Material (Silt, Clams, and MIC)." The analyses used several formal systematic processes to identify root and contributing causes.

For PER 78378, the licensee formed a root cause team consisting of a corporate senior manager as lead along with two site managers, a site system engineer, the corporate Raw Water Program manager, and a consultant. The Event and Causal Factors Chart (E&CF) methodology was utilized. In addition, the licensee performed an Organizational and Programmatic Deficiency and Management Error Stream Analysis. The team evaluated a significant amount of information including past history and industry experience along with conducting interviews of personnel. The licensee concluded that the root causes of the failure to promptly initiate appropriate corrective actions were as follows:

- Less than adequate sensitivity to silt
- Failure to use a systematic process for non-design engineering output products

For PER 78261, the licensee formed a root cause team consisting of an Engineering manager, a site expert in root cause analysis, a corporate chemistry person, and two additional Engineering personnel. This team utilized information from the other analysis and expanded on the E&CF analysis with more specific information regarding all possible fouling of raw water systems. In addition a Kepner-Tregoe (K-T) analysis was performed. The licensee concluded that the root cause for excessive silt buildup was as follows:

- The lack of a systematic program and capability for flushing

The licensee analysis also showed that inadequate corrective action was a management error that directly contributed to this finding. The analysis identified that implementation and monitoring of the corrective action program as related to ERCW foreign material management were primary causes of this failure. The licensee identified multiple opportunities that had existed to recognize the significance and the need for broader corrective actions.

Contributing to the failure was an omission to promptly update the site PRA analysis for common cause failure probabilities.

The licensee identified numerous related causal factors in the analyses associated with the finding. These involved the following:

- Inadequate personnel performance for emergent and off-normal conditions
- Lack of a systematic strategy for the ERCW system
- Over reliance on individual expertise
- Procedure weaknesses
- Poor use of operating experience
- Communications weaknesses
- Expectations for the Raw Water Team
- System design vulnerabilities
- Lack of routine on-line monitoring or trending of river water turbidity
- Ineffective chemical treatment
- Localized areas of higher temperatures

- Bioloading caused reduced effectiveness of chemical treatment, and
- Weaknesses in guidance for PER trending.

b. Level of detail of the root cause evaluation.

The analyses appropriately considered hardware, process, and human performance issues that contributed to the problems.

The inspector's review of the licensee's root cause analyses determined that they had been performed to a level of depth commensurate with the significance of the issue and provided reasonable assurance that the root causes and contributing causes had been identified.

c. Consideration of prior occurrences of the problem and knowledge of prior operating experience.

The inspector determined that during the root cause analyses conducted under PERs 78378 and 78621, the licensee reviewed a significant amount of information for both industry and in-house operating experience to determine if any similar problems had been previously identified to aid in the resolution of the issues. The licensee recognized the failed previous opportunities to identify adequate corrective actions and factored this into the current corrective actions.

d. Consideration of extent of cause and extent of condition of the problem.

The licensee evaluated both extent of condition and extent of cause. Regarding the causes related to allowing excessive silting, the licensee considered all raw water systems as potentially having similar problems. The root cause associated with use of the systematic process for Engineering products was specific to Engineering. The licensee did not identify any other patterns of recurring conditions or causes which had not received aggressive action.

The inspector concurred that the licensee's actions properly identified and addressed extent of cause and the extent of condition at the station.

e. Assessment

The licensee's root cause analyses associated with the silting problems that resulted in the White finding were adequate and identified both root and contributing causes relative to the event. Corrective actions have been developed to address each of these causes in the PERs containing the root cause analyses documentation. One deficiency was noted in PER 78378, in that, wording indicated that guidance for Engineering products did not exist and an action would be initiated to develop the guidance.

In fact, guidance did exist in licensee procedure Nuclear Engineering Department Procedure (NEDP-20), Conduct of the Engineering Organization. The licensee subsequently clarified the corrective action to providing improvements to the guidance.

02.03 Corrective Actions

a. Appropriateness of corrective actions

The inspector reviewed all completed and pending corrective actions associated with this finding.

The licensee initiated appropriate corrective actions for each of the root causes and other causal factors. In some cases multiple corrective actions addressed an individual cause. Corrective actions included the following:

- Clarification of management expectations in several areas
- Improved procedural guidance
- Correction of the inappropriate risk characterization of the ERCW line to 1A-CCP
- Personnel briefings
- Improve quality assurance of Engineering products
- Formally document review of dead legs and low flow areas
- Assure the Raw Water Team addresses all aspects of using river water
- Develop a project plan for an improved flushing regime for low flow and dead leg areas
- Chemical treatment improvements
- Initiate turbidity monitoring
- Initiate veliger monitoring
- Evaluation for necessary design changes
- Evaluation of cooling tower basin cleaning frequency
- Evaluation of heat exchanger cleaning frequencies
- Initiation of Intake Pumping Station cleaning preventive maintenance instructions
- Improvement in operating experience reviews

- Revising PER trending guidance
- Personnel training, and
- Improvement in the Management Review Committee process.

b. Prioritization of corrective actions

The inspector determined that the corrective actions associated with the silting problems have been appropriately prioritized by the licensee considering the risk significance.

c. Establishment of schedule for implementing and completing the corrective actions.

The inspector verified that the remaining corrective actions associated with this finding are captured in the electronic corrective action program system with responsible individuals, due dates and sufficient detail to ensure they are tracked and completed commensurate with their relative priority.

d. Establishment of quantitative or qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence.

Relative to measuring effectiveness of corrective action, the licensee's electronic PER process was programmed to initiate an effectiveness review.

e. Assessment

Corrective actions specific to the issues related to the corrective action deficiencies and silting problem have been effective in addressing the extent of cause and extent of condition.

The corrective actions addressing the aspects of the White finding appear adequate to resolve the weaknesses that resulted in the event.

02.04 Open Items

(Closed) VIO 05000390/2005008-01: Inadequate Corrective Action to Identify and Correct Silt Blockage of ERCW Piping. Based on the satisfactory results of this supplemental inspection and the licensee's established corrective actions, this violation was determined to be sufficiently addressed to close the associated open item. Given the licensee's acceptable performance in addressing the silting problems, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in IMC 0305, "Operating Reactor Assessment Program."

03 **Management Meetings**

Exit Meeting Summary

The inspector presented the inspection results to Mr. M. Skaggs, Site Vice President, and other members of licensee management on July 15, 2005. The inspector did not review proprietary information during the inspection.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

L. Bryant, Manager, Engineering &Technical Systems
M. DeRoche, Site Nuclear Assurance Manager
J. Frisco, Site Engineering Manager
A. Hinson, Maintenance & Modifications Manager
M. King, Chemistry Superintendent
S. Krupski, NSSS System Engineering Manager
W. Lagergren, Site Vice President
G. Morris, Manager, Corporate Nuclear Licensing and Industry Affairs
P. Pace, Site Licensing Manager
M. Skaggs, Site Vice President
G. Vickery, Chemistry and Environmental Manager
D. White, Operations Manager

NRC

S. Cahill, Chief, Reactor Projects Branch 6, Division of Reactor Projects, Region II
M. Pribish, Resident Inspector, Watts Bar Nuclear Plant

ITEMS OPENED AND CLOSED

Opened

None

Closed

05000390/200508-01	VIO	Inadequate Corrective Action to Identify and Correct Silt Blockage of ERCW Piping (Section 02.04)

Attachment

LIST OF DOCUMENTS REVIEWED

Procedures

NEDP-20; Conduct of the Engineering Organization, Revision 5
SPP-7.1, On Line Work Management, Revision 5
SPP-9.7, Corrosion Control Program, Revision 10
SPP-3.1; Corrective Action Program, Revision 9
BP-250, Corrective Action Program Handbook, Revision 9
OEDP-9, Emergent Issue Response, Revision 2
TI-50.030, Manual Valve Exercising (System 67), Revision 9
TI-67.003, Component Flow Debris/Foreign Material Testing Utilizing Ultrasonics Essential Raw Cooling Water-Train A, Revision 3
TI-124, Equipment to Plant Risk Matrix, Revision 11

Corrective Action Documents

PER 78261, Raw Water Foreign Material (Silt, Clams, and MIC)
PER 78378, Potential White Finding di to Silt Blockage
PER 72620, CCP 1A ERCW Alt Cooling
PER 74391, ERCW Silt Accumulation Trend
PER 77230, ERCW Emergency Supply to CCS Surge Tanks A/B
PER 76364, WBN PSA CCS/ERCW Modeling Issues

Maintenance Documents

Work Order (WO_ 04-821839Component Flow Blockage Testinf-Essential Raw Cooling Water Train B dated 01/11/2005
WO 04-822048, Component Flow Blockage Testing-Essential Raw Cooling Water Train A dated 01/23/2005
WO 04-815764, Component Flow Blockage Testing Utilizing Ultrasonics Essential Raw Cooling Water Train A dated 03/17/2005
WO 05-810436, Component Flow Blockage Testing Utilizing Ultrasonics Essential Raw Cooling Water Train A dated 06/16/2005
WO 04-815882, Component Flow Blockage Testing Utilizing Ultrasonics Essential Raw Cooling Water Train B dated 03/22/2005
WO 05-810248, Component Flow Blockage Testing Utilizing Ultrasonics Essential Raw Cooling Water Train B dated 05/31/2005

Miscellaneous Documents

Events and Causal Factors charts and K-T analysis associated with PERs 78261 and 78378
Supervisory Brief to Managers/Supervisors dated July 1, 2005
Supervisory Brief to System Engineers dated July 1, 2005
Supervisor Brief to System and Design Engineers and Managers dated July 6, 2005
Corrective Action Program training slides
Self-assessment guidance for conduct of Engineering dated July 15, 2005
3-OT-SOER02-4, Reactor Pressure Vessel Head Degradation at Davis-Besse Nuclear Power Station, Revision 1