APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-382/94-15

Operating License: NPF-38

Licensee: Entergy Operations, Incorporated
P.O. Box B
Killona, Louisiana 70066

Facility Name: Waterford Steam Electric Station, Unit 3

Inspection At: Waterford Steam Electric Station, Unit 3

Inspection Conducted: May 29 through July 9, 1994

Inspectors: E. J. Ford, Senior Resident Inspector

J. L. Dixon-Herrity, Resident Inspector

K. D. Weaver, Reactor Inspector

Approved: Gregory A. Pick for 8/4/94
C. A. VanDenburgh, Chief, Project Branch D Date

Inspection Summary

Areas Inspected: Routine, unannounced, resident inspection of plant status, plant operations, maintenance and surveillance observations, plant support activities, and onsite engineering.

Results:

Plant Operations

Operator attentiveness, execution of duties, and communications were considered to be good during this inspection period (Section 2.1). Operator response to the June 12, 1994, turbine trip reflected a good knowledge of plant systems and utilization of proper procedures and practices (Section 2.3). In addition, the operators were knowledgeable of minor plant and equipment discrepancies (Section 2.3).

Incorrect flow diagrams for the chemical and volume control system and the primary makeup water system resulted in the June 7, 1994, positive reactivity addition event during purging of the letdown radiation monitor. These examples of inadequate plant configuration control were identified as a violation of NRC requirements (Section 2.2.1).

Inadequate equipment control of shield building ventilation fan Train B fuses provided an example of inattention to detail (Section 2.4).

Maintenance

Routine maintenance and surveillance activities were observed by the inspectors with no significant observations noted (Sections 3.1 and 4.1). However, while minor in nature, the failure to remove a condition identification tag from a previously repaired valve operator indicated inattention to detail by maintenance personnel (Section 2.2.1).

Plant Support

General observations of workers and radiation protection personnel indicated that good radiation work practices were being performed. The inspectors noted that proper protective clothing practices were utilized, conveyance of required equipment into posted areas was appropriately performed, postings were appropriate to the circumstances, and good practices were observed for maintaining radiation exposure as low as reasonably achievable (Section 5.1).

Engineering

The inspectors concluded that during this inspection licensee engineering personnel were aggressive in identifying equipment problems and resolutions. The problem solving capabilities of the engineers allowed quick identification and resolution of the main feedwater equipment problems (Section 6.1).

Management Overview

Plant management displayed a conservative approach concerning plant operations and equipment reliability during this inspection. Management elected to not return to power until reasonable root-cause determinations had been made concerning the June 12, 1994, turbine trip event (Section 2.3). Additionally, license management aggressively pursued methods of dose equivalent iodine (DEI) level reduction and control (Section 5.2).

Summary of Inspection Findings:

Violation 458/9415-01 was opened (Section 2.2.1).
Unresolved Item 382/9415-02 was opened (Section 2.4).

Attachment:

- Persons Contacted and Exit Meeting

DETAILS

1 PLANT STATUS

At the beginning of the inspection period, the unit was at 100 percent power. On May 30, 1994, the licensee commenced a power reduction in accordance with the Technical Specification requirements for a core operating limits supervisory system failure. After the supervisory system was returned to service, the unit was raised from 88 to 100 percent power. On June 7, 1994, the reactor coolant system was inadvertently diluted, resulting in a positive reactivity addition, which caused reactor power to increase to approximately 100.5 percent. The dilution was corrected, and the unit was stabilized and returned to 100 percent power that day. On June 12, 1994, the plant experienced a reactor cutback from 100 percent power due to a main turbine trip on high moisture separator levels. The operators stabilized the unit at 30 percent power to return condenser water chemistry to normal specifications. On June 14, 1994, the operators attempted to achieve full power; however, at approximately 50 percent power, problems were experienced with main feedwater Pump B. Subsequent to troubleshooting and corrective activities, the unit was returned to 100 percent power on June 15.

2 PLANT OPERATIONS (71707)

The objectives of this inspection were to ensure that the facility was being operated safely and in conformance with regulatory requirements, to ensure that the license's controls were effective in achieving continued safe operation of the facility, to independently verify the status of the plant systems, and to evaluate the effectiveness of the licensee's self-assessment programs.

2.1 Control Room Observations

The inspectors observed control room activities on a daily basis, noting that the operators demonstrated a professional attitude throughout the period. During periodic reviews of control panels in the control room, the inspectors noted that three of the four safety channel indications for reactor coolant system hot leg temperature Loops A and B indicated a 2-3°F difference between the loops. When questioned, the operators provided the inspectors with documentation that described a vendor evaluation, which determined that the acceptable amount of hot leg instrument deviation was 10°F and indicated that the difference was due to reactor coolant system flow stratification.

On June 10, 1994, the inspectors observed the operating staff's performance during a tornado event. The control room had received several telephone calls that a tornado had formed near the site. After contacting the National Weather Service, the operations staff initiated Off-Normal Procedure OP-901-521, "Severe Weather and Flooding," sounded the station alarm, and instructed personnel to seek shelter. The observed funnel cloud did not touch down in the licensee's owner-controlled area. Within

approximately 1 hour, the National Weather Service cancelled the tornado warning, and use of Procedure OP-901-521 was terminated. Operator attentiveness, execution of duties, and communications during the tornado event were good.

2.2 Plant Tours

During daily tours of the plant, the inspectors noted that the electrical breakers for the main feedwater bypass valve were locked in the open position on the associated 480 volt motor-control center. The inspectors' questioning of this practice disclosed that the main feedwater startup valves, not the feedwater bypass valves (unlike similarly designed plants), receive an open signal on a turbine trip. The inspectors concluded that no problem existed with the bypass valves' breakers being locked in the open position.

2.2.1 Inadequate Configuration Documents Resulted in Positive Reactivity Addition

On June 7, 1994, a positive reactivity addition to the core occurred as a result of purging the letdown radiation monitor with primary makeup (unborated) water. The letdown radiation monitor was purged to support maintenance on the radiation monitor's heat exchanger. Upon noting an increasing reactor power and temperature, control room personnel added boric acid to the reactor coolant system to stabilize plant conditions. The licensee determined that approximately 285 gallons of unborated primary makeup water had been added to the volume control tank during the purging evolution and that reactor power peaked at 100.5 percent. Condition Report CR-94-558 was initiated and an event review team was formed to evaluate the incident and determine the root cause.

The inspectors reviewed the flow diagrams for the chemical and volume control system (Drawing No. G-168, Sheet 1) and the primary makeup system (Drawing 161, Sheet 2). The flow diagram for the chemical and volume control system did not show the purge connections for the radiation monitors but did show the process flow through the monitor. The flow diagram for the primary makeup system incorrectly indicated that purge flow went to a floor drain and not to the chemical and volume control system. The inspectors questioned engineering personnel as to why the station-controlled flow diagrams located in the control room did not provide detailed radiation monitor flow connections. The licensee stated that this level of detail is normally not included in flow diagrams because it is detailed in the vendor drawings. However, the inspectors noted that the vendor drawings were not located in the control room for operations personnel usage. The failure to provide adequate plant configuration documents is a violation of NRC requirements and one example of Violation 382/9415-01.

On June 23, 1994, during a tour of the component cooling water heat Exchanger A room, the inspectors identified a ball valve installed downstream of drain Valve CC-120A which did not have a identification label and was not on the component cooling water system flow diagram (Drawing G-160).

Licensee personnel indicated that the ball valve was probably installed during the last refueling outage for chemical cleaning of the heat exchangers and that, after cleaning, the ball valve should have been removed and a pipe endcap reinstalled.

The inspectors were concerned that the lever-type handle of the ball valve could be inadvertently pushed open allowing auxiliary component cooling water to flow to the floor, since no lock was installed to limit operation. In response to this concern, the licensee indicated that drain Valve CC-120A upstream of the ball valve was closed and that, if the ball valve were inadvertently opened, there would be no flow. In an attempt to demonstrate the lack of flow from the drain line to the inspectors, operations personnel opened the ball valve. Upon opening the ball valve auxiliary component cooling water flowed to the floor despite attempts to tighten Valve CC-120A. The operators closed the ball valve and wrote a condition identification tag for leakage from Valve CC-120A. However, the licensee stated that, if flow had been allowed to continue, it would not have effected the operability of the component cooling water heat exchanger. The failure to maintain accurate plant configuration documents is a second example of Violation 382/9415-01.

During a tour of component cooling water Pump B room, the inspectors noted Condition Identification CI-2232, which stated that the valve operator for component cooling water Pump B discharge Valve MV-125B was broken. The inspectors questioned the system engineer and asked if the valve would be able to close, if necessary. The engineer stated that the valve had been repaired during the last refueling outage and that maintenance personnel had failed to remove the tag following the repair activities. The inspectors concluded that, while minor in nature, the failure to remove the tag indicated inattention to detail by maintenance personnel.

2.3 Turbine Trip

On June 12, 1994, while operating at full power, the plant experienced a reactor cutback due to a turbine trip caused by moisture separator reheater (MSR) high water level. The reactor cutback automatically inserts preselected control element assembly Subgroups 5 and 11 into the core. The inspectors responded to the control room to observe operator performance and evaluate plant status.

The plant was stabilized by the operators at approximately 20 percent power utilizing the steam bypass system. All reactor functions occurred as designed and no abnormal system responses were observed by the licensee. The operators appropriately maintained the plant at 20 percent, while troubleshooting efforts commenced to determine the cause of the problem. Plant management convened an event review team (ERT) to perform a root-cause analysis prior to returning the plant to full power.

The ERT results indicated that one of three level indicators on an MSR sensed a high level and its mercury switch stuck in the high level position. While

operators were evaluating the resultant annunciator, a second high level on that MSR was received and completed the coincidence needed for a turbine trip.

The ERT determined that the root cause of the event was equipment malfunction due to lack of insulation on the common high-point sensing line for the instruments. The lack of insulation apparently allowed steam condensation in the line when heavy thunderstorm activity in the area caused a sudden drop in temperature. Additionally, the ERT reported that thunderstorm-induced vibrations contributed in the level switch actuation.

The licensee initiated a review to evaluate the adequacy of piping supports to prevent inadvertent actuation of the MSR level switches due to vibration. Additionally, the licensee determined that all MSR level switches were free to actuate and reset.

On June 13, 1994, the plant was held at 30 percent power to allow the condensate system demineralizers to restore condenser chemistry to specification. On June 14, 1994, the licensee attempted to return to full power operations upon satisfying chemistry requirements; however, main feedwater Pump B failed to come up to speed and repeatedly tripped. The plant was held at approximately 60 percent power to troubleshoot and correct the main feedwater pump (see Section 6.1). The unit was restored to full power on June 15, 1994.

The inspectors determined that the operator's response to the reactor cutback and turbine trip reflected a good knowledge of plant systems and utilization of proper procedures and practices. Plant management conservatively elected to not return to power until reasonable root-cause determinations had been made.

2.4 Valve SI-502B Electrical Breaker Found in the Off Position

On June 21, 1994, in preparation for testing of hot leg injection flow control Valve SI-506B, the breaker for Hot Leg 2 injection isolation Valve SI-502B was found in the off position. Operation Procedure OP-009-008, Revision 11, Attachment 3, "Safety Injection System," required electrical power supply Breaker SI-EBKR-13B-7J for Valve SI-502B be in the on position. The licensee initiated Condition Report CR-94-601 to document the occurrence. The station log indicated that the breaker was last opened on June 10, 1994, when Valve SI-502B was deenergized to comply with the Technical Specification requirements for containment isolation (because Valve SI-506B was declared inoperable for testing).

Valve SI-502B is required to be opened for hot leg injection 2-4 hours after a loss-of-coolant accident. Simultaneous injection to the hot and cold legs is used to prevent precipitation of boric acid in the reactor vessel following a break that is too large to allow the reactor coolant system to refill. Injecting to both sides of the reactor vessel ensures that fluid from the reactor vessel (where the boric acid is concentrated) flows out of the break location and is replenished with a diluted solution of borated water.

This issue is considered an unresolved item because of the potential of the de-energization of Valve SI-502B to adversely affect the ability of the high pressure safety injection system to be aligned for simultaneous hot and cold leg injections within 2-4 hours following a loss of coolant accident (Unresolved Item 382/9415-02).

The inspectors reviewed previous condition reports related to problems with control of equipment status. Condition Report CR-94-071 documented a similar event of incorrect equipment status. This condition report documented that, on January 30, 1994, control power was found in the off position for Breaker SI-EBKR-90A-25 for no apparent reason. This breaker provided a backup DC power supply for valve position indication in the control room for reactor coolant hot leg injection isolation Valve SI-502A. Valve indication was still available at that time because the AC power supply breaker was in the closed position. In addition, on June 24, 1994, the fuses for the control power to shield building ventilation fan Train B were inadvertently removed while hanging a clearance on the fuel handling building Train B heating ventilation and air condition system. The error was immediately realized when an annunciator in the control room was received that informed operators that control switch power indication was lost and the fuses were reinstalled for the shield building ventilation fan.

The licensee stated that, during the previous Safety Review Committee meeting, previous examples of equipment status control had been identified and documented in the Safety Review Committee Meeting Minutes. The inspector reviewed the committee meeting minutes and verified that the examples were identified.

2.5 Conclusions

The operators were knowledgeable of the hot leg differential readings and the reason for the difference. Based on the vendor evaluation, the root cause of the difference was reactor coolant system flow stratification. Operator attentiveness, execution of duties, and communications were good. However, inadequate plant configuration documents for the letdown radiation monitor purge lines resulted in an inadvertent reactivity addition and is one example of Violation 382/9415-01. In addition, the failure to maintain plant configuration documents for the component cooling water heat exchanger drain line is a second example of Violation 382/9415-01. Finally, the failure to remove a condition identification tag indicated inadequate attention to detail by maintenance personnel.

Plant management conservatively maintained the plant at a reduced power level, while troubleshooting efforts commenced to determine the cause of the moisture separator reheater high level and turbine trip. Operator response to the turbine trip reflected a good knowledge of plant systems and utilization of proper procedures and practices. The removal of fuses for the shield building ventilation fan instead of the fuel handling building heating ventilation and air conditioning system was another example of inadequate equipment control resulting from inadequate attention to detail.

3 MAINTENANCE OBSERVATION (62703)

The maintenance activities addressed below were observed and documentation reviewed to verify that maintenance activities for safety-related structures, systems, and components were conducted in a manner which resulted in reliable safe operation of the plant and plant equipment.

3.1 Maintenance Observations

Work Authorization	Task
01125792	Replace PTID A59911 in Multiplexer 5 - Not Indicating Correct Voltage
01125929	Replace UV Bulb For Toxic Gas Monitor
01125938	Repair - Valve ACC-122A Will Not Move Using Controller
01125972	Repair Fast Speed Winding Leads on Dry Cooling Tower Fan 10B

Routine maintenance activities were observed by the inspectors with no significant observations noted.

4 SURVEILLANCE OBSERVATION (61726)

The inspectors observed the surveillance testing of safety-related systems and components addressed below to verify that the activities were being performed in accordance with the licensee's approved programs and the Technical Specifications.

4.1 Surveillance Observations

Procedure	Title
OP 903-001	Technical Specification Surveillance Logs
OP 903-066	Electrical Breaker Alignment Check

Routine surveillances were observed by the inspectors with no significant observations noted.

5 PLANT SUPPORT ACTIVITIES (71750)

The objectives of this inspection were to ensure that selected activities in the different areas of plant support were implemented in conformance with the facility policies and procedures and in compliance with regulatory requirements.

5.1 Radiological Controls

During plant tours of the radiological controlled areas, the inspectors verified that a selected sample of radiation protection doors were locked as required by Technical Specifications. The inspectors also verified that selected radiological areas were properly posted.

Additionally, the inspectors made general observations of workers and radiation protection personnel to ensure that good radiation work practices were being performed during maintenance activities on the chemical and volume control system radiation monitor. The inspectors noted that proper protective clothing practices were utilized, conveyance of required equipment into posted areas was appropriately performed, posting was appropriate to the circumstances, and good ALARA practices were observed.

5.2 Sampling and Chemistry

On June 21, 1994, control room personnel notified the inspectors that the dose equivalent iodine (DEI) levels in the reactor coolant system had increased from the normal value of approximately 4.0 E-3 microcuries per gram to a peak value of 95.0 E-3 microcuries per gram. The licensee stated that chemistry samples were being taken approximately every 4 hours. Because of the increase in the DEI levels in the sample analysis, the licensee was concerned that a possible fuel pin leak could exist. The licensee stated that samples had been sent to the vendor for analysis to collect further data. The licensee also stated that, since gross cesium activity did not increase, the failure was probably new fuel in the core. The inspectors continued to monitor the licensee's reports for iodine and at the end of the inspection period DEI levels had decreased and stabilized at approximately 40.0 E-3 microcuries per gram. Even though the highest peak DEI levels were below the one microcurie per gram amount specified in Technical Specifications, the license aggressively pursued methods of DEI level reduction and management.

5.3 Conclusions

Good radiation practices were exhibited by all personnel observed by the inspectors who participated in maintenance activities on the chemical and volume control system radiation monitor. The licensee was aggressive in its attempts to reduce and manage reactor coolant iodine levels.

6 ONSITE ENGINEERING (37551)

The objectives of this inspection were to provide periodic engineering evaluations for Regional assessment of the effectiveness of the onsite engineering staff.

6.1 Main Feedwater Pump B

On June 13, 1994, the inspectors observed the control room staff proceed with the power ascension. During attempts to start main feedwater Pump B, the pump

tripped on recirculation failure. During troubleshooting activities, system and maintenance engineers concluded that main feedwater Pump B recirculation Valve FW-111B was closed. Maintenance personnel disassembled the valve and found the valve disc had separated from the stem. Recirculation Valve FW-111B was repaired, placed back in service, and the feedwater pump successfully restarted.

Each of the two 12-inch feedwater pump recirculation lines discharged to the condenser and were designed to be modulated at 3200 gpm by Flow Controllers FW-111A and FW-111B. The valves normally remained closed during plant operation, but modulated flow when the associated feedwater pump operated at low flows. If recirculation flow decreased to less than 2700 gpm, with pump discharge pressure greater than 900 psig, the feedwater pump would trip after a 10-second time delay.

Discussion with engineering personnel disclosed that, on one prior occasion, the recirculation valve on main feedwater Train A had separated from the valve stem. The inspectors were concerned that there could be a possible generic problem with those types of valves. It was stated that only two valves of that type were installed in the plant and that the point on the stem where the disc had separated was the weakest point in the valve design and the expected failure point. The licensee also stated that during the previous failure the valve design was evaluated; however, a new valve design was not justified at that time. Licensee engineering personnel also stated that the valve internals would be sent back to the vendor for analysis and further evaluation and that further evaluations for a new valve design, possible preventative maintenance, or nondestructive examination inspections were in progress.

The inspectors reviewed the vendor technical manual for the recirculation valves to determine if possible vendor recommendations for inspection of these types of valves existed and noted that none were specified. Additionally, the system engineer stated that no recommendations had been supplied by the vendor.

Licensee system engineering staff provided 24-hour coverage during troubleshooting activities in order to achieve timely problem identifications and resolutions.

6.2 Conclusions

The inspectors concluded that licensee engineering personnel were aggressive in identifying the main feedwater equipment problem and the resolution. The inspectors also concluded that the engineering staff displayed a conservative approach by shipping the valve to the vendor for further analysis.

ATTACHMENT

1 PERSONS CONTACTED

1.1 Licensee Personnel

R. G. Azzarello, Director, Design Engineering
R. E. Allen, Security and General Support Manager
R. F. Burski, Director, Nuclear Safety
T. J. Gaudet, Operational Licensing Supervisor
J. G. Hoffpauir, Maintenance Superintendent
A. L. Holder, Senior Engineer, Technical Services
J. B. Houghtaling, Technical Services Manager
L. R. Leblanc, Acting Licensing Manager
A. S. Lockhart, Quality Assurance Manager
D. E. Marpe, Mechanical Maintenance Superintendent
D. P. Ortego, Shift Supervisor
D. F. Packer, General Manager, Plant Operations
W. H. Pendergrass, Licensing Shift Supervisor
R. D. Peters, Electrical Maintenance Superintendent
R. G. Pittman, Instrumentation & Controls Maintenance Superintendent
J. A. Ridgel, Radiation Protection Superintendent
R. S. Starkey, Manager, Operations and Maintenance

The personnel listed above attended the exit meeting. In addition to these, the inspectors contacted other personnel during this inspection period.

2 EXIT MEETING

An exit meeting was conducted on July 15, 1994. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee did not express a position on the inspection findings documented in this report. Information reviewed by the inspectors which related to chemical cleaning of the component cooling water heat exchanger was identified as proprietary information.