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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Request For Additional Information Regarding NPF-38-157

Gentlemen:

On August 19, 1994, Waterford 3 submitted the subject license amendment request. The proposed change would modify the Technical Specifications contained in Appendix A of the operating license by removing Limiting Condition for Operation (LCO) 3/4.3.4 "Turbine Overspeed Protection" and relocating the requirements therein to the Waterford 3 Updated Final Safety Analysis Report. The submittal complied with the NRC Final Policy Statement on Technical Specification Improvements for Nuclear Power Reactors. The intent of the proposed change (as described in our initial submittal) was to relocate the testing and maintenance requirements and subsequently increase the turbine valve test interval from monthly to quarterly via the provisions of 10CFR50.59. During a telephone conversation on October 10, 1994, the staff requested additional information concerning turbine overspeed testing. The following topics were identified:

- Turbine overspeed valve performance.
- Vendor overspeed test recommendations.
- Actions taken in response to the Salem event.
- Location of safety related equipment with regard to the turbine.
- Results of the recently completed vendor study.

Turbine overspeed valve performance.

Functional testing of the turbine steam inlet valves is performed in accordance with the Technical Specifications and based on manufacturer recommendations. The purpose of the test is to insure proper operation of throttle, governor, reheat stop and the interceptor valves. The operation of these valves are observed during the test by an operator stationed at the valves.

In the past, Waterford 3 has experienced three failures of a governor valve to stroke closed that may have affected an overspeed event. The failures occurred in December 1985, February 1987 and October 1988. The 1985 and 1987 failures were due to binding of the valve plug (piston) seal rings. This failure mechanism is addressed in Westinghouse Availability Improvement Bulletins (AIB) 8714 and 9008. The majority of recommendations in these AIBs have been implemented and no subsequent failures have occurred. The October 1988 failure was due to failure of the (MOOG) servo valve.

The electrical overspeed protection system consists of two subsystems. They are the overspeed protection controllers (OPC) which controls turbine speed when the speed reaches 103% and the overspeed protection system which closes all turbine valves when turbine speed reaches 111% of rated speed. There have been five instances of Reheat Stop Valves failing to stroke closed. These failures only affected the Reheat Stop Valves in the valve test mode. At 111% overspeed the Auto Stop Trip (AST) solenoid valves actuate and close all turbine valves (by draining the AST header). The Reheat Stop Valves are not used during OPC actuation (103%).

These failures occurred from December 1985 to July 1990. In each case a blocked orifice was determined to be the cause. Subsequent investigation resulted in finding a jell-like substance in the EH fluid system. The system was flushed and all orifices cleaned. No subsequent failures to close have occurred. The jell was believed to be formed from an interaction of the EHC fluid and o-ring lubricant. Waterford 3 no longer uses o-ring lubricant in the EH system.

Waterford 3 has no documented failures of any Throttle Valve or Intercept Valve to stroke closed that may have affected an overspeed event.

Actions taken in response to the Salem event.

The documentation associated with the Salem overspeed event, SER 92-07 and IN 91-83 has been reviewed for applicability to the Waterford 3 plant. This includes Westinghouse reports and recommendations, NRC and Salem reports, photographs and drawings. This information was used to compare the Waterford 3 physical plant as well as overspeed testing methods with other plants of similar design. The results of this review indicate that the Waterford 3 plant design contains sufficient redundancy to mitigate the occurrence of an accident similar to Salem. In addition, overspeed testing procedures have been revised to further enhance the plants overspeed circuitry reliability.

NOTE: During initial independent testing of redundant trip solenoids, one of two AST solenoid valves failed to stroke. This valve was replaced and retested satisfactorily. No other failures of solenoids has been documented that could affect an overspeed event.

Vendor overspeed test recommendations.

The Technical Specification testing and maintenance requirements are based on Westinghouse recommendations. As a result of the Salem event Westinghouse issued AIB 9301 which made several additional recommendations. The Westinghouse recommendations and the Waterford 3 positions with regard to complying with those recommendations are provided in attachment A.

Location of safety related equipment with regard to the turbine.

There is no safety-related equipment located in the Turbine Building. FSAR Section 10.2.2.1 addresses this.

The Waterford 3 turbine-generator placement and orientation is unfavorable with respect to the station reactor buildings. This configuration places the reactor auxiliary building, control room, battery room, primary water condensate storage tanks, main steam lines, and intake cooling water structure, as well as the containment building, within the low trajectory missile (LTM) strike zone.

Waterford 3 performed an analysis to evaluate the probability of damage from postulated missiles to safety related systems using the NRC recommended (Regulatory Guide 1.115) P1 value of approximately 10^{-4}. This resulted in a strike and damage probability (P2 x P3) for low trajectory missile (LTM) design and destructive overspeed cases of 0.0 and 8.4×10^{-4} per turbine failure, respectively. For high trajectory missile (HTM) design and destructive overspeed cases, probabilities of 4.4×10^{-4} and 8.5×10^{-4} respectively, were calculated. Using the NRC probabilities for missile generation (P1) of 6×10^{-5} for design overspeed failure and 4×10^{-5} for destructive overspeed resulted in a total probability (P4) of 9.4×10^{-8}. The NRC staff, in their evaluation of Waterford 3 turbine generated missiles, used more conservative P2 x P3 numbers and the same P1 numbers. The staff calculated a P4 of 4.6×10^{-7}, which was described as within the 10^{-6} to 10^{-7} range and therefore acceptable..

Results of the recently completed vendor study.

Westinghouse has recently reevaluated failure rates for turbine valves on BB-296 units with steam chests (Waterford 3 type turbines) based on valve reliability through May of 1994. The probability for turbine missile ejection (P1) at Waterford 3 was also calculated. The results show that for the maximum surveillance interval studied (6 months) P1 for Waterford 3 is much lower than the historical values assumed in the Waterford 3 and NRC studies above.

Conclusion

For the reasons described in our initial submittal and those addressed by the staff in their report to the commission (i.e., NUREG 1366), Waterford 3 respectfully request your expedited review. The Turbine Overspeed Protection System is necessary for protection of the turbine from only an operational and economic point of view. The probability of damage to safety related equipment based on turbine manufacturer's failure data was determined to be acceptably low. The subject change request will have no negative impact on the periodic turbine generator inspections, including inspections and tests of the main steam stop and control valves and reheat stop and control valves. Waterford 3 will continue to implement these commitments with the goal of maximizing turbine generator reliability and efficiency and thus minimizing long-term power generation costs.

As stated in NUREG 1366, "the issue here is not whether the test should be done , but rather how often it should be done." The factors that will determine the timing of inspections and tests will continue to include:

- Operating symptoms: vibration, abnormal pressures and temperatures, loss of capability, increase in heat rate, etc.

- Mode of Operation: number of start-ups, cyclic or base loading, etc.

- Findings from prior inspections both in-house and at other utilities,

- Recommendations of the turbine-generator manufacturer.

If you should have any questions concerning the above, please contact Paul Caropino at (504) 739-6692.

Very truly yours,

R.F. Burski

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Director
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RFB/PLC/ssf
Attachment

cc: L.J. Callan, NRC Region IV
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Westinghouse Recommendations Associated to Turbine Overspeed Testing

1. Modify the EH control system to permit on-line testing and replacement of turbine trip solenoid valves (20/OPC and 20/ET).

   This recommendation has not been implemented. Current designs to perform on-line testing have not proven to be reliable. Overall maintenance, testing and reliability of the installed system precludes the additional risk involved in on-line testing.

2. Remove, replace or rebuild and then test each turbine trip solenoid during each major unit outage.

   Turbine trip solenoids are removed each refuel to perform system flushing under procedure MM-007-018. A visual inspection is performed of the solenoid valve internals, without disassembly, under the plant cleanliness control program. The solenoids are tested for proper operation and leakage using a Electro-Hydraulic Valve Actuator Tester. Disassembly and rebuilding of these solenoid is discouraged on site. The valves are independently stroke tested after re-installation under plant procedure MI-003-441.

3. Verify all autostop oil pressure switches are set at the same pressure level.

   Autostop oil pressure switches are calibrated at the same pressure level every refuel per plant procedure MI-005-202.

4. Test each trip solenoid valve individually each startup.

   Each turbine trip solenoid valve is individually tested at the end of each refuel. A functional test of the OPC (overspeed protection circuitry) and 20/AST solenoids is performed each startup.

5. Install a second 20/AST valve on the high pressure oil supply side of the test handle.

   The Waterford 3 design contains this solenoid valve.

Westinghouse Recommendations Associated to
Turbine Overspeed Testing

6. Perform trip test of the 20-1/AST solenoid valve monthly.

This solenoid is tested at each startup. One recommendation resulting from the Salem Event is to have a redundant AST trip solenoid that is not bypassed during protective device testing. This solenoid valve is incorporated in the Waterford 3 design. Both AST trip solenoids are operated from redundant trips. Activation of any of the associated turbine trips will activate both AST trip solenoids. Testing of the 20-1 AST would require the addition of a test trip circuit or the bypassing of the 20-2 AST trip solenoid. A bypass capability of the 20-2 AST solenoid valve would defeat the inherent advantage of the solenoid. The addition of an independent trip circuit for 20-1 AST is not warranted due to the proven past performance of the trip system and current startup testing.

7. Perform mechanical overspeed trip test monthly.

Waterford 3 has experienced an inadvertent turbine trip while performing turbine protective device testing (OP-904-003). Because of the possibility of causing significant plant transients during this testing, OP-904-003 is only performed during turbine start-ups.

8. When conducting periodic trip tests at the front pedestal, the operator must have constant communications with the control room and have visual access to indications of unit speed. Also, the front pedestal operator is to release the trip bypass handle if an indication or overspeed is indicated.

Procedure OP-904-002 requires communications between the front pedestal operator and the control room.

Turbine speed indication is provided via the main oil pump discharge pressure gage.

The additional 20-2/AST trip solenoid valve is not bypassed during front pedestal protective device testing.

9. Each unit should have two independent means of tripping the unit on overspeed.

Waterford 3 has two methods of actuating a turbine trip on overspeed. The DEH senses turbine speed and provides OPC actuation or a trip as necessary. The mechanical overspeed device serves as the second dependent trip mechanism.