U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 50-344/90-33

Docket No. 50-344

License No. NPF-1

Licensee: Portland General Electric Company
121 S.W. Salmon Street
Portland, OR 97204

Facility Name: Trojan Nuclear Plant

Inspection at: Rainier, Oregon

Inspection conducted: November 26 - 29, 1990

Inspectors: F. Gee, Reactor Inspector
J. Mauck, NRR/SICB
D. Gamberoni, Reactor Inspector
A. Nolan, INEL

Approved by: D F Kirsch for F. R. Huey, Chief
Engineering Section

12/20/90
Date Signed

Summary:

Inspection During November 26 -29, 1990 (Report 50-344/90-33)

Areas Inspected: An announced inspection was conducted to verify the implementation of the Anticipated Transients Without Scram (ATWS) Mitigating System Actuation Circuitry (AMSAC) and to assess its conformance with the ATWS rule, 10 CFR 50.62. Inspection procedure 30703 and Temporary Instruction 2500/020 (25020) were used as guidance for this inspection.

Results:

General Conclusions and Specific Findings:

The licensee has installed the AMSAC equipment adequately to meet the requirements of the ATWS rule, 10 CFR 50.62. In general, the physical arrangement and installation was done in accordance with the NRC staff Safety Evaluation Report (SER) on the system. The inspectors identified that there was no plant-specific determination of the C-20 bypass time delay. The licensee committed to perform such a determination.

Significant Safety Matters: None

Summary of Violations and Deviations: None

Open Items Summary:

One item was opened, and one followup item was closed.

Details

1. Persons Contacted

*C. Cox, Compliance
*W. Nicholson, Branch Manager, Operations
*W. Peabody, Manager, Nuclear Plant Engineering
*C. Seaman, General Manager, Nuclear Quality Assurance
*T. Walt, General Manager, Technical Functions
*M. Hoffmann, Manager, Nuclear Safety & Regulation
*S. Bauer, Branch Manager, Nuclear Regulation
*P. Yundt, General Manager, Trojan Excellence
*W. Robinson, General Manager, Trojan Plant
*K. Hyland, Electrical Engineer, Nuclear Plant Engineering
*L. Phillips, Electrical Engineer, Nuclear Plant Engineering
*R. Fredricksen, Electrical Engineer, Nuclear Plant Engineering
*G. Tingley, Systems Engineering Supervisor

NRC

*J. Melfi, Resident Inspector

*Attended the exit meeting on November 29, 1990.

The inspectors also held discussions with other licensee personnel during the course of the inspection.

2. Introduction

The purpose of this inspection was to evaluate the implementation of the Anticipated Transients Without Scram Mitigating System Actuation Circuitry (AMSAC) design and installation by the Portland General Electric Company (licensee) to ensure that the implementation was in accordance with NRC Safety Evaluation Report (SER) addressing the Trojan AMSAC design. The post-implementation inspection was conducted in accordance with the guidelines established in the NRC Inspection Manual Temporary Instruction (TI) 2500/20 Revision 2, dated May 4, 1990.

3. TECHNICAL EVALUATION

3.1 GENERAL

At the Trojan Nuclear Station, the licensee implemented the AMSAC design based on steam generator low water level actuation. To reduce the possibility of spurious AMSAC actuation, the AMSAC design incorporated three-out-of-four logic taken twice. The logic function was performed by programmable logic controllers (PLCs). The SER stated that the staff's acceptance of the Trojan AMSAC design was subject to the following confirmatory items:

1. Isolation Device Qualification Tests - To verify that the electrical isolator test data was applicable to the Trojan plant and that the maximum credible fault testing was performed.

2. Test Procedures, At Power and During Refueling Cycles - To verify that the AMSAC test procedures were written, approved, in place, part of a periodic surveillance program, and part of a continuing training program.

3. Locations and Uses of Controls, Indicators, and Alarm Points - To examine the uses and locations of the AMSAC controls, indicators and alarm points through a plant walkdown.

4. Human Factors Engineering Review - To verify that the physical aspects of the AMSAC system were through a structured Human Factors review.

In addition to the confirmatory items, the inspection team examined other aspects of the AMSAC such as completed work sign-off, diversity, safety related interfaces, bypasses, procedures, annunciators, and time delays.

3.2 CONFIRMATORY ITEMS

1. Isolation Device Qualification Tests

The licensee used series SCA-100 electronic isolators manufactured by Energy, Inc. The team reviewed Qualification Report EIP-QR-100, and the test data in the report appeared to be adequate for the electronic isolators to be used in safety systems.

2. Test Procedures, At Power and During Refueling Cycles

The AMSAC test procedures were incorporated into the Surveillance Monitoring System as a Technical Specification Priority Code 1 by Administrative Order AO 6-5. General Operating Instructions GOI-5, Rev 22, dated October 31, 1990 had a line item that called for verification that the AMSAC test procedures were to be performed within the required time, prior to the plant exceeding 40% power. However, if the procedures were not performed, the plant could continue the start-up. If an AMSAC surveillance procedure was missed, a Quality Assurance Corrective Action Report (CAR) was to be issued and the missed surveillance procedure was to be performed as soon as possible. At the time of the inspection there was no priority level assigned to the performance of the maintenance routines.

The at-power surveillance procedure was performed quarterly, and the end-to-end surveillance and calibration procedures were to be performed during each refueling outage. The inspection team noted that the AMSAC was declared operational in July 1990 and at the time of the inspection some of the surveillance procedures were still in draft form. The inspection team stated the following concerns:

A. Not all of the test and maintenance procedures were approved and in place at the time the system was declared operational.

B. The AMSAC was assigned a priority level 1 for surveillance testing but with no priority assigned to the CARs or other maintenance requests.

These two concerns were discussed with the licensee and the team was informed that the required test and maintenance procedures will be in place by the time when they are actually needed and that Nuclear Plant Engineering (NPE) had recommended to operations that the maintenance requests be given a priority 2 level. The recommendation was still under consideration.

The inspection team noted that the AMSAC was designed such that a jumper was needed for testing and calibration. The licensee stated that there were two independent sets of controls governing the removal of the jumper and that the AMSAC could not be placed in operation without first removing the jumper.

3. Locations and Uses of Controls, Indicators and Alarm Points

The team observed the AMSAC controls, indicators, and alarms during the plant walk down. The AMSAC control panel and the equipment used in the AMSAC system appeared to be adequate. The control panel was very well laid out with a mimic showing the path of the signal as it progressed through the system logic. The hardware used in the system appeared to be of good quality. The inspection team found the licensee's integration of the AMSAC into the plant to be acceptable and consistent with the licensee submittals.

With respect to the alarm points, only two main control room annunciator slots were assigned to the AMSAC system. This design decision was based on the fact that the annunciator, at that time, was being fully utilized and spare or unused annunciator slots were at a premium. The annunciator, since that time, had been redesigned and upgraded with many spare slots located through the annunciator system.

Of the two slots assigned to the AMSAC, one slot read AMSAC ACTUATED and the second slot read AMSAC TROUBLE. The first alarm was self explanatory while the second alarm consisted of all of the other AMSAC alarm points. This made the alarm ambiguous as it would alarm on such points as AMSAC in Bypass, in Test, or in Trouble. The team stated a concern that the main control room alarms were ambiguous and were not reflective of true system status. With the advent of the new annunciator system, the licensee should revisit the design decision to use only two annunciator slots.

4. Human Factors Engineering Review

During the Human Factors Engineering review, the inspection team noted that the licensee did not have a formal Human Factors group as such. The licensee contracted General Physics to develop a Human Factors manual and policy. The plant's design engineers

performed the Human Factors function using the manual as a guideline. This procedure was applied to the AMSAC control panel as stated earlier.

3.3 Other Considerations

1. Completed Work

The AMSAC was declared operational in July 1990. As of the date of the inspection, the installation packages had not been closed out and the affected drawings had not been updated. The Plant Modifications group just recently gave the installation packages to Nuclear Plant Engineering (NPE) for close out. NPE had 120 days to close out the packages. The team expressed a concern that the turnaround time for plant modifications was untimely.

The licensee informed the team that this problem was being corrected by the issuance of a new procedure "As-Built Package Processing" dated September 1990. This new procedure allowed the Plant Modifications group 90 days to forward installation packages to NPE for close out. With the issuance of the new procedure, the inspection team considered the licensee's actions in this area to be acceptable.

2. Diversity

The licensee supplied an equipment list that showed that the equipment used in the AMSAC was diverse from similar type equipment used in the Reactor Protective System (RPS) performing a like function. The AMSAC logic equipment was Allen-Bradley programmable logic controllers (PLCs). The PLCs were not used anywhere in the RPS and were powered by a non-safety related uninterruptable power supply (UPS). The RPS used Westinghouse Hagan equipment. The inspection team considered the licensee's implementation of the diversity requirement to be acceptable.

3. Safety Related Interfaces

The team inspected the areas where the AMSAC interfaced with the existing safety related systems. The physical interfaces were in keeping with the plant's approved procedures, and the electrical interfaces were protected by the approved EI electrical isolators. The inspection team considered the licensee's implementation of the safety related interfaces to be acceptable.

4. C-20 Bypass

The C-20 bypass was used in the AMSAC to inhibit the actuation of the AMSAC whenever the reactor was below 40% power. Westinghouse in their generic AMSAC design set the hold-in time delay for the C-20 bypass at 360 seconds. The licensee incorporated the 360 second time delay in the Trojan AMSAC design. The team asked the licensee to demonstrate that the generic 360 second time delay was

encompassed by the plant specific conditions. The licensee could not show where the 360 time delay had been determined to be sufficient for the plant's operating conditions. The licensee committed to perform a calculation to show that the 360 second time delay was consistent with the Trojan operating conditions (Followup Item 50-344/90-33-01).

5. Training Procedures

The status of the training procedures were the same as that of the test procedures. The training procedures were not in place at the time when the AMSAC was declared operational, and they were still not in place at the time of the inspection. The team expressed concerns similar to the concerns expressed with the test procedures.

6. Means for Bypassing

The means for bypassing the AMSAC was by the use of permanently installed bypass switches. These switches were located on the AMSAC control panel installed in Rack C-72. The indication of the bypass status was displayed in the Control Room by means of an "AMSAC TROUBLE" light on the annunciator system.

7. Quality Assurance

Appendix G, Quality Assurance and Administrative Controls for Nonsafety-Related ATWS Equipment, to Trojan Nuclear Quality Assurance Program, PGE-8010, appeared to meet the intent of the quality assurance guidance in the enclosure to Generic Letter 85-06. The team observed that the activities related to AMSAC appeared to be performed in accordance with the said quality controls and that the personnel responsible for supervising and implementing the ATWS plan were knowledgeable and capable of implementing the plan.

8. Software

The team inspected the software process that was used for the Allen Bradley programmable logic controllers (PLCs). The software was basic ladder logic which was provided in a document labeled "Software Package of AMSAC, Revision 0." This software logic was reviewed by the inspection team, and all questions were answered satisfactorily by the licensee. The team then inspected the verification and validation process that was used for the AMSAC software. The licensee stated that Nuclear Division Procedure (NDP) 200-5 "Quality Related Computer Programs" was used as a guideline where applicable. This document set forth the procedures to be followed for the verification of software programs. Section 5.2.6.6 outlined the verification process. In addition, documentation requirements were discussed in this document. The administrative order (AO-5-6) which controlled software changes was reviewed. This document established the methods by which

controlled computer software changes were to be requested, reviewed, implemented, approved and documented. The team concluded that this document provided an acceptable format for a configuration management process. The formal validation of the software was performed using Temporary Plant Test (TPT) TPT-342, "AMSAC LOGIC TEST." The team reviewed this test procedure and considered that it only tested the software for normal inputs and that underrange, overrange, negatives and zeros were not accounted for by the logic test. The team discussed this shortcoming with the licensee and also provided information regarding current industry software standards such as those from the Institute of Electrical and Electronics Engineers (IEEE) and the American Society of Mechanical Engineers (ASME). The team stated that the software process for AMSAC was marginally adequate and could have been improved with the adoption of current industry standards. The team also stated that the software process, NDP 200-5, if used for a safety system would not be adequate and that the mentioned industry standards would have to be incorporated in some form in the verification and validation process.

No violations or deviations were identified.

4. (Closed) Followup Item No. 50-344/TI-00-20 Implementation of AMSAC

This inspection verified the implementation of the AMSAC in accordance with the NRC staff Safety Evaluation Report and with the concerns identified in the aforementioned paragraphs.

This item is closed.

5. Exit Meeting (30703)

The inspectors conducted an exit meeting on November 29, 1990, with members of the licensee staff as indicated in paragraph 1. During this meeting, the inspectors summarized the scope of the inspection activities and reviewed the inspection findings as described in this report. The licensee acknowledged the concerns identified in the report.