UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
PORTLAND GENERAL ELECTRIC COMPANY
TROJAN NUCLEAR PLANT
DOCKET NO. 50-344
APPENDIX R TO 10 CFR 50, SECTIONS III.G.3 AND III.L

I. INTRODUCTION

By letter dated July 31, 1984, Portland General Electric Company (PGE) provided a report entitled "Trojan Nuclear Plant, 10 CFR 50 Appendix R Review" to achieve compliance with the requirements of Appendix R, Sections III.G.3 and III.L. This report was submitted in response to the fire protection rule for nuclear power plants (10 CFR 50.48) which became effective on February 17, 1981. In addition, the licensee responded to a staff request for additional information via a March 6, 1985 letter.

Previously, the results of the staff evaluation of the licensee's Topical Report No. PGE-1012, "Trojan Nuclear Plant Fire Protection Review," were provided to the licensee in Safety Evaluations (SEs) dated March 9, 1978 and March 25, 1980. The staff has reviewed the above mentioned submittals to determine compliance with 10 CFR 50, Appendix R, Items III.G.3 and III.L. The results of the staff evaluation are presented in the following sections. The licensee has provided a safe shutdown analysis for a fire event and has demonstrated that adequate alternative shutdown methods exist.

II. Evaluation

A. Areas Where Alternate Shutdown Is Required

The licensee has provided alternative shutdown capability for the control room (CR), cable spreading room (CSR), service water pump rooms, manhole MH-3, and manhole MH-4. The alternate shutdown method will be accomplished independent of the above areas by procedural means with actions performed at local shutdown control stations or locally at the equipment and as described below:

1. The licensee has demonstrated closing of the main steam isolation valves (MSIVs) independent of the control room if control room evacuation warrants.

2. The licensee has also demonstrated compliance with or provided an equivalent level of protection to the requirements of Appendix R, Sections III.G.3 and III.L by:

   a. Identifying alternate shutdown deviations and proposed modifications to isolate control circuits from the control room and cable spreading room by means of decouple (disconnect) switches, cable rerouting and/or 1-hour barrier wraps for the turbine-driven AFW pump, diesel fuel oil transfer pump, emergency diesel generator controls, 480V load center feeder and load side breakers and steam generator level indication.

b. Providing additional administrative controls and/or modifications independent of the CR and CSR for the neutron flux, RCS temperature, and pressurizer level indication.

c. Committing to provide tempcrary decouple procedures as the interim compensatory measures to prevent spurious operation of the Train B diesel fuel oil transfer pump and emergency diesel generator.

3. The exemption requests from the various requirements of Appendix R, Sections III.G.3 and III.L for the control room, service water pump room and manholes MH-3 and MH-4 were granted, as requested, in an NRC letter dated December 14, 1982.

4. The licensee has addressed the concerns as identified in IE Information Notice No. 85-09 regarding transfer switches. The licensee has proposed modifications for the existing local decouple (disconnect) switches outside the control room, installation of additional decouple switches, and procedural controls for new and existing decouple switches to preclude fire-induced circuit damage for safe shutdown. The licensee actions include the manual operation of switchgear and load center breakers without fuse replacement and modified decouple switch circuits in lieu of manual operation of corresponding component circuit breakers to ensure control power vailability for hot shutdown. In other licensee actions, it was determined that the replacement of fuses was acceptable since the identified components did not have an immediate effect on hot shutdown and ample time is available for fuse replacement. The licensee will identify the procedural controls in their post-fire shutdown procedures for the above items. The licensee committed to complete the above proposed modifications prior to startup after the 1986 refueling outage except the turbine driven AFW pump decouple switch will be installed during the 1987 outage.

5. The licensee demonstrated that, for a worst-case fire event in the CR or CSR, charging flow to the RCS will be established within 1 hour for seal cooling and RCS makeup. The licensee stated that the Trojan Appendix R analysis assumes no additional seal leakage above normal, based upon Westinghouse document WCAP-10541 which has conservative assumptions for seal injection flow integrity.

B. Systems Required For Alternate Shutdown

For alternative shutdown, the immediate actions following reactor scram will be to interrupt emergency a-c power, initiate AFW pump flow to the steam generators, open various circuit breakers to alleviate spurious operations, manually align valves for RCS makeup, and restore emergency a-c power. The following systems and/or components are used to provide alternate shutdown capability:

1. Reactor Protection System (RPS) - Reactor shutdown is initiated by an automatic trip from the RPS or by a manual trip from control room if an automatic trip has not occurred.

2. Refueling Water Storage Tank (RWST) and Chemical Volume Control System (CVCS) - Continued reactivity control will be assured by operation of the reactor makeup portion of the CVCS taking suction from the borated RWST.

3. Reactor coolant system (RCS) and centrifugal charging pump (CCP) - The operators will open the power breaker to each potential spurious operation valve, (when the 480 volt AC buses are de-energized). All RCS pressure boundary valves that could potentially provide a leakage path will be prevented from opening or will be promptly isolated following control room evacuation. For potential spurious operation valves other than RCS pressure boundary valves, the operators will perform a walkdown to verify valve positions and will close or open each valve locally by manual action if mispositioned. The operator will use manual actions to line-up the CCP flow to the RCS. RCS pressure is controlled by use of CCP and by automatic operation of the pressurizer safety valves (overpressure protection).

4. Pressurizer and steam generator(s) - The transition from stable hot shutdown to cold shutdown is achieved by maintenance of a steady pressurizer level during ambient heat losses and RCS cooldown via manual control of a steam generator atmospheric dump valve.

5. Auxiliary feedwater system (AFWS) and residual heat removal system (RHRS) - The turbine-driven AFWS pump is used initially to achieve decay heat removal. The diesel-driven AFWS pump can be used as soon as the service water flow is established to cool it. Once the RCS drops below 350°F, the residual heat removal system (RHRS) is used to maintain cold shutdown.

C. Remaining Plant Areas

All other areas of the plant not required to have an alternate safe shutdown system will comply with the requirements of Section III.G.2 of Appendix R, unless an exemption request has been approved by the staff.

D. Performance Goals

The performance goals for post fire alternate shutdown for reactivity control, reactor coolant makeup, reactor coolant pressure control and decay heat removal can be met by using the existing systems and equipment indicated in Section B above. The control of these functions can be accomplished using the alternate shutdown methods or the control room depending on the location of the fire. The licensee's alternate shutdown method relies on procedures and actions at local shutdown stations or at the required equipment.

The process monitoring capability provided at the auxiliary feedwater control panel (or primary station) are RCS pressure, pressurizer level, steam generator pressure and level, steam generator level control and decouple switch to isolate AFW pump control circuits. The RCS hot and cold leg temperature (wide-range) indications will be provided adjacent to the neutron source range monitor preamplifier in the electrical penetration area, in proximity of the AFWS control panel outside containment. The support stations inside the turbine driven AFWS pump room, control building switchgear room, turbine building switchgear room, train B emergency diesel generator (EDG) room, and miscellaneous valve locations provide protective features, such as: isolation of control circuits through decouple switches; operation of local equipment; local operation of feeder breakers; isolation of a-c and d-c powers; isolation of instrument air supply; and verification of valve positions to achieve safe shutdown. The available support systems for achieving and maintaining safe alternate shutdown are as follows:

- o Emergency a-c and d-c power system;
- o Emergency service water system for cooling EDG, CCP, diesel-driven AFW pump, containment air coolers and CCW and RHR heat exchangers.
- o Ventilation system for EDG, diesel-driven AFWS pump and CCP.

E. 72 Hour Requirement

The licensee stated that the plant can achieve cold shutdown within 72 hours without offsite power by using the alternative shutdown system except for the intake structure and manholes MH-3 and MH-4 areas and proposed alternatives in an exemption request from the requirement of Section III.L. The staff concluded per letter dated December 14, 1982 that the proposed alternatives represented an acceptable means for assuring safe plant cooldown and granted an exemption.

F. Repairs

The licensee stated that the only repairs necessary to achieve cold shutdown are for the source range monitors. A spare source range drawer will be stored onsite in an area separate from the CR/CSR. A repair procedure will be written to ensure that the spare drawer is properly connected to the existing detector circuits in the electrical penetration area outside containment. This procedure will also specify provision of a local power supply to the spare drawer.

G. Associated Circuits Protection

To assure the availability of the above systems following a fire, the licensee identified associated circuits that could prevent operation or cause maloperation of shutdown systems and equipment. For identified associated circuits, protection for the safe shutdown systems was provided in accordance with NRC guidelines as outlined in the following paragraphs.

1. Common Power Source

The licensee indicated that all circuits of the ac and dc emergency power system were reviewed to assure proper coordination of protective devices and identified common power supply associated circuit deficiencies and upgrades to correct these deficiencies. These involve the addition of protective devices to isolate associated circuits from safe shutdown circuits, replacement of fuses to provide adequate coordination, installation of voltage-limiting devices on current transformers to limit open circuit voltages, replacement of improperly sized and coordinated breakers, changing breaker trip settings to provide coordination, and instituting operational limitations on certain bus lineups.

With regard to multiple high-impedance faults which could potentially result in the loss of both AC divisions, the operators can identify the location of a fault and status of the breaker where an appropriate action can be taken to restore power. It is unlikely that all feeders will short simultaneously due to the physical differences and the extremely short interval that faults exist before clearing. Even if the main bus feedbreaker did open, the operator can readily restore power to the bus after clearing the faulted load feeders.

2. Common Enclosure

The licensee indicated that coordinated electrical circuit fault protection was provided by design for all cases of common enclosures of associated circuits. The licensee identified common enclosure associated circuit deficiencies and upgrades to correct these deficiencies. These include the replacement of breakers and cables to provide overload current protection and common enclosure associated circuit deficiencies have been or will be precluded by the fire barriers provided, or proposed to be added, between and within fire areas. Therefore, the spread of faults via associated circuits is not a concern.

The staff reviewed the licensee's cable sampling methodology to determine the proper protection of the common enclosure associated circuits. Based on review of the FSAR drawings and calculations, the staff believes there is a reasonable assurance that the licensee has adequately addressed the cable protection criteria for the 480V load center of 4.16 KV cables.

3. Spurious Signal

The licensee identified a number of circuits where fire-induced failures may adversely affect the safe shutdown capability. As a result, the licensee stated that the potential spurious malfunctions will be prevented or mitigated by providing circuit modifications or opening circuit breakers to either prevent a spurious operation from occurring, or mitigating a spurious operation should it occur.

The disabling of certain motor-operated valve power breakers (such as the RHR/RCS interface) will prevent their spurious operation. Also, manual isolation of dc control power to components such as PORVs, ac and dc motor-operated valves, and solenoid valves will prevent or terminate their potential spurious operation.

H. Safe Shutdown Procedure And Manpower

The licensee has developed procedures for obtaining alternate shutdown operations independent of the CR/CSR. The licensee has committed to develop a repair procedure for source range monitors to achieve cold shutdown. These procedures will be revised as necessary to reflect Appendix R analysis. The manpower necessary for accomplishing the operations required for alternate shutdown is available in the plant at all times. Members of the fire brigade are not included in the shutdown manpower requirements.

III. CONCLUSION

Based on our review which includes exemptions previously granted, proposed modifications, and proposed interim measures, we conclude that the Trojan Nuclear Plant post-fire alternate shutdown design provides one train of systems necessary to achieve and maintain safe shutdown conditions and thus meets the requirements of Appendix R to 10 CFR 50, Sections III.G.3 and III.L with respect to alternate shutdown in the event of a fire and is, therefore, acceptable.

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Principal Contributor:
J. Ravel, DSI