U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

BRANCH TECHNICAL POSITION 10-1

DESIGN GUIDELINES FOR AUXILIARY FEEDWATER SYSTEM PUMP DRIVE AND POWER SUPPLY DIVERSITY FOR PRESSURIZED WATER REACTOR PLANTS

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of cooling water systems

Secondary - None

A. BACKGROUND

Heat removal from pressurized-water reactor (PWR) plants following reactor trip and a loss of offsite power is accomplished by the operation of several systems including the secondary via the steam relief system. Similar capability is required to mitigate the consequences of certain postulated piping breaks. Such heat removal transfers heat from the reactor to the steam generators, producing steam released to the atmosphere. In this process a supply of makeup water to the steam generators is necessary and accomplished by an auxiliary feedwater system (AFWS), which generally consists of redundant components powered by both electrical and steam-driven sources.

The AFWS functions as an engineered safety system because it is the only source of makeup water to the steam generators for decay heat removal when the main feedwater system becomes inoperable. It must, therefore, be designed to operate when needed under the principles of redundancy and diversity so it can function under postulated accident conditions.

Revision 3 - March 2007

USNRC STANDARD REVIEW PLAN

This Standard Review Plan, NUREG-0800, has been prepared to establish criteria that the U.S. Nuclear Regulatory Commission staff responsible for the review of applications to construct and operate nuclear power plants intends to use in evaluating whether an applicant/licensee meets the NRC's regulations. The Standard Review Plan is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide an acceptable method of complying with the NRC regulations.

The standard review plan sections are numbered in accordance with corresponding sections in Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." Not all sections of Regulatory Guide 1.70 have a corresponding review plan section. The SRP sections applicable to a combined license application for a new light-water reactor (LWR) are based on Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

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Most current systems are powered by electrical or steam-driven sources. Operating experience demonstrates that each type of motive power can be subject to a failure of the driving component itself, its source of energy, or its control system. The effects of such failures can be minimized by diverse systems with energy sources of at least two different and distinct types.

The provision of several independent AFWS flow paths precludes the possibility of a complete loss of function due to a single event either alone or with the failure of an active component. The AFWS is a high-energy system because either the line section connecting to the main feedwater piping or the steam generator is pressurized during plant operation or the entire system is pressurized when in use during startup, hot standby, and shutdown.

In the belief that AFWS design guidelines are necessary, the staff has developed guidelines for selection of the minimum diversity acceptable for AFWS pump drives and power supplies.

B. BRANCH TECHNICAL POSITION

1. The AFWS should have at least two full-capacity, independent systems with diverse power sources.

2. Other AFWS powered components also should have separate and multiple sources of motive energy (e.g., two separate auxiliary feedwater trains, each capable of removing the reactor system after-heat load, one separate train powered from either of two alternating current sources and the other powered wholly by steam and direct current electric power).

3. The piping arrangements, both intake and discharge, for each train should be designed for the pumps to supply feedwater to any combination of steam generators. This arrangement should be designed for pipe failure, active component failure, power supply failure, or control system failure that could prevent system function. One acceptable arrangement is crossover piping with valves operable by remote manual control from the control room applying the power diversity principle to the valve operators and actuation systems.

4. The AFWS design should have suitable redundancy to offset the consequences of any single-active component failure; however, each train need not have redundant active components.

5. For a high-energy line break, the system should be arranged to assure the capability to supply necessary emergency feedwater to the steam generators despite the postulated rupture of any high-energy section of the system, assuming a concurrent, single, active failure.

C. REFERENCES

None.

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Part 50 and 10 CFR Part 52, and were approved by the Office of Management and Budget, approval number 3150-0011 and 3150-0151.

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