

## SAFETY EVALUATION REPORT

### FORT CALHOUN STATION UNIT NO. 1

#### SEISMIC QUALIFICATION OF THE AUXILIARY FEEDWATER SYSTEM

#### I. Introduction and Background

On August 8, 1980, the Division of Safety Technology (DST) transmitted the results of a study on the seismic capability of decay heat removal systems to the Division of Licensing (DL). That study included a simplified probabilistic risk analysis and recommendation for action by DL. Since August 1980, this subject has been the topic of additional correspondence relative to NUREG-0667, "Transient Response of Babcock and Wilcox-Designed Reactors," and has been discussed at several ACRS meetings and at planning sessions with DL and the Office of Nuclear Regulatory Research (RES). As a result of these concerns, and to assure conformance of each plant with General Design Criteria 2 and 34 of Appendix A to 10 CFR Part 50, "Multiplant Action Plan C-14: Seismic Qualification of Auxiliary Feedwater Systems" was formulated.

The purpose of this plan is to determine the extent of the seismic qualification of the auxiliary feedwater (AFW) system for all operating Pressurized Water Reactors (PWRs). For plants with AFW systems that are not seismically qualified, either in whole or in part, this plan ultimately involves increasing the seismic resistance of the systems in a timely, systematic manner, where necessary. Upgrading of the AFW systems will be required to the extent that is appropriate to provide reasonable assurance that they are able to function following the occurrence of earthquakes up to and including the design Safe Shutdown Earthquake (SSE) for the plant.

To identify those plants without AFW systems, or portions thereof, which have been designed, constructed and maintained (and included within the scope of seismic related IE Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-21) as seismically qualified systems in accordance with the criteria for other safety-grade systems at the facility, NRC Generic Letter 81-14, "Seismic Qualification of Auxiliary Feedwater Systems," dated February 10, 1981, was issued under 10 CFR 50.54(f) to all operating PWR licensees. This letter also requested walk-downs of the equipment, components and piping comprising those portions of the AFW system which were not designed, constructed and maintained as seismically qualified systems in accordance with the criteria for other safety-grade systems at the facility.

These walk-downs were to be performed by personnel experienced in the analysis, design and evaluations of structures, systems and components similar to those comprising the non-seismically qualified portions of the AFW system to identify any readily recognized deficiencies in seismic resistance and to recommend any appropriate remedial modifications. Any corrective actions taken, or planned, were to be described, and a schedule for the planned corrective actions provided. Similar considerations as those described above were to be given to alternate decay heat removal paths in those cases where portions of the AFW system are not seismically qualified.

The bounds to be considered for these systems were defined as follows:

In responding to this letter, the AFW system boundary from suction to discharge (including the water source and heat sink) shall include those portions of the system required to accomplish the AFW system function and connected branch piping up to and including the second valve which is normally closed or capable of automatic closure when the safety function is required. The AFW system boundary shall also include any portion of branch piping that is structurally coupled to the AFW system boundary such that the seismic response of the branch piping transmits loads to the AFW system. As a minimum, this includes the branch lines outside the AFW system boundary to a point of three orthogonal restraints. All mechanical and electrical equipment, piping (e.g., instrument air), conduits and cable trays, which are necessary or contain items which are necessary, for the operation of the AFW system shall also be considered. In addition, the structures housing these systems and components shall be included. Similar considerations shall be applied when considering alternate means of decay heat removal.

#### Discussion

Omaha Public Power District submitted the information requested for Fort Calhoun Unit 1 in NRC Generic Letter 81-14 via letter from N. C. Jones to Darrell G. Eisenhut, dated July 14, 1981, and supplemental letters from W. C. Jones to Robert A. Clark, dated September 14, 1981 and January 8, 1982. This information indicated that:

- 1) The safety-related portions of the AFW system (including the structures within which they are housed) are designed, constructed and maintained (and included within the scope of IE Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-27) as Seismic Category 1 in accordance with seismic criteria consistent with those for other safety grade systems in the station. The remaining mechanical and electrical equipment which was not included in Bulletins 79-02 and 79-14 was inspected. Four areas were subsequently identified as containing deficiencies as discussed in item 2 below. The portions of the AFW system considered are consistent with the bounds defined in GL 81-14.

2) The following four deficiencies and corresponding corrective actions were identified:

- a) Electrical Supply Conduit to the AFW Pump FW-6 Motor--Inadequate restraint. An additional support will be added to increase the conduit resistance to seismic movements.
- b) Valve Operators on Small Bore Piping--The current operator supports were found to be unstable. Modification work will involve replacing the existing support rods with a more stable support.
- c) Small Bore Piping (Cold System)--The rigidity of this piping was found to be inadequate due to improper support spacing. Pipe restraints will be added.
- d) Small Bore Piping (Hot System)--The rigidity of this piping also appeared to be inadequate although the high operating temperatures (350°F) of this piping makes it critical to consider potential negative impacts of additional restraints on thermal displacements and loads. The District performed a detailed pipe stress analysis to determine detrimental impact of additional pipe restraints.

These corrective actions were scheduled for completion by the end of 1981, consistent with the schedule for the overall upgrade of the AFW system, as required by NUREG-737. These modifications are sufficient to restore the AFW system to Seismic Category 1, as defined in the FSAR, with bounds as defined in GL 81-14.

3) The primary water source (Emergency Feedwater Storage Tank) is considered safety-related and is seismically qualified.

#### Evaluation

The NRC staff and its consultants have reviewed the information in the July 14, September 14, 1981, and January 8, 1982, Omaha Public Power District responses to Generic Letter 81-14 concerning the seismic qualification of the Fort Calhoun Unit 1 auxiliary feedwater system. Based on this review we have determined that:

- 1) The appropriate safety-related portions of the Fort Calhoun Unit 1 AFW system, including the structures housing them, are Seismic Category 1 and all, but the four areas in which deficiencies were noted (See item 2 above) have been designed, constructed and maintained to resist an SSE in accordance with the seismic criteria applicable to other safety grade systems at the facility with the incorporation of the modifications discussed above, and therefore, are seismically qualified.

- 2) The modifications implemented to correct the deficiencies noted in the four areas discussed in item 2 above will be sufficient to restore those items to Fort Calhoun Unit 1 Seismic Category 1 standards, as defined in the FSAR.
- 3) The primary water supply (Emergency Feedwater Storage Tank) is seismically qualified, therefore, Generic Letter 81-14 did not require information regarding a secondary water supply.

#### Conclusion

We find that the SSE seismic qualification of the appropriate portions of the Fort Calhoun Unit 1 auxiliary feedwater system is consistent with that of other safety grade systems at the facility with the incorporation of the modifications discussed above. Therefore, there is reasonable assurance that it will function following the occurrence of earthquakes up to and including the SSE for the plant. On this basis, the Omaha Public Power District responses to Generic Letter 81-14 are acceptable. No further actions are required on the part of Omaha Public Power District for Fort Calhoun Unit 1, pending the outcome of the long-term studies discussed in 'Multiplant Action C-14: Seismic Qualification of Auxiliary Feedwater Systems.'

#### Principal Contributors:

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