



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

CALVERT CLIFFS UNITS 1 AND 2

DOCKET NOS. 50-317 AND 50-318

SEISMIC QUALIFICATION OF THE

AUXILIARY FEEDWATER SYSTEM

Introduction

Since the accident at Three Mile Island Unit 2, attention has been focused on the ability of pressurized water reactors to provide reliable decay heat removal. While it is recognized that alternate methods may be available to remove decay heat following transients or accidents, heat removal via the steam generators is the first choice for accomplishing a safe shutdown of the plant. Therefore, there should be reasonable assurance that the auxiliary feedwater system (AFW) can withstand the postulated Safe Shutdown Earthquake (SSE), consistent with other safety-related systems in the plant.

To address this concern, the NRC developed and initiated Multiplant Action C-14, "Seismic Qualification of Auxiliary Feedwater Systems." The objective of this plan is to increase, to the extent practicable, the capability of those plants without seismically qualified AFW to withstand earthquakes up to the SSE level. This program was implemented with the issuance of NRC Generic Letter 81-14, dated February 10, 1981. Our review of the licensee's responses to this letter is the subject of this evaluation.

Evaluation

The enclosed report dated July 8, 1982 was prepared for us by our consultant, Lawrence Livermore National Laboratory, as part of our technical assistance contract program. The report provides their technical evaluation of the licensee's conformance to the requirements of Generic Letter 81-14.

In his Technical Evaluation Report, the consultant concludes that the AFW system is seismically qualified for the SSE, with one exception. The licensee has stated that virtually all manual AFW valves were purchased without any seismic qualification. Based upon subsequent information submitted by letter dated March 14, 1984, we conclude that these valves have been properly qualified for the SSE.

Conclusion

Based upon our review of the consultant's technical evaluation, and subsequent information submitted by letter dated March 14, 1984, we conclude that the AFW system has the capability to withstand a safe shutdown earthquake and perform its essential safety function.

Attachment:
LLNL Technical Evaluation
Report

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TECHNICAL EVALUATION REPORT
CALVERT CLIFFS NUCLEAR PLANT UNITS 1 AND 2
SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM

1. INTRODUCTION

Since the accident at Three Mile Island, considerable attention has been focused on the capability of nuclear power plants to reliably remove decay heat. The NRC has recently undertaken Multiplant Action Plan C-14 "Seismic Qualification of AFW Systems" [Ref. 1], which is the subject of this evaluation.

To implement the first phase of Action Plan C-14, the NRC issued Generic Letter No. 81-14 "Seismic Qualification of AFW Systems" [Ref. 2], dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walk-down of non-seismically qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance, and (2) to provide design information regarding the seismic capability of the AFW system to facilitate NRC backfit decisions.

The licensee of Calvert Cliffs Units 1 and 2 responded with a letter dated June 30, 1981 [Ref. 3]. The licensee's response was found not to be complete and a Request for Additional Information was issued by the NRC, dated January 6, 1982 [Ref. 4]. The licensee provided a supplemental response in a letter dated February 25, 1982 [Ref. 5].

This report provides a technical evaluation of the information provided in the licensee's responses to the Generic Letter, and includes a recommendation regarding the need for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in licensee's responses included:

- o Specification of the overall seismic capability of the AFW system.
- o Identification of AFW system components that are currently non-seismically qualified for SSE.
- o Discussion of levels of seismic capability of non-seismically qualified components.
- o Description of the AFW system boundary.
- o Status of compliance with seismic related NRC Bulletins and Information Notices.
- o Results of walk-down of non-seismically qualified areas.
- o Additionally, schematic sketch of the AFW system.
- o Additionally, identification of areas of modification/upgrade that have recently been completed, and proposed areas and schedules for modifications/upgrade under the long term general AFW system modification.
- o Additionally, description of methodologies and acceptance criteria for seismically qualified components.

We have reviewed the licensee's responses, and a point-to-point evaluation of licensee's responses against Generic Letter's requirements is provided below.

(1) Seismic Capability of AFW System

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand an SSE utilizing methods and acceptance criteria consistent with that applicable to other safety-related systems in the plant. Presently those items identified by the licensee as not being fully qualified seismically are evaluated below:

- o Pumps/Motors - Pump turbine and associated trip/throttle valve assembly. However, the licensee has stated that the same model in another nuclear plant having the similar configuration was qualified for seismic load exceeding that required for Calvert Cliffs Plant. Therefore, we believe that the turbine and associated trip/throttle valve assembly possess seismic capability that will survive an SSE.

- o Piping - (a) A portion of the AFW pump minimum flow recirculation piping. The recirculation line is routed through the non-seismic Class I turbine building, but the minimum flow requirement is not an important safety parameter with respect to other one-time system functions under emergency conditions and failure of this portion downstream of the first restriction orifice will not significantly affect the AFW system function. (b) The 10" exhaust line from each AFW pump turbine. It is routed through the seismic Class I AFW pump room and the non-seismic Class I turbine building. However, we considered it to be acceptable because the turbine building portion of the line is properly supported, and because failure or rupture of the line would not significantly affect the AFW pump turbine operation. (c) The chemical addition piping which ties into the common pump suction piping in the AFW pump room. The line is non-seismic Class I and the chemical addition equipment is located in the turbine building. However, this line can be isolated from the AFW system by an existing manual valve located in the pump room. The licensee noted that the portion of piping between the valve and the AFW system is very small (two welds). The licensee also plans to cut and cap the additional chemical addition line installed by each AFW containment penetration room of Unit 1 because these lines are not presently in use.
- c Valves/Actuators - All manual valves except for the penetration and condensate storage tank No. 12 discharge valves. These manual valves were purchased without seismic qualification, and were installed in seismic lines and analyzed with the system. The licensee noted that these valves are similar in material and construction to others that have been seismically qualified. In the absence of any information on the specific level of seismic capability of the other seismically qualified valves, we believe the valves at Calvert Cliffs plants probably possess a seismic capability that will survive an operating basis earthquake (OBE).
- o Power Supplies - All circuit-carrying conduits. They were installed according to standard seismic installation details and guidelines, and will be upgraded to Class 1E during the general AFW system modifications.

- o Water Source(s) - None
- o Initiation/Control Systems - (a) The Burbon tube type pressure indicators and the remote turbine trip hand-switches. They are being upgraded under the general AFW modification and will meet IE 79-01B and NUREG-0588 intent. (b) The instrument air source for AFW pump turbine throttle. However, it is not a safety related item and when it fails, the throttle valve will be in a fully open position.
- o Structures - The turbine building. However, this does not present seismic related concerns because the turbine building houses and supports only components such as the recirculation line, exhaust piping, and chemical addition line, which are not essential to safety function of the AFW system.

Based on our evaluation described above, those areas of the AFW system judged not to possess an SSE seismic capability are identified below.

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|---|-----------------------------------|------|
| o | <u>Pumps/Motors</u> | None |
| o | <u>Piping</u> | None |
| o | <u>Valves/Actuators</u> | OBE |
| o | <u>Power Supplies</u> | None |
| o | <u>Water Source(s)</u> | None |
| o | <u>Initiation/Control Systems</u> | None |
| o | <u>Structures</u> | None |

In summary, our evaluation indicates that the licensee's AFW system does not possess an overall seismic capability that can survive an SSE.

Because the primary water source and supply path is seismically qualified, switchover to a secondary water source is not involved.

Seismic qualification information for any alternate decay heat removal system was not provided in the licensee's responses. This information was requested by GL 81-14 if substantial lack of seismic qualification is indicated for the AFW system. The licensee stated that its AFW system exhibit a high degree of inherent seismic resistance. Based on the information provided by the licensee we did not find that the licensee's AFW system has an SSE capability. For the purpose of removing

decay heat following an SSE, the licensee needs to either re-analyze and/or modify its AFW system or provide an alternate decay heat removal system seismically qualified to the SSE level and appropriate operating procedures.

Regarding the AFW system boundary, the licensee identified that:

(1) the pump turbine exhaust piping has no isolation valves, but we do not consider the turbine exhaust piping to be part of the boundary of the AFW system. (2) the recirculation piping has two valves that are required to be open during operation of the AFW pumps and cannot be normally or automatically shut. The recirculation line, however, is seismically mounted to a point downstream of the flow restriction orifices. Should the pipe break off downstream of these orifices, no problems would result because the increase in flow through the line would be minimal compared with that available to the pump suction. Therefore, we determine that the AFW system boundary conforms to that required by the Generic Letter.

The licensee stated that the AFW system was included within the scope of seismic related Bulletins 79-02, 79-04, 79-07, 79-14, 80-11, and IE Information Notice 80-21.

(2) Walk-Down of Non-Seismically Qualified Portions of AFW System

The licensee performed a walk-down of the as-built configurations of those non-seismically qualified items for which there are no plans to upgrade. Areas where a walk-down was not performed include the recirculation piping, pump turbine exhaust piping, all non-seismically qualified manual valves, and instrument air source. We conclude that the walk-down performed by the licensee is not complete.

(3) Additional Information

The licensee provided a schematic sketch of the AFW system including the water source, heat sink, suction and discharge piping, major mechanical equipment, and structures housing and supporting AFW system items.

Additionally, licensee's responses provided a description of the methodologies, loading combinations, and acceptance criteria that were used in the design of the seismic Class I components of the AFW system.

The licensee also provided the following information on completed and scheduled modification/upgrade related to, but not as a direct result of, GL 81-14:

- o All electric power supplies have been upgraded to Class IE during recent plant modifications.
- o Each AFW system has been modified to include a safety-related automatic start system in accordance with NUREG 0578 and 0737.
- o The general AFW system modifications are scheduled to be completed by fall 1982 for Unit 2 and fall 1983 for Unit 1. For Unit 2, however, the completion date will be delayed to the spring, 1984 outage if equipment deliveries are not met. These modifications include upgrading the pump turbine and associated trip/throttle valve assembly, upgrading the chemical addition line to seismic Category I, cutting and capping the chemical addition lines installed by the Unit 1 containment penetration rooms, and upgrading all circuit carrying conduits and initiation/controls to Class IE to meet requirements of IE 79-01B and NUREG 0588.
- o The upgraded chemical addition line seismic supports will be installed by January 1, 1983.

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 is complete. The licensee conducted a partial walk-down in that it encompassed only those non-seismically qualified areas which the licensee has no plan to upgrade. The walk-down did not find seismic related deficiencies. Based on submitted information, we conclude that the AFW system does not provide a reasonable assurance to perform its required safety function following an SSE, because the non-seismically qualified valves are judged to have only an OBE level resistance. Since the licensee does not presently plan to upgrade these valves, we recommend that the NRC considers requiring the licensee to provide a re-analysis and/or modification to acquire an SSE capacity for these valves.

REFERENCES

1. D. G. Eisenhut, U.S. Nuclear Regulatory Commission, memorandum to H. R. Denton, "Multiplant Action Plant C-14: Seismic Qualification of Auxiliary Feedwater Systems," February 20, 1981.
2. U.S. Nuclear Regulatory Commission, Generic Letter No. 81-14 to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater Systems," February 10, 1981.
3. A. E. Lundvall, Jr., Baltimore Gas & Electric, letter to R. A. Clark of U.S. Nuclear Regulatory Commission, June 30, 1981.
4. R. A. Clark, U.S. Nuclear Regulatory Commission, letter to A. E. Lundvall of Baltimore Gas & Electric, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Calvert Cliffs Nuclear Plants Units 1 and 2," January 6, 1982.
5. A. E. Lundvall, Jr., Baltimore Gas & Electric, letter to R. A. Clark of U.S. Nuclear Regulatory Commission, February 25, 1982.