Seismic Qualification of PWR Plant Auxiliary Feedwater Systems

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ABSTRACT

The NRC Standard Review Plan specifies that the auxiliary feedwater (AFW) system of a pressurized water reactor (PWR) is a safeguard system that functions in the event of a Safe Shutdown Earthquake (SSE) to remove the decay heat via the steam generator. Only recently licensed PWR plants have an AFW system designed to the current Standard Review Plan specifications. The NRC devised the Multiplant Action Plan C-14 in order to make a survey of the seismic capability of the AFW systems of operating PWR plants. The purpose of this survey is to enable the NRC to make decisions regarding the need of requiring the licensees to upgrade the AFW systems to an SSE level of seismic capability. To implement the first phase of the C-14 plan, the NRC issued a Generic Letter (GL) 81-14 to all operating PWR licensees requesting information on the seismic capability of their AFW systems.

This report summarizes Lawrence Livermore National Laboratory's efforts to assist the NRC in evaluating the status of seismic qualification of the AFW systems in 40 PWR plants, by reviewing the licensees' responses to GL 81-14. The result was the preparation of a Technical Evaluation Report (TER) for each plant. The TER identifies the status of seismic qualification and recommends the need for reanalysis, possible upgrade, and modification of the AFW system. Each TER has been utilized as a technical basis for the NRC to issue a Safety Evaluation Report to each licensee involved in the review in order to implement the C-14 plan. Our technical evaluation indicated that, out of 40 plants, about 68% (27 plants) have a seismically qualified AFW system. Only about 7% (3 plants) have major deficiencies in their AFW systems. In general, piping, valves/actuators, structures housing or supporting the AFW systems, and power supplies are the areas where deficiencies occurred most frequently.

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EXECUTIVE SUMMARY

In 1981 the NRC developed and implemented a Multiplant Action Plan C-14, "Seismic Qualification of Auxiliary Feedwater Systems." The intent of the plan was to survey the seismic capability of the AFW systems of all operating PWR plants and, as necessary, require an upgrade of the nonqualified AFW system areas to the SSE level of seismic capability. In the first phase of the C-14 plan, the NRC generated a Generic Letter (GL) 81-14 to all operating PWR licensees requesting information on the seismic capability of their AFW systems.

GL 81-14 requested the licensees to perform a walkdown of all presently nonqualified areas in the AFW system, identify deficiencies amenable to simple remedial actions, and report information regarding the seismic capability of the AFW system. The Lawrence Livermore National Laboratory (LLNL) assisted the NRC by performing the technical evaluation of licensees' responses for 40 operating PWR plants.

The initial screening of licensee' responses indicated that many of the responses were incomplete. Subsequently, all licensees, with a few exceptions, were issued a Request for Additional Information (RAI) asking them to provide the complete information as required by GL 81-14. Based on the information provided in the licensees' responses to GL 81-14 and RAI, a TER was prepared by LLNL on a per plant basis. Each TER details the results of our technical evaluation and serves as the technical basis for issuing a Safety Evaluation Report (SER) by the NRC to the licensee.

Our technical evaluation has revealed that, of the 40 operating PWR plants presently involved, 68% (27 plants) have a fully qualified AFW system or an AFW system that will be fully qualified when the licensee completes all planned upgrading modifications. About 25% (10 plants) have minor seismic deficiencies, and only 7% (3 plants) have substantial seismic deficiencies in their AFW systems. For the purpose of this evaluation, the AFW system was divided into seven areas: pumps/motors, valves, piping, water source(s), power supplies, initiation/control systems, and structures that support and/or house the AFW system components.

Our evaluation indicated that all plants either have a qualified primary-water source or have a qualified secondary-water source together with a switchover procedure where the primary-water source is not qualified. The areas of most frequent deficiencies were piping, valves, structures, and power supplies. For plants that have seismic deficiencies and no plans to upgrade, we recommended the NRC require the licensee to reanalyze and/or modify such nonqualified areas.

Our evaluation also revealed that about 45% of the plants involved in this study may not have an AFW system boundary that fully conforms to the screening criteria specified in GL 81-14, in particular, the criterion for a qualified second isolation valve on the branch lines. We did not consider the boundary nonconformance as a major factor in this evaluation. About 35% of the plants either did not perform the required walkdown of the nonqualified

AFW system areas or did not cover all nonqualified areas. In this case, we recommended the NRC require the licensee to complete the required walkdown within a reasonable time duration.

Finally, some licensees voluntarily evaluated and/or inspected the seismically-qualified AFW system areas resulting in additional information. In certain cases, this additional information revealed additional seismic deficiencies in the qualified areas of the AFW system. We recommend that the NRC critically evaluate the significance of such additional information. It appears unfavorable to the pertinent licensee, but it should not be overlooked.

CHAPTER 1

INTRODUCTION

Since the incident at Three Mile Island, much attention has been focused on the ability of pressurized water reactors (PWRs) to reliably provide for shutdown 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 generator is the first choice for accomplishing the safe shutdown of a PWR plant. The auxiliary feedwater (AFW) system, a safety-related system, should be seismically qualified for the Safe Shutdown Earthquake (SSE) using criteria consistent with that applicable to other safety-related systems in the plant. However, only those facilities recently designed and licensed are in compliance with the NRC Standard Review Plan, which recognizes the AFW systems as an engineered safety feature.

On August 8, 1980, the NRC Division of Safety Technology (DST) provided the Division of Licensing (DL) of NRC with the results of a study¹ on the seismic capability of decay-heat removal systems. The study included a simplified probabilistic risk analysis and a recommendation for action to be taken by the DL. One of the conclusions of the study was that the increase in risk during the next three years is sufficiently small to allow plant operations to continue. Another conclusion was that plants should be surveyed to determine the number of PWR plants that did not have seismically-qualified AFW systems. On October 21, 1980 the NRC sent a letter² to all operating PWR licensees to identify the generic concerns and to describe the initial approach for determining the capabilities of operating PWR plants to remove decay heat following an SSE. Information regarding the seismic capability of the AFW system was obtained informally from the licensees. To better define the scope and depth of the program, site visits to a few plants were made by the NRC staff.

As a result of the aforementioned actions, the NRC developed and embarked on a Multiplant Action Plan C-14, "Seismic Qualification of Auxiliary Feedwater Systems,"³ One objective of this plan is to increase, to the extent practicable, the capability of those plants without seismically-qualified AFW systems to withstand earthquakes up to the SSE level. The plan has two phases to accomplish this objective. The first phase includes: (1) to identify via a walkdown of the AFW system, deficiencies amenable to simple remedial actions, and (2) to survey the plants to determine the extent and areas where significant improvements may be needed. The second phase is to complete reanalyses and/or modifications for those plants that do not have an AFW system with demonstrated reasonable assurance of functioning after an SSE. Between these two phases, the NRC is to make certain decisions and take action to require licensees to make any necessary improvements.

In Generic letter, dated February 10, 1981, (GL 81-14)⁴ the NRC requested that all operating PWR licensees complete the AFW walkdowns and report information regarding the seismic capability of their AFW systems. This action implemented the first phase of the C-14 program. According to GL 81-14, each licensee was requested to:

- (a) Consider the AFW system within those boundaries defined in the Generic Letter.

- (b) Identify the seismic qualification of the AFW system as (1) having been designed, constructed, and maintained as seismic Category I, (2) having been designed, constructed, and maintained to withstand an SSE, or (3) not fully qualified for an SSE. As a convenience, the AFW system was divided into seven areas, i.e., pumps/motors, piping, valves/actuators, power supplies, water source(s), initiation/control systems, and support structures. The licensee was requested to define the existing level of seismic capabilities for those areas of the AFW systems that are presently not seismically qualified.
- (c) Describe the qualification methodology, acceptance criteria, loadings, etc., to achieve the seismic qualification when the AFW system is fully seismically qualified.
- (d) Provide the procedure for switchover from a nonqualified primary water supply to a seismically-qualified secondary-water supply that can be relied upon.
- (e) Indicate the status of compliance of the AFW system with seismic related NRC Bulletins 79-02, 79-04, 79-07, 79-14, 80-11 and IE Information Notice 80-21.
- (f) Perform a walkdown of those areas of the AFW system that are not presently qualified and, where deficiencies are observed, identify plans for simple remedial actions that will increase their seismic resistance.
- (g) When a sizeable lack of seismic qualification of the AFW system is identified, provide the same seismic qualification information as in paragraphs (a) through (f), for an alternate decay-heat removal system.

The information provided by the licensee of the Trojan Nuclear Plant in response to GL 81-14 was evaluated directly by the NRC staff and the result was the issuance of a Safety Evaluation Report (SER) for that plant.⁵ Moreover, the five PWR plants that were then included in the NRC Systematic Evaluation Program (SEP) were later excluded from the present Lawrence Livermore National Laboratory (LLNL) project subsequent to their responses to GL 81-14. They were the Haddam Neck and Palisades Nuclear Plants, the San Onofre Nuclear Generating Station, Unit 1, the Ginna Nuclear Plant, and the Yankee Rowe Nuclear Plant. The NRC also decided, during the course of their technical reviews associated with the issuance of the operating license for Sequoyah, Unit 1, that the licensee adequately addressed the seismic capability of the AFW system of Sequoyah, Unit 1, and, hence, no separate review was required. As a result, the remaining 40 operating PWR plants listed in Table 1-1 became the subjects of this technical assistance program. The technical assistance program has been undertaken by LLNL to provide technical evaluation of the licensees' responses to GL 81-14.

The initial review by LLNL identified that the information contained in most of the licensees' initial responses was not complete or needed clarification. As a result, a Request for Additional Information (RAI) was issued by the NRC to the licensees. Table 1-2 shows the chronology of the licensees' responses to GL 81-14, the RAI, and the licensees' subsequent responses to the RAI. Based on the additional information provided in the licensees' responses to the RAI and the initial responses to GL 81-14, we completed our evaluation of the status of seismic qualification of the licensees' AFW systems. Separate Technical Evaluation Reports (TERs) were then prepared on a per plant basis and submitted to the NRC to provide them

with the technical basis for issuing a Safety Evaluation Report to each licensee. Additionally, this project report has been prepared to present an evaluative and management summary for the aggregate of all plants involved in this review.

Table 1-1. Pressurized water reactor licensees.

	Plant	Unit No.	TACS No.
1.	Arkansas	1	43632
2.	Arkansas	2	43633
3.	Beaver Valley	1	43646
4.	Calvert Cliffs	1	43634
5.	Calvert Cliffs	2	43635
6.	D.C. Cook	1	43651
7.	D.C. Cook	2	43652
8.	Crystal River	3	43647
9.	Davis-Besse	1	43665
10.	Farley	1	43631
11.	Farley	2	47192
12.	Fort Calhoun	1	43659
13.	Indian Point	2	43640
14.	Indian Point	3	43641
15.	Kewaunee	-	43671
16.	Maine Yankee	-	43653
17.	McGuire	1	47125
18.	McGuire	2	(none)
19.	Millstone	2	43656
20.	North Anna	1	43666
21.	North Anna	2	45673
22.	Oconee	1	43643
23.	Oconee	2	43644
24.	Ocones	3	43645
25.	Point Beach	1	43669
26.	Point Beach	2	43670
27.	Prairie Island	1	43657
28.	Prairie Island	2	43658
29.	Rancho Seco	-	43663
30.	H.B. Robinson	2	43636
31.	Salem	1	43661
32.	Salem	2	43674
33.	St. Lucie	1	43643
34.	Surry	1	43667
35.	Surry	2	43668
36.	TMI	1	43654
37.	Turkey Point	3	43649
38.	Turkey Point	4	43650
39.	Zion	1	43637
40.	Zion	2	43638

Table 1-2. Chronology of licensees' responses to generic letter 81-14 and RAI.

Plant name	Unit	Initial response to GL 81-14	RAI	Response to RAI
Arkansas	1	8/7/81	4/2/82	5/27/82
Arkansas	2	8/7/81	4/29/82	5/27/82
Beaver Valley	1	8/5 & 11/10/81		
Calvert Cliffs	1/2	6/30/81	1/6/82	2/25/82
Crystal River	3	7/14/81	1/7/82	2/26 & 4/20/82
Davis-Besse	1	7/15/81	1/11/82	2/10/82
D. C. Cook	1/2	8/28/81	4/5/82	6/15/82
Farley	1/2	10/9/81	4/2/82	7/16/82
Ft. Calhoun	1	7/14 & 9/14/81, 1/8/82		
Indian Point	2	8/7/81	4/6/82	5/10/82
Indian Point	3	8/28/81	4/9/82	9/2/82
Kewaunee		8/14/81	2/25/82	4/8/82
Maine Yankee		8/5/81	4/2/82	5/27/82
McGuire	1/2	7/15/81		
Millstone	2	7/24/81	4/15/82	6/4/82
North Anna	1/2	7/16 & 12/1/81		
Oconee	1/2/3	1/28/82	4/8/82	5/25/82
Point Beach	1/2	7/16/81	1/25/82	5/4/82
Prairie Island	1/2	7/14/81	4/5/82	5/6/82
Rancho Seco	1	7/17 & 10/14/81	5/7/82	7/9/82
H. B. Robinson		12/31/81	7/21/82	8/20/82
Salem	1/2	8/11/81	1/7/82	3/1/82
St. Lucie	1	9/18/81	4/2/82	5/6/82
Surry	1/2	7/16/81	1/6/82	2/12/82
TMI	1	9/29 & 12/8/81, 2/16/82	4/5/82	7/7, 9/14, 9/29, & 12/20/82. 2/4, 3/22 & 5/2/83
Turkey Point	3/4	9/8/81	4/9/82	5/15/82
Zion	1/2	7/14/81	1/6/82	7/12/82

This report is divided into four chapters. Following the Introduction, Chapter 2 discusses the general evaluation criteria as well as plant-specific considerations for reviewing the licensees' responses to the GL 81-14 and RAI. Chapter 3 summarizes the results of our reviews. The PWR plants under review have been grouped according to the status of seismic qualification of their AFW systems. The status of the AFW system boundary conformance and the required walkdown of seismically nonqualified areas are also discussed in this chapter. The individual TERs for all 40 plants involved in the review are given in the appendix. Chapter 4 summarizes our conclusions from the review and recommendations to the NRC.

CHAPTER 2

EVALUATION CRITERIA

For the purpose of evaluation, the information contained in each of the licensees' response(s) to the GL 81-14 and the RAI was grouped in accordance with the nature of the information. The result was two general groups:

- (1) Information directly pertinent to the seismic capability of the AFW system, such as the status of seismic qualification, the need for switchover from a seismically-nonqualified primary-water source to a seismically-qualified secondary-water source, the seismic qualification of any alternate decay-heat removal system, the AFW system boundary, the status of compliance with the seismic related NRC Bulletins and Information Notices, the results of walkdown of any seismically nonqualified areas in the AFW system, the completeness of the walkdown, any deficiencies identified during the walkdown, and the licensees' plans for simple remedial measures to remove such deficiencies.
- (2) Additional information not explicitly requested by the GL 81-14, such as sketches and diagrams of the AFW system, and information on any voluntary evaluation/inspection and voluntary upgrade of the seismically-qualified areas of the AFW system that are not a direct result of either the Generic Letter or the seismic-related NRC Bulletins and Information Notices. The methodology and acceptance criteria for the original seismic design of the AFW components were also considered to be additional information unless, in accordance with the GL 81-14, the entire AFW system is seismically qualified, in which case this information would be treated as a part of Group (1) information.

Typically, the information in Group (2) was mentioned in the TER without a specific evaluation. The information in Group (1) was reviewed using the general evaluation criteria described in this chapter. There were, however, cases to which the general evaluation criteria may not be applicable, and plant-specific considerations were applied. The significant plant-specific considerations are discussed following the description of the general criteria.

2.1 GENERAL EVALUATION CRITERIA

The overall seismic capability of the AFW system is determined by several factors. These include the status of seismic qualification of the AFW system components, the conformance of the AFW system boundary with the definitions specified in GL 81-14, the compliance with seismic related NRC Bulletins and Information Notices, the status of seismic qualification of any available alternate decay-heat removal systems, and the results of the walkdown of the seismically nonqualified areas of the AFW system. For convenience of evaluation, the components of an AFW system were categorized into seven areas: pumps/motors, piping, valves/actuators, power supplies, water source(s), initiation/control systems, and structures that support or house the AFW system. The water source(s) as referred to here do not include the supply paths. The supply paths were evaluated as a part of the AFW system piping.

2.1.1 Status of Seismic Qualification of the AFW System Components

The following represent the general criteria for evaluating the status of seismic qualification of the various areas in the AFW system:

- (a) The present level of seismic qualification of the AFW system components was evaluated on the basis of the licensees' explicit statements and our own engineering judgement, particularly when the present level of seismic qualification was not available. This is the typical occasion when plant-specific considerations may be required, and is discussed later in greater detail. In any case, we rated a nonqualified component to be "conditionally seismically qualified" regardless of its present level of seismic capability, as long as the licensee provided some plans for modification/upgrade of the components.
- (b) In general, we evaluated the seismic capability of the components within the AFW system boundary presently existing in the plant. In case the existing boundary does not fully conform to the definitions specified in the Generic Letter, such nonconformance was, however, merely identified as a deficiency that is unrelated to our evaluation of the current overall seismic capability of the AFW system.
- (c) An AFW system component was rated as "seismically qualified" if it was originally designed to the seismic Class 1 or Category I criteria, or, if so stated by the licensee, to withstand the SSE. Within this context, a Design Basis Earthquake (DBE) level of seismic capability was considered equivalent to the SSE level because some plants were constructed at an earlier time when the term SSE did not exist. We did not evaluate the sufficiency of the methodology and acceptance criteria employed in the licensees' original design of the seismically-qualified AFW system components as long as they were consistent with that applicable to other safety-grade systems in the plant. Examples where we accepted the licensees' statement include: the power supplies at Indian Point, Unit 2; the bypassing valve arrangement at Rancho Seco, Unit 1; the turbine building and the condensate transfer pump foundation at Turkey Point, Units 3 and 4.
- (d) As stated previously, the information about any of the licensees' voluntary evaluation and/or inspection of the AFW system would be considered as additional information unless it was the direct result of the GL 81-14 requirements. For instance, the inspection of any seismically-qualified areas of the AFW system and the evaluation of any potential interference from seismically nonqualified items outside the AFW system were not explicitly required by GL 81-14 and, hence, would be treated as additional information. As such, any deficiencies identified through the licensees' voluntary evaluation/inspection were not a factor when we rated the present level of the AFW system.
- (e) Nonqualified components in the AFW system were not construed to degrade the overall seismic capability of the AFW system when the licensee stated and/or we judged that they would not be essential

to the performance of the required safety function of the AFW system. Examples include: the power supplies at Crystal River, Unit 3; the initiation/control systems at Fort Calhoun, Unit 1, Three Mile Island, Unit 1, and St. Lucie, Unit 1; the 3/4-in. air-operated vent valves (located downstream of the motor-operated steam-admission valves to the AFW turbines) at Turkey Point, Units 3 and 4; etc.

- (f) The level of seismic capability of all essential and presently nonqualified items was rated as either "OBE equivalent" or "Less than OBE" (Operating Basis Earthquake). Our engineering judgement played a major role in the rating and, hence, plant-specific considerations may be required. In general, the "OBE equivalent" rating was given to an item when the licensee stated that the applicable seismic documents were not found, but seismic analysis was required in the original design and/or purchase specifications, that the item was designed as seismic Class II, or that follow-up analyses have indicated the existence of a substantial seismic resistance that was short of the SSE level. Otherwise, the "Less than OBE" rating would be given to the nonqualified item. Examples of the plant-specific considerations are discussed in paragraph 2.2

2.1.2 Boundary

Evaluation of the AFW system boundary was based on either the sketches and diagrams provided by the licensee, or their statement regarding compliance of the boundary with the definitions given in GL 81-14. Factors considered in our evaluation included:

- (a) the existence on branch lines of a second valve that is normally closed or is capable of automatic closure when required and
- (b) the branch lines outside of and seismically coupled to the AFW system, up to a point of three orthogonal restraints. We typically rated the existing AFW system boundary in the licensees' plant as either "fully conforming" or "not fully conforming" to the GL 81-14 boundary definitions. In the event that the sketches and/or the licensees' statement were not specific enough to allow us to reach such a rating, we, in effect, stated that it was not clear whether the AFW system boundary fully conforms to the definitions specified in GL 81-14.

As stated in paragraph 2.1.1(b), any nonconformance of the AFW system boundary with GL 81-14 definitions was merely identified in the TER as a nonseismic-related deficiency.

2.1.3 Compliance of IE Bulletins and Information Notices

Based on the licensees' statement, we evaluated as to whether or not the licensees' AFW system has complied with all applicable seismic-related NRC bulletins and information notices. These included the IE Bulletins 79-02, 79-04, 79-07, 79-14, 80-11, and Information Notice 80-21. The AFW system was given a rating of "full compliance" when the licensee has complied or was in the process of complying with all applicable IE Bulletins and Information

Notices. The same rating was given when certain IE Bulletins and Information Notices were not complied with and the licensee provided the necessary justification for waiving the compliance.

We did not consider any current IE Bulletin-related deficiencies as affecting our evaluation of the seismic evaluation of the AFW system as long as the licensee was in the process of complying with the applicable IE Bulletins. In addition, a plant-specific consideration was given to Prairie Island, Units 1 and 2.

2.1.4 Alternate Decay-Heat Removal System

In GL 81-14, information regarding the seismic qualification for any alternate decay-heat removal system was requested if a substantial lack of overall seismic qualification of the AFW system was indicated from the licensees' responses. In our evaluation, we did not specifically define what constituted a "substantial" lack of seismic qualification of the AFW system and, hence, did not specifically request the information on any alternate decay-heat removal system when the licensees' AFW system is presently not fully seismically qualified. Instead, we inclined to recommend requesting the licensee to reanalyze and/or upgrade those seismically nonqualified areas in the AFW system for which the licensee had no plans to reanalyze/upgrade and did not provide any alternate decay-heat removal system.

A complete evaluation was conducted on the status of seismic qualification of any alternate decay-heat removal system and the availability of an acceptable procedure for switchover from the AFW system when such information was provided by the licensee. This was the case with Oconee, Units 1, 2, and 3. The criteria for such evaluation are similar to those applied to the AFW system.

2.1.5 Walkdown of Nonqualified AFW System Components

For presently nonqualified areas of the AFW system, GL 81-14 requested that the licensee perform a walkdown of these areas with personnel experienced in the analysis, design, and construction of the AFW system. In addition, GL 81-14 requested that the licensee propose simple, quick corrective actions, along with schedules, for any deficiencies identified from the walkdown so that the seismic resistance of the deficient nonqualified areas would be increased. Therefore, our criteria for evaluating the required walkdown are as follows:

- (a) If the walkdown of all nonqualified areas was found to be incomplete, we would recommend that the licensee be required to complete the walkdown within a reasonable time.
- (b) If deficiencies were identified from the walkdown, as indicated by the licensee, we would recommend that the licensee be required to provide the information on corrective actions and schedules, if such information was not provided by the licensee.

Whenever voluntary walkdown was performed by the licensee on the seismically-qualified components of the AFW system, we identified it as "additional information". This was previously mentioned in paragraph 2.1.1(d).

2.2 PLANT SPECIFIC CONSIDERATIONS

As mentioned previously, we have found unique plant situations where the general evaluation criteria were not applicable. We also occasionally deviated from the general evaluation criteria described above, when it was deemed appropriate to do so. In such cases our engineering judgement was involved to a substantial degree. Under these circumstances, plant-specific considerations were applied. These are discussed in paragraphs 2.2.1(a) through (g).

2.2.1 Status of Seismic Qualification of the AFW System

Typically, we exercised our engineering judgement when the licensee relied on their judgement or other information to substantiate the seismic resistance of certain items in the AFW system. This resulted in the following plant-specific considerations:

- (a) We would rate an item as seismically qualified when identical items installed elsewhere or in other plants have been qualified to a seismic level equal to or exceeding that required at the plant under review, provided that the original purchase specifications explicitly required a seismic qualification. This was the case, for example, with the AFW pump turbine and associated trip/throttle valve at Calvert Cliffs, Units 1 and 2; the conduit supports at St. Lucie, Unit 1; and the initiation/control systems at Indian Point, Unit 2. On the other hand, we did not accept the licensees' substantiation of seismic qualification on the basis of similarity when the other items in the comparison were qualified to an unspecific seismic level and the item under review was purchased without specific seismic requirements. This was the case, for example, with all the manual valves in the Calvert Cliffs, Units 1 and 2, to which we gave an "OBE equivalent" rating based on our best judgement.
- (b) Nonqualification of the primary water supply lines was considered nonessential to the overall rating of the seismic capability of the AFW system piping, when a seismically-qualified secondary-water source and supply path exists and an acceptable switchover procedure is available. This was the case with the D. C. Cook, Units 1 and 2 and Zion, Units 1 and 2.
- (c) We rated an item as seismically qualified when the licensee substantiated, on a generic basis, that the said item can withstand a seismic level substantially higher than required. For instance, the AFW motor and air-operated gate and globe valves at Indian Point, Unit 2, were purchased without specific seismic requirements and the licensees' consultant had analytically established their generic seismic capacity to be from 0.34g to 23g, with a medium value of 7.3g. Moreover, the licensees' consultant established the medium ground-acceleration capacity of the AFW water-regulator valves and steam-inlet valve at Indian Point, Unit 2, to be about 5g. Based on this data and assuming a log-normal distribution for the generic data, we estimated the lower-bound ground-acceleration capacity of the water-regulator valves and steam-inlet valve to be approximately 0.58g. The design ground-acceleration for Indian Point, Unit 2 was 0.15g. Hence, we rated all of the above-mentioned valves to be seismically qualified.

- (d) For Indian Point, Unit 3, we did not accept the licensee's statement about the nonessentiality of the nonqualified valve, LCV-1128, and the pipe between the said valve and a seismically-qualified valve, LCV-1158. We rated both of them to be "Less than OBE". Such a rating was given because of our belief that, if the pipe under consideration should break during a seismic event, and the single failure assumed to be the qualified isolation valve, LCV-1158, a path would be created that would jeopardize the capability of the water source to deliver an adequate amount of water to the AFW system.
- (e) When the "OBE equivalent" rating was given to a nonqualified item, it usually involved a very subjective judgement from us. For example, we gave the same rating to the manual valves at Calvert Cliffs, Units 1 and 2, as mentioned in subparagraph (a) above. We also gave this rating to the overall seismic capacity of the AFW system piping at D. C. Cook, Units 1 and 2, because the main feedwater piping downstream from the check valve to the motor-operated valve is seismic Class III and was designed to withstand only the OBE.
- (f) According to the general criteria [paragraph 2.1.1(b)], we would evaluate only the AFW system piping, within the existing boundary at the plant, even though the boundary might not fully conform to GL 81-14 definitions. We deviated from this general criteria, however, for the Oconee, Units 1, 2, and 3, because the licensees indicated that all branch lines beyond the first valves are nonqualified, where such first valves are considered to be the existing AFW system boundary. In other words, we would consider it a seismic-related deficiency for any licensee-identified nonqualified piping beyond the first valves that represent the existing AFW system boundary.
- (g) The sheet-metal enclosure structure, which is on the suction side of and close to the condensate storage tank, at D. C. Cook, Units 1 and 2, represent a unique case. The structure is not seismic Class I, but houses a seismic Class I first valve and about three feet of seismic Class I piping. We rated the structure to be seismic qualified; however, the rating would be reduced to "OBE equivalent" if the segment of piping protected by the enclosure is an essential AFW water supply line.

2.2.2 Boundary

Where the licensee indicated their existing AFW system boundary to be not fully conforming to GL 81-14 definitions, we still gave a "full conformance" rating when the licensee presented sufficient justification for the boundary deviation. This was the case with Calvert Cliffs, Units 1 and 2, Indian Point, Unit 2, North Anna, Units 1 and 2, Salem, Units 1 and 2, and Three Miles Island, Unit 1.

2.2.3 Compliance of IE Bulletins and Information Notices

The licensee of Prairie Island, Units 1 and 2, has stated that they do not comply with Information Notice 80-21, and will defer any reviewing action

until 1984. We did not consider this as a seismic-related concern in our evaluation of the AFW electrical systems at Prairie Island, Units 1 and 2.

2.2.4 Walkdown of Nonqualified AFW System Areas

The licensee of D. C. Cook, Units 1 and 2, did not perform a walkdown of the nonqualified sheet-metal enclosure that is on the suction side of and close to the condensate storage tank. In the TER, however, we did not recommend requiring the licensee to complete this walkdown, because, as previously discussed in the plant-specific consideration example [paragraph 2.2.1(g)], the enclosure structure is a nonessential item unless the segment of piping protected by the enclosure structure is an essential water supply line. As another example, the licensee of Indian Point, Unit 2, did not specifically state that their walkdown covered all nonqualified AFW system items. However, we believed that additional walkdown is not required, because there were previous walkdowns performed by both licensee and the NRC resident inspector and appeared to have covered more than just the nonqualified areas. In addition, the walkdown performed by the NRC resident inspector did not identify any unacceptable conditions.

CHAPTER 3

EVALUATION RESULTS

The responses, from the licensees of the 40 PWR plants under review, were evaluated using the general criteria and plant-specific bases that were delineated in Chapter 2. A summary of the evaluation results is shown in Table 3-1. The status of seismic qualification of each of the seven AFW system areas in Table 3-1 is represented by:

- (a) a blank indicating "presently seismically qualified,"
- (b) a bracketed footnote in a blank indicating "conditionally seismically qualified,"
- (c) a numeral "1" accompanied by a bracketed footnote indicating an "OBE equivalent" seismic level, or
- (d) a numeral "2" accompanied by a bracketed footnote indicating a "Less than OBE" seismic level.

In both (c) and (d), the footnote explains the plant-specific basis for reaching the associated rating. A "No" in any column of Table 3-1 represents a partial or total noncompliance with the applicable requirements of the GL 81-14.

The significant aspects of the results of our evaluation are discussed in paragraphs 3.1 through 3.5 for the status of overall seismic qualification, AFW system boundary, walkdown, alternate decay-heat removal system, and additional information, respectively. The evaluation generated a TER for each of the PWR plants involved. These are included in the appendix. The TER contains the details of our evaluation, conclusions, and recommendations for each plant.

Table 3-1 Summary of evaluation results.

Legend:		Not fully-qualified areas															Other considerations				Walkdown results				Qualification of alt. system
● BLANK - Yes/acceptable/ SSE-equivalent ● 1 - OBE equivalent ● 2 - Less than OBE ● 3 - None ● No - Not qualified/ Not acceptable/ Not conforming		System classification	Pumps/motors	Pipeline	Valves/actuators	Power supplies	Water source(s) ^a	I&C	Structures	AFW system boundary	Bulletins conformance	Qual. methods/criteria	Switchover procedures	System walkdown performed	Deficiencies identified	Corrective actions taken	Corrective plan identified	Schedule provided							
Arkansas 1	[1]b							[1]		No				No											
Arkansas 2										[2]															
Beaver Valley 1																									
Calvert Cliffs 1/2	No			[3] 1	[4]		[5]							[6]											
Crystal River 3	[7]				[7]		[7]			No															
Davis-Besse 1	[8]		[8]						[8]	No				No											
D.C. Cook 1/2	No		[9] 1						[10]																
Farley 1/2																									
Fort Calhoun 1	[11]		[11]	[11]	[11]																				
Indian Point 2																									
Indian Point 3	No		[12] 2	[13] 2	[14] 2		[15] 2	[16] 2	No	[17]				[6]											

a) May include switchover to a secondary source.

b) Numbers in brackets "[]" designate plant-specific notes at the end of this table.

Table 3-1 Summary of evaluation results. (Cont'd)

Legend:	System classification	Not fully-qualified areas						Other considerations				Walkdown results						
		Pumps/motors	Piping	Valves/actuators	Power supplies	Water source(s) ^a	I&C	Structures	AFM system boundary	Bulletins conformance	Qual. methods/criteria	Switchover procedures	System walkdown performed	Deficiencies identified	Corrective actions taken	Corrective plan identified	Schedule provided	Qualification of alt. system
• BLANK ~ Yes/acceptable/ SSB-equivalent • 1 - OBE equivalent • 2 - Less than OBE • 3 - None • No - Not qualified/ Not acceptable/ Not conforming			[18] 1	[19]	[20] 2				No	[21]			No					
Plant name																		
Kewanee													No					
Maine Yankee	No		[19]	[19]	[20] 2				No	[21]			[6]					
McGuire 1/2																		
Millstone 2																		
North Anna 1/2																		
Oconee	[22]	[22]	[22]	[22]	[22]			[22]	No				No					[22]
Point Beach 1/2	No		[23] 2					[23] 2	No				No					
Prairie Island 1/2	No		[24] 2	[25] 1					No	[26]								
Rancho Seco 1				[27]					No									
H.B. Robinson 2	[28]				[28]				[2]									
Salem 1/2																		

PLANT-SPECIFIC NOTES FOR TABLE 3-1

1. Not all components of the I&C system are currently seismic qualified, but they will be upgraded to seismic qualification after the next refueling outage.
2. It is not clear whether the AFW system boundary fully conforms to GL 81-14 definitions.
3. All manual valves, except for the penetration and condensate storage tank No. 12 discharge valve, were purchased without seismic qualification. These valves probably possess an OBE level seismic capability because they are similar in material and construction to others that have been qualified to a certain unspecified seismic level.
4. All circuit carrying conduits will be upgraded to Class 1E during the general AFW system modification.
5. The Bourbon tube-type pressure indicators and the turbine trip hand-switches are nonseismic Class I. They are being upgraded under the general AFW modification.
6. Walk-down of nonseismically-qualified components has been performed, but it is not complete.
7. The current seismic capability is unknown, but nonseismically-qualified items will be upgraded.
8. The auxiliary feedwater pump, turbine pipe support, and certain masonry walls are not seismically qualified, but modification will be completed.
9. The main feedwater piping upstream from the check valve to the MOV is seismic Class III, but was designed to USAS B31:1 (1967) to withstand an OBE.
10. The seismic level becomes OBE if the segment of piping covered by the nonseismically qualified sheet-metal enclosure structure on the suction side, close to the condensate storage tank, is not a part of the primary water supply path.
11. The following areas are currently nonseismatically qualified:
(a) small-bore piping in both cold and hot systems, (b) valve operators on small-bore piping, and (c) electric supply conduit to the AFW pump, FW-6 motor. They are subject to modifications.
12. Branch piping CT-1070 is seismic Class III. No plans are made for upgrading.
13. Valve LCV-1128 is seismic Class III. No plans are made for upgrading.
14. Original seismic design level is not available for the motor control centers (MCC) 34 and 39, 480 switchgear Nos. 31 and 32, and 125-VDC power panels Nos. 31, 32, and 33. Investigations are to be completed by the summer of 1984.

PLANT-SPECIFIC NOTES FOR TABLE 3-1 (Cont'd)

15. Seismic documentation is not available for the turbine AFW pump, speed control system, and flow control switches, FC-1135S and FC-1136S static "O" ring. Investigations are to be completed by the summer of 1984.
16. The turbine building is seismic Class III. No plans are made for upgrading.
17. IE Information Notice, 80-21, is under review.
18. The licensee is currently verifying the seismic design of the additional branch piping due to licensee's relocation of the Class I boundary; and will submit their findings at a later date.
19. Currently, (a) small-bore minimum-flow recirculating piping, (b) majority of large-bore suction piping, (c) small-bore piping, and (d) all actuators are not seismically qualified, but corrective actions will be implemented to assure the SSE capability of the AFW system.
20. Seismic capacity of conduit is currently unknown, and licensee will assess the feasibility of qualifying the conduit, as time permits.
21. The AFW system will comply with all seismic related NRC Bulletins and Information Notices when the licensee completes their seismic qualification assessment program.
22. Currently, nonseismically-qualified areas include all but water source(s) and initiation/control systems. According to the licensee's responses, a seismically-qualified standby-shutdown facility is being constructed to provide a dedicated, separate train of auxiliary feedwater.
23. Branch lines No. 20 to 28 were not originally seismically designed. Except for the control building, other buildings are not seismic Class I. Currently, the licensee has no plan for upgrading these deficiencies.
24. All identified modifications will be completed prior to or during Units 1 and 2 refueling outages in 1983.
25. Certain VELAN valves are not seismically qualified. They are judged to possess an OBE level of resistance because seismic analysis was required by purchase specifications. No plans are made for upgrading.
26. The licensee is deferring any action on IE Information Notice 80-21 pending on NRC's issuance of the Rule and Regulatory Guide expected in 1984.
27. Air-operated valves, FV20526 and FV20527, were not qualified to any seismic requirements. However, they were bypassed by seismically-qualified motor-operated valves, SFV20577 and SFV20578.

PLANT-SPECIFIC NOTES FOR TABLE 3-1 (Cont'd)

28. The adequacy of the seismic qualification of electrical cables and motor control centers is under evaluation in compliance with NE Information Notice 80-21.
29. The control-grade automatic-initiation circuitry was upgraded to seismic Category I during the September 1981 outage.
30. The turbine building is seismic Class II, but was judged nonessential.
31. Currently, pumps/motors, piping, power supplies, and I&C systems are not fully, seismically qualified but, except for I&C systems, they will be modified/upgraded to the SSE level.

3.1 STATUS OF OVERALL SEISMIC QUALIFICATION

Based on our evaluation, the 40 operating PWR plants under review may be categorized into four groups in accordance with the status of overall seismic qualification of the AFW system, as shown in Table 3-2:

(1) Fully Qualified - Those plants with an AFW system that is presently fully qualified. There are 18 (45%) plants in this category.

(2) Conditionally Qualified - Those plants with an AFW system that presently has certain seismic-related deficiencies, but will be able to withstand an SSE upon completion of the upgrading/modification programs planned by the licensee. This includes six plants (15%).

(3) Minor Deficient - Those plants with an AFW system that has, according to our engineering judgement, "minor" seismic deficiencies and for which no specific plans for upgrade/modification were provided by the licensees. There are ten plants (25%) in this category.

(4) Major Deficient - Similar to Group 3 plants, but with "major" seismic deficiencies in the AFW system. The remaining six plants (15%) belong to this category.

Table 3-2. Categories of PWR plants in accordance with status of seismic qualification of AFW systems.

Group 1 Fully qualified	Group 2 Conditionally qualified	Group 3 Minor deficient	Group 4 Major deficient
Arkansas, 2 Beaver Valley, 1 Farley, 1/2 Indian Pt., 2 McGuire, 1/2 Millstone, 2 North Anna, 1/2 Rancho Seco, 1 H.B. Robinson, 2 Salem, 1/2 Surry, 1/2 Zion, 1/2	Arkansas, 1 Crystal River, 3 Davis-Besse, 1 Ft. Calhoun, 1 St. Lucie, 1 TMI, 1	Calvert Cliffs, 1/2 D. C. Cook, 1/2 Maine Yankee Kewaunee Prairie Island, 1/2 Turkey Pt., 3/4	Indian Point, 3 Oconee, 1/2/3* Pt. Beach, 1/2
18 units	6 units	10 units	6 units

*Has a conditionally-qualified alternate decay-heat removal system (the standby shutdown facility, SSF).

It must be noted, that since Oconee, Units 1, 2, and 3, have a conditionally-qualified alternate decay-heat removal system (SSF) under construction, the overall decay-heat removal capability will be fully qualified once the SSF modification is completed.

Thus about 60% of the plants have a fully or conditionally-qualified AFW system (68% if Oconee, Units 1, 2, and 3, AFW systems are rated "conditionally qualified"), twenty-five percent of the plants have a minor deficient AFW system, and only 15% have a major deficient AFW system (or 7% if Oconee may be excluded).

We found that all plants have seismically-qualified water sources. Either the primary water source is seismically qualified, or a qualified secondary-water source exists, and a procedure for switchover from the primary water source is available. For the other six areas in the AFW system, the statistics of conditional qualification and nonqualification for the 40 plants reviewed are presented in Tables 3-3 and 3-4, respectively. Based on Table 3-3, statistics of conditional qualification are as follows:

• Water source(s)	- none
• Structures	- 1 plant
• Pumps/motors	- 2 plants
• Valves/actuators	- 2 plants
• Piping	- 5 plants
• Initiation/control systems	- 5 plants
• Power supplies	- 7 plants

For nonqualification, Table 3-4 gives the following statistics:

• Water source(s)	- none
• Pumps/motors	- 3 plants
• Initiation/control systems	- 3 plants
• Power supplies	- 5 plants
• Structures	- 6 plants
• Valves/actuators	- 8 plants
• Piping	- 11 plants

From this summary, we conclude that the most frequently deficient areas are: piping, valves, structures, and power supplies. In general, older plants have more conditionally qualified and nonqualified items.

This is anticipated, because the older plants were probably constructed prior to the NRC's issuance of the Standard Review Plan, which specifies that the AFW system is a safety-grade system.

3.2 BOUNDARY

For the AFW system boundaries in most plants, either they do not fully conform to or it was not clear from the licensees' responses that they fully conform to the definitions given in GL 81-14. Table 3-1 indicates that, out of the 40 plants under review, 14 plants (or 35%) have a nonconforming AFW system boundary, and four plants (or 10%) have an AFW system for which we could not determine if the boundary fully conforms to the GL 81-14 definitions.

Table 3-3. Conditionally-qualified areas in the AFW systems of the 40 PWR plants.

Plant name	Structures	Pumps/ motors	Valves/ actuators	Piping	I&C	Power supplies
Arkansas 1 Arkansas 2 Beaver Valley 1					X	
Calvert Cliffs 1/2 Crystal River Davis-Besse 1	X			X		
D.C. Cook 1/2 Farley 1/2 Fort Calhoun 1			X	X		X
Indian Point 2 Indian Point 3 Kewaunee						
Maine Yankee McGuire 1/2 Millstone 2			X	X		
North Anna 1/2 Oconee 1/2/3 Point Beach 1/2						
Prairie Island 1/2 Rancho Seco 1 H.B. Robinson						
Salem 1/2 St. Lucie 1 Surry 1/2					X X	
TMI 1 Turkey Point 3/4 Zion 1/2		X		X		X
Total No. of plants	1	2	2	6	5	6

NOTE: No plant has conditionally-qualified water source(s).

Table 3-4. Nonqualified areas in the AFW systems of the 40 FWR plants.

Plant name	Structures	Pumps/ motors	Valves/ actuators	Piping	I&C	Power supplies
Arkansas 1						
Arkansas 2			X			
Beaver Valley 1						
Calvert Cliffs 1/2						
Crystal River						
Davis-Besse 1						
D.C. Cook 1/2				X		
Farley 1/2						
Fort Calhoun 1						
Indian Point 2						
Indian Point 3	X		X	X	X	X
Kewaunee				X		
Maine Yankee						X
McGuire 1/2						
Millstone 2						
North Anna/2						
Oconee 1/2/3	X	X	X	X		X
Point Beach 1/2	X			X		
Prairie Island 1/2			X	X		
Rancho Seco 1				X		
H.B. Robinson						
Salem 1/2						
St. Lucie 1						
Surry 1/2						
TMI 1						
Turkey Point 3/4					X	
Zion 1/2						
Total No. of plants	6	3	8	11	3	5

NOTE: No plant has nonqualified water source(s).

Together, about 45% of the plants have an AFW system with a boundary that does not or may not fully conform to GL 81-14 definitions. In general, the nonconformance of the boundary was attributed to: (a) in most cases, the lack of a second valve on branch lines that is normally closed or capable of automatic closure, and/or (b) the lack of seismic qualification of the branch piping beyond the AFW system boundary, up to a point of three orthogonal restraints, where the branch piping is seismically coupled to the AFW system. It is no surprise that the main reason for the nonconformance in the AFW system boundary is the lack of a second isolation valve on the branch lines. The GL 81-14 requirement on double-isolation valves was used by the NRC as screening criterion. Double valves are acceptable immediately without review. If double valves are not provided, the system may be acceptable if the single failure criterion is satisfied, or if the licensee justifies the design on some other basis.

3.3 WALKDOWN

The walkdown requested by GL 81-14 was intended to come up with simple remedial actions, together with a schedule, to correct any identified deficiencies of the presently nonqualified item in order to increase their seismic resistance. Our review indicated that, according to Table 3-1, eight plants (20%) did not perform any of the required walkdown, and six plants (15%) did not completely walkdown all nonqualified items. On the other hand, for some plants the licensees not only installed quick, simple fixes for the deficiencies identified during the walkdown, but also proposed long-term upgrade/modification programs that were not explicitly required by GL 81-14. Moreover, some licensees even performed a voluntary walkdown of the qualified areas and installed quick fixes for the identified deficiencies, as discussed in paragraph 3.5

3.4 ALTERNATE DECAY-HEAT REMOVAL SYSTEM

Out of the 40 plants, only Oconee, Units 1, 2, and 3, will rely upon an alternate decay-heat removal system. Denoted as a standby shutdown facility, the system is conditionally qualified in accordance with our evaluation. Therefore, Oconee, Units 1, 2, and 3, may be considered to have an overall conditionally-qualified decay-heat removal facility although their AFW systems have major seismic deficiencies and are categorized as major deficient in Table 3-2.

3.5 ADDITIONAL INFORMATION

The additional information provided by the licensees, which was not a direct request of the GL 81-14, included the following:

- (a) Schematic sketches and diagrams of the AFW system. They usually provided information regarding the existence of a second valve on branch lines, the seismic boundary, water sources, piping, and other major equipment, etc.
- (b) The results of voluntary walkdown of seismically-qualified areas and any licensees' proposed corrective actions.

- (c) Description of the methodologies and acceptance criteria for seismically-qualified areas when the AFW system is not fully qualified. However, if the AFW system is fully qualified, the methodologies would be discussed in paragraph 2.1.1, Status of Seismic Qualification of AFW System Components.
- (d) Identification of areas of voluntary modification/upgrade that have been or were being implemented by the licensee, but were not a direct result of GL 81-14.
- (e) In the case of Indian Point, Unit 3, results of an interaction study of nonqualified items outside of the AFW system that may have a potential to damage or interfere with the AFW system function following an SSE.

We found that the schematic sketches/diagrams of the AFW system have usually been very helpful to our evaluation of the AFW system boundary and, sometimes, the seismic capability of certain piping. In addition, although we did not specifically evaluate any of the additional information, the additional information provided us a better understanding of the seismic capability of the AFW system with respect to the modern day seismic design practice for a safety-grade system. Apparently, some licensees performed the voluntary evaluation and/or upgrade of their AFW systems with the modern day design practice although GL 81-14 required only that the AFW system be originally designed to methodologies and criteria consistent with those applicable to other safe-grade systems at the plant. The licensee of Indian Point, Unit 3, went beyond the GL 81-14 requirements by performing the interaction study to assure the required safety function of the AFW system following an SSE. On the other hand, it has been noted that the additional information could expose more deficiencies in the seismic capabilities of the AFW system. Since each licensee provided different amounts of additional information, it could happen that some AFW systems appear inferior in seismic capability to the others simply because the licensees of the former volunteered more additional information than the latter. It has been our opinion that the licensees should not be penalized for deficiencies identified while providing additional information. Meanwhile, we strongly feel that any deficiencies so identified should not be completely overlooked. Such ironic observation has led us to wonder what deficiencies could have also been discovered if other licensees had similarly performed additional investigations and inspections.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

In summary, we prepared a TER (Technical Evaluation Report) for each of the 40 operating PWR plants as listed in Table 1-1. The evaluation was based on the licensees' responses to GL 81-14 and Request for Additional Information (RAI). The significant results of our evaluation were previously discussed in Chapter 3. The individual TERs are a part of the appendix. The general evaluation criteria and any plant-specific considerations were delineated in Chapter 2.

The following conclusions are made with regard to our evaluation of the licensees' responses:

- (1) In general, the plants involved in the review can be divided into four categories in accordance with the status of seismic qualification of the AFW systems, i.e., fully qualified, conditionally qualified, minor deficient, and major deficient, as shown in Table 3-2. About 68% of the plants are in the first two categories (including the conditionally-qualified standby shutdown facility at Oconee, Units 1, 2, and 3, as the alternate decay-heat removal system), 25% are minor deficient, and only 7% are major deficient.
- (2) All plants have a qualified primary or secondary-water source. Secondary water sources have a switchover procedure to facilitate the switchover when required. For the other six AFW system areas, i.e., pumps/motors, piping, valves/actuators, power supplies, initiation/control systems, and structures, the statistics of conditional qualification and nonqualification are shown in Tables 3-3 and 3-4, respectively. The most frequently deficient areas are: piping, valves/actuators, structures, and power supplies. Usually the older plants have more deficient items because they were constructed prior to the issuance of the Standard Review Plan and, hence, their AFW systems may not have been designed originally as a safety-grade system.

For 14 plants (35%), we determined that the AFW system boundary did not fully conform to the requirements of GL 81-14. In addition, there were four plants (10%) where we were unable to fully review the conformance condition of the AFW system boundary. Most of the plants with a nonconforming AFW system boundary do not have double-isolation valves on branch lines. Altogether, 45% of the plants do not or may not have their AFW system boundary fully conforming to GL 81-14 definitions.
- (4) For those plants presently having nonqualified AFW system items, many licensees did not complete the required walkdown. In particular, a walkdown has usually not been conducted for the nonqualified structures that support or house essential AFW items.

- (5) Licensees usually provided additional information such as sketches/diagrams, methodologies and criteria for the original seismic design, voluntary walkdown of the seismically-qualified areas, and long-term voluntary upgrade of the AFW system. In the case of Indian Point, Unit 3, the licensee submitted an interaction study on the potential damaging effect of nonqualified items outside the AFW system in the event of a seismic event. The additional information helped us evaluate the seismic capability and boundary conformance of the AFW system.
- (6) Oconee, Units 1, 2, and 3, are the only plants that will rely on an alternate decay-heat removal system: the Standby Shutdown Facility. This system was rated as conditionally qualified.

Our recommendations to the NRC regarding the licensees' responses to GL 81-14 and RAI are as follows:

- (1) In the TER, we generally recommend that the NRC require the licensee to reanalyze and/or modify the nonqualified AFW system items, if a plan for such corrective action was not provided by the licensee.
- (2) Regarding the required walkdown of nonqualified areas, we recommend that NRC define what constitutes a reasonable time schedule for the licensee to complete their proposed quick fixes to any identified deficiencies, and a reasonable time schedule to complete the required walkdown of all nonqualified items whenever the walkdown is found incomplete.
- (3) In general, our evaluation indicated that the more information that could be provided by the licensee the more the potential weaknesses in the seismic capability of the AFW system would be exposed. As such, an AFW system may appear inferior to others simply because the licensee provided more additional information while, in reality, the reverse may be true. This is a very important aspect for which the NRC must take a prudent position so that no licensees would be unnecessarily penalized simply because they provided more information. On the other hand, it appears that the NRC may not want to ignore any seismic related deficiencies identified in the licensees' additional information. Therefore, we recommend that the NRC evaluate the significance of all voluntary investigations and/or inspections that resulted in the additional information provided by certain licensees. One good example is the interaction study performed by the Indian Point, Unit 3, licensee that was intended to investigate the potential interference and damage to AFW functions should any nonqualified components outside the AFW system boundary fail.

CHAPTER 5

REFERENCES

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3. D. G. Eisenhut, "Multiplant Action Plan C-14: Seismic Qualifications of Auxiliary Feedwater Systems," memorandum to H. R. Denton, Office of Nuclear Reactor Regulation (February 20, 1981).
4. D. G. Eisenhut, "Seismic Qualification of Auxiliary Feedwater Systems," Generic Letter 81-14, U.S. Nuclear Regulatory Commission, letter to all operating pressurized water reactor licensees (February 10, 1981).
5. R. A. Clark, "Safety Evaluation Report for the Trojan Nuclear Plant", U.S. Nuclear Regulatory Commission, letter to B. D. Withers of the Portland General Electric Company (August 4, 1981).

APPENDIX

TECHNICAL EVALUATION REPORTS

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

ARKANSAS NUCLEAR ONE: UNIT 1

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Arkansas Nuclear One, Unit 1, responded by letter on August 7, 1981.³ The licensee's response was not complete and a Request for Additional Information (RAI) was issued by the NRC, dated April 2, 1982.⁴ The licensee replied with a supplemental letter dated May 27, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of the AFW system components that are currently, nonseismically qualified for a SSE.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC bulletins and information notices.
- Identification of areas of modification/upgrade and proposed areas and schedules for modification/upgrade after the next refueling outage.
- Description of methodologies and acceptance criteria for seismic design of the AFW system that was to be determined by the licensee to be seismically qualified to a SSE level .

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

•	<u>Pumps/Motors</u>	None
•	<u>Piping</u>	None
•	<u>Valves/Actuators</u>	None
•	<u>Power Supplies</u>	None
•	<u>Water Source(s)</u>	None
•	<u>Initiation/Control Systems</u>	The licensee stated that some components of the initiation/control systems are currently nonseismically qualified and they will be upgraded after the next refueling outage. Because the licensee did not discuss their specific seismic capacity, we judge that the current seismic capacity of the initiation/control system is less than OBE; but it will be at the SSE level when the licensee's upgrade is completed.
•	<u>Structures*</u>	None

Based on our evaluation described above, those areas of the AFW system judged not to possess a SSE seismic capability are identified below. We conclude that the AFW system will possess a SSE level of seismic capability on the completion of the AFW upgrade project.

•	<u>Pumps/Motors</u>	None
•	<u>Piping</u>	None
•	<u>Valves/Actuators</u>	None
•	<u>Power Supplies</u>	None
•	<u>Water Source(s)</u>	None
•	<u>Initiation/Control Systems</u>	None*
•	<u>Structures</u>	None

Based on the above evaluation, we conclude that the AFW system will possess a SSE level of seismic capability upon completion of the AFW upgrade project.

Because the primary water source and supply path is seismically qualified, switchover to a secondary water source is not involved. Additionally, information regarding the seismic capability of any alternate decay-heat removal system is not required because the AFW system will have a SSE level of seismic capability.

* Not fully qualified, but currently being investigated.

In regard to the AFW system boundary, the licensee considered only those portions of piping up to and including a single valve that is normally closed or capable of remote closure. Therefore, the AFW system boundary does not fully conform to the definition specified in GL 81-14. Since the licensee's response did not include any discussion on this deviation, we feel that it needs to be evaluated further by the NRC.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown of the nonseismically-qualified portion of the initial/control systems is required. The licensee's responses did not report any walkdown results, but indicated that they are continuing their investigation into the issues of seismic qualification by performing walkdowns, documentation reviews, and analyses, as appropriate.

2.3 ADDITIONAL INFORMATION

The licensee's responses provided a description of the methodologies, loading combinations, and acceptance criteria that were used in the design of the seismically-qualified portions of the AFW system.

3. CONCLUSIONS

The information contained in the licensee's responses to GL 81-14 is complete. The licensee did not report any results for a walkdown of the nonseismically-qualified areas of the AFW system. However, the licensee indicated that they were continuing the investigation into seismic qualification by performing walkdowns as well as other means. It is also noted that the licensee's AFW system boundary does not fully conform to the definition as specified in GL 81-14.

Based on the submitted information, we conclude that the AFW system at Arkansas Nuclear One, Unit 1, with exception of the boundary question, presently provides a reasonable assurance to perform the safety-related function following the occurrence of a SSE. We recommend that no further action be initiated regarding modification and/or upgrading of the AFW system of this plant under NRC Multiplant Action C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).

5. D. C. Trimble, Arkansas Power and Light Company, letter to D. G. Eisenhower of the U. S. Nuclear Regulatory Commission (August 7, 1981).
4. J. F. Stolz, U. S. Nuclear Regulatory Commission, letter to the Arkansas Power and Light Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Arkansas Nuclear One, Unit 1" (April 2, 1982).
5. J. R. Marshall, Arkansas Power and Light Company, letter to J. F. Stolz, U. S. Nuclear Regulatory Commission (May 27, 1982).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

ARKANSAS NUCLEAR ONE: UNIT 2

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Arkansas Nuclear One: Unit 2, responded with a letter dated August 7, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated April 29, 1982.⁴ The licensee provided a supplemental response in a letter dated May 27, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Description of methodologies and acceptance criteria for seismic design of the AFW system, which is determined to be seismically qualified to the SSE level by the licensee.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletin's and Information Notices.

We have reviewed the licensee's responses, and a point-by-point evaluation of licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

The AFW system has been designed, constructed, and maintained to withstand a SSE utilizing methods and acceptance criteria consistent with that applicable to other safety-related systems in the plant. All areas of the AFW system, i.e., pumps/motors, piping, valves/actuators, power supplies, water source, instrument/control systems, and structures supporting and housing the AFW system, are seismically qualified to the SSE level.

The licensee provided a description of the methodologies and acceptance criteria used for seismic qualification of the AFW system, and referred to the applicable sections of the FSAR. The description includes seismic analysis methods, seismic input, load combinations, allowable stresses, qualification testing, and engineering evaluations performed.

Because the primary water source and supply path is seismically qualified, switchover to a secondary water source is not involved. Additional information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system currently has a SSE level of seismic capability.

Regarding the AFW system boundary, the licensee did not clarify whether the boundary fully conforms to the definitions given in the Generic Letter 81-14 with respect to branch piping being qualified out to the second valve normally closed or capable of automatic closure when function is required or to a point of three orthogonal restraints.

The licensee stated that the AFW system was included within the scope of the seismic related NRC Bulletins 79-02, 79-04, 79-07, 79-14, 80-11, and IE Information Notice 80-21.²

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTIONS OF THE AFW SYSTEM

A walkdown is not required because no lack of seismic qualification of the AFW system is indicated.

3. CONCLUSIONS

The information contained in licensee's responses to Generic Letter 81-14 is complete except that it did not clarify whether the AFW system boundary fully conform to the definitions of Generic Letter 81-14.

Based on the submitted information, we conclude that the AFW system is fully seismically qualified and is able to provide the safety related function following a SSE assuming that the AFW system boundary fully conform to the boundary definitions specified in GL 81-14. Therefore, we recommend that no further action be initiated regarding upgrading of the AFW systems of this plant under NRC Multiplant Action Plant C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. D. C. Trimble, Arkansas Power and Light Company, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission (August 7, 1981).
4. USNRC, letter to Arkansas Power and Light Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Arkansas Nuclear One, Unit 2" (April 29, 1982).
5. J. R. Marshall, Arkansas Power and Light Company, letter to R. A. Clark of U. S. Nuclear Regulatory Commission (May 27, 1982).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

BEAVER VALLEY: UNIT 1

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Beaver Valley, Unit 1, responded with a letter dated August 5, 1981,³ and provided a supplemental response in a letter dated November 10, 1981.⁴

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Description of methodologies and acceptance criteria for seismic design of the AFW system, which is determined to be seismically qualified to the SSE level by the licensee.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

The AFW system has been designed, constructed, and maintained to withstand a SSE utilizing methods and acceptance criteria consistent with that applicable to other safety-related systems in the plant. All areas of the AFW system (i.e., pumps/motors, piping, valves/actuators, power supplies,

water source, instrumentation/control systems, and structures supporting and housing the AFW system) are seismically qualified to the SSE level.

The licensee provided a description of the methodologies and acceptance criteria used for seismic qualification of the AFW system, and referred to the applicable sections of the FSAR. The description includes seismic analysis methods, seismic input, load combinations, allowable stresses, qualification testing, and engineering evaluations performed.

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

Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system is fully seismically qualified.

Regarding the AFW system boundary, the licensee stated that it fully conforms to the definitions of the Generic Letter 81-14.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown is not required because no lack of seismic qualification of the AFW system is indicated.

3. CONCLUSIONS

The information contained in licensee's responses to Generic Letter 81-14 is complete. The licensee stated that the AFW system boundary fully conforms to the definitions of Generic Letter 81-14.

Based on the submitted information, we conclude that the AFW system is fully seismically qualified and is able to provide the safety related function following a SSE. Therefore, we recommend that no further action be initiated regarding upgrading of the AFW system of this plant under NRC Multiplant Action Plan C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).

3. J. J. Carey, Duquesne Light, letter to S. A. Varga of U. S. Nuclear Regulatory Commission (August 5, 1981).
4. J. J. Carey, Duquesne Light, letter to S. A. Varga of U. S. Nuclear Regulatory Commission (November 15, 1981).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM TECHNICAL EVALUATION REPORT

CALVERT CLIFFS NUCLEAR PLANT: UNITS 1 AND 2

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Calvert Cliffs Nuclear Plant, Units 1 and 2, responded with a letter dated June 30, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information was issued by the NRC, dated January 6, 1982.⁴ The licensee provided a supplemental response in a letter dated February 25, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Discussion of levels of seismic capability of nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Results of walkdown of nonseismically-qualified areas.
- Additionally, schematic sketch of the AFW system.
- 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.
- Additionally, description of methodologies and acceptance criteria for seismically-qualified components.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- 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 a SSE.
- Piping

(a) A portion of the AFW pump minimum flow recirculation piping. The recirculation line is routed through the nonseismic 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 nonseismic 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 nonseismic Class I and the chemical addition equipment is located in the turbine building. However, this line can be isolated

from 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.

- 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). 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.

- Power Supplies

- Water Source(s)

- Initiation/Control Systems

None

(a) The Burdon 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.

- 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 a SSE seismic capability are identified below.

•	<u>Pumps/Motors</u>	None
•	<u>Piping</u>	None
•	<u>Valves/Actuators</u>	OBE
•	<u>Power Supplies</u>	None
•	<u>Water Source(s)</u>	None
•	<u>Initiation/Control Systems</u>	None
•	<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 a 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 is 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 a SSE capability. For the purpose of removing decay heat following a 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.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTIONS OF THE AFW SYSTEM

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

2.3 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:

- All electric power supplies have been upgraded to Class IE during recent plant modifications.
- Each AFW system has been modified to include a safety-related automatic start system in accordance with NUREG 0578 and 6737.
- The general AFW system modifications are scheduled to be completed by the fall 1982 for Unit 2 and the fall 1983 for Unit 1. For Unit 2, however, the completion date will be delayed until the spring of 1984, if equipment deliveries are not met. These modifications include: upgrading the pump turbine and associated trip/throttle valve assemblies, 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 the requirements of IE 79-01B and NUREG 0588.
- 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 walkdown in that it encompassed only those nonseismically-qualified areas which the licensee has no plan to upgrade. The walkdown 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 a SSE, because the nonseismically-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 consider requiring the licensee to provide a re-analysis and/or modification to acquire a SSE capacity for these valves.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).

2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (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).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

DONALD C. COOK NUCLEAR PLANT: UNITS 1 AND 2

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of D. C. Cook Nuclear Plant, Units 1 and 2, responded with a letter dated August 28, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated April 5, 1982.⁴ The licensee provided a supplemental response in a letter dated June 15, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of the plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Discussion of levels of seismic capability of nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Results of partial walkdown of the nonseismically-qualified piping, and schedule for the ongoing field verification of the remaining nonseismically piping.
- Additionally, diagrams of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically-qualified components.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- Pumps/Motors
- Piping

None

(a) The condensate storage tank associated piping was designed to seismic Class II criteria. The condensate storage tank itself is seismic Class II and was designed to the OBE level. However, a seismic Class I secondary water source, i.e., the essential service water system, exists at the plant. Therefore, we judge that this piping is not essential to the safety related function of the AFW system. (b) The main feedwater piping upstream from the check valve to the motor operated valve is classified as seismic Class III, but was designed to the USAS B 31.1, 1967 edition and to withstand the OBE. Additionally, this segment of piping is part of licensee's ASME B&PV Code, Section XI, Code Class 2 Surveillance Program. Since the portion of the main feedwater piping discussed in (b) above is required to accomplish the AFW system function, we conclude that the AFW system piping possesses a seismic capability of the OBE level although the AFW system piping itself is seismically qualified to the SSE level.

- Valves/Actuators
- Power Supplies

None

Licensee indicated that the 4 KV switchgear cabinets (11A to D), the 600 V switchgear cabinets 11A to D, and the reactor trip and bypass breaker cabinets were found to be inadequately installed against overturning during the SSE. However, the permanent modification of the anchorage has been completed by August 28, 1981, and we therefore

- Water Source(s)

conclude that the power supplies now possess a seismic capability that will withstand a SSE.

The primary water source, i.e., the condensate storage tank, is seismic Class II and was designed to the OBE level. The secondary water source is the seismic Class I essential service water system. The procedure to switch the AFW pump suction to the essential service water system exists and is in place at the plant. Details of the procedure was described in licensee's letter to NRC dated March 28, 1980, No. AEP:NRC:0307A, and the procedure was accepted by NRC via S. Varga's letter of October 6, 1980 to the licensee. We conclude that the water sources possess a SSE level of seismic capacity.

- Initiation/Control Systems
- Structures

None

On the suction side, close to the condensate storage tank, the first valve and about three feet of piping are seismic Class I but do not have a seismic Class I enclosure. The enclosure provided is a fabricated sheet metal enclosure and the licensee did not discuss its seismic capacity. We judge that the structures possess an OBE level of overall seismic capacity. However, it is not clear to us whether the portion of the piping protected by the nonseismically qualified enclosure is part of the primary water source and path. If this is the case, the failure of the enclosure should not affect the safety related function of the AFW system.

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

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

* The level becomes OBE if the segment of piping protected by the nonseismically-qualified enclosure structure is not part of the primary water source and path.

In summary, our evaluation indicated that the majority of the AFW system at D. C. Cook Nuclear Plant, Units 1 and 2, presently possesses a level of seismic capability that can withstand a SSE with the exception of a portion of the main feedwater piping connected to the AFW system and, possibly, one piping enclosure structure as discussed above.

The primary water source and supply path is not seismically qualified and, therefore, switchover to the seismically-qualified secondary water source and supply path, i.e., the essential service water system, is required. The switchover procedure is available at the plant and was accepted by the NRC.

The seismic qualification information for any alternate decay heat removal system was not provided in the licensee's responses. This information was requested by the Generic Letter if substantial lack of seismic qualification is indicated for the AFW system. Based on the submitted information from licensee's responses, we find that the AFW system is not fully capable of performing the required safety-related function following the occurrence of a SSE. Therefore, we conclude that the licensee is required to either provide the information on seismic qualification of any alternate decay heat removal system or reanalyze/upgrade the existing AFW system to withstand the SSE.

Regarding the AFW system boundary, the licensee stated that the boundary of the AFW system as currently evaluated coincide with the boundary definition specified in GL 81-14. The licensee also stated that all work applicable to the AFW system for IE Bulletins 79-02 and 79-07 is completed; work applicable to the AFW system for IE Bulletins 79-14 and 80-11 is presently being completed; and IE Information Notice 80-21 is currently under review. The licensee also indicated that IE Bulletin 79-04 is not applicable to the AFW system re-evaluation because IE Bulletin 79-04 was issued in reference to incorrect weights for Velan swing check valves and there are no Velan valves in the AFW system for D. C. Cook Plant. We conclude that the AFW system is included within the scope of the applicable seismic related NRC Bulletins and Information Notices.

2.2 WALKDOWN OF NONSEISMICALLY QUALIFIED PORTIONS OF THE AFW SYSTEM

A walkdown of the nonseismically-qualified portion of the AFW system is required. The licensee indicated that walkdown has been conducted for the nonseismically-qualified piping connected to the condensate storage tanks and no deficiencies were identified. The licensee also indicated that efforts are underway to verify in the field the portion of the seismic Class III main feedwater piping upstream from the check valve to the motor-operated valve. As part of this effort, the licensee identified one valve control cabinet missing the anchorage shown on the design drawings. This deficiency was immediately repaired and reported to the NRC, Region III. The licensee will submit the results of the fieldwalk once it is completed, currently scheduled to be during the next refueling outage.

2.3 ADDITIONAL INFORMATION

The licensee provided a feedwater diagram and main stream diagram which illustrate the boundary of the AFW system. Additionally, licensee's responses provided a description of the methodologies, loading combinations and acceptance criteria that were used in the design of the seismically-qualified portion of the AFW system.

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 is complete. The licensee has conducted a partial walkdown for the nonseismically-qualified piping and is currently performing another field walkdown of the remaining nonseismically-qualified piping scheduled to be completed during the next refueling outage.

Based on the submitted information, we judge that the AFW system at D. C. Cook Nuclear Plant, with the exception of a portion of the main feedwater piping connected to the AFW system and one enclosure structure, presently provides a reasonable assurance to perform its required safety functions following a SSE. In conclusion, we recommend that the NRC consider requiring the licensee to reanalyze and/or upgrade the AFW system to assure an overall seismic capability of the SSE level.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. R. S. Hunter, Indiana & Michigan Electric Co., letter to H. R. Denton of U. S. Nuclear Regulatory Commission (August 28, 1981).
4. S. A. Varga, U. S. Nuclear Regulatory Commission, letter to R. S. Hunter of Indiana & Michigan Electric Co., "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Donald C. Cook Nuclear Plant, Units 1 and 2" (April 5, 1982).
5. R. S. Hunter, Indiana & Michigan Electric Co., letter to H. R. Denton of U. S. Nuclear Regulatory Commission (June 15, 1982).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

CRYSTAL RIVER NUCLEAR PLANT: UNIT 3

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Crystal River Nuclear Plant, Unit 3, responded with a letter dated July 14, 1981.³ The licensee's response was incomplete and a Request for Additional Information (RAI) was issued by the NRC, dated January 7, 1982.⁴ The licensee provided a supplemental responses in letters dated February 26, 1982⁵ and April 20, 1982.⁶

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Discussion of levels of seismic capability of nonseismically-qualified components of the AFW system.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Results of a walkdown of nonseismically-qualified areas.
- Additionally, a schematic sketch of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically-qualified AFW system components.
- Additionally, results of walkdown of the seismically-qualified AFW system areas.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

•	<u>Pumps/motors</u>	None
•	<u>Piping</u>	None
•	<u>Valves/Actuators</u>	None
•	<u>Power Supplies</u>	In Ref. 5, the licensee provided a partial list that identifies the turbine-building motor-control center that supplies power to the individual pump-discharge valve, condensate storage-tank suction, and main condenser suction valve. However, these valves are prepositioned to be not required for actuation for AFW system operation and are only required for maintenance or transfer of suction supply from the condensate storage tank to the nonqualified backup condenser hotwell. We, therefore, conclude that the turbine-building motor-control center is not essential to providing the safety function of the AFW system. Later in Ref. 6, the licensee identified the remaining nonseismically-qualified power supply times, but did not evaluate their seismic capability. However, the licensee also stated that such power supplies will be upgraded under their overall AFW system upgrade project.
•	<u>Water Source(s)</u>	None
•	<u>Initiation/Control Systems</u>	In Ref. 5 the licensee provided a partial list that identifies (a) the automatic actuation and control system, and (b) several manual control stations located on a section of the main control board that was not seismically qualified. However, seismically-qualified manual flow controls and circuits independent of the nonnuclear instrumentation (NNI) and integrated control system (ICS) are provided on a qualified section of the main control board, and hence there is no seismic related concern. Later in Ref. 6, the licensee identified the remaining nonseismically-qualified

initiation/control system components, but did not evaluate their seismic capability. However, the licensee also stated that initiation/control systems will be upgraded under their general AFW upgrade project.

- Structures

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

•	<u>Pumps/Motors</u>	None
•	<u>Piping</u>	None
•	<u>Valves/Actuators</u>	None
•	<u>Power Supplies</u>	None*
•	<u>Water Source(s)</u>	None
•	<u>Initiation/Control Systems</u>	None*
•	<u>Structures</u>	None

Based on the above evaluation, we conclude that the AFW system will possess a SSE level of seismic capability upon completion of the general upgrade project

Because the primary water source and supply path is seismically qualified, switchover to a secondary water source is not involved. Additionally, information regarding the seismic capability of any alternate decay-heat removal system is not required, because the AFW system will have a SSE level of seismic capability.

Regarding the AFW system boundary, with only one exception, all branch lines, which are not seismically qualified and are structurally coupled to the AFW system, have been analyzed out to a point of three orthogonal restraints, such that all transmitted seismic loads have been considered in the AFW system qualification. The one exception is the AFW steam-supply drain-tank vent connection to the turbine exhaust line. This vent line is currently under review by the licensee.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown of the nonseismically-qualified areas identified certain power supply items to be deficient. They include some inadequate cable tray supports at elevation 95 ft, a clamp missing from a cable tray support at elevation 119 ft, one loose hanger in the cable spreading room, and three loose items in the control-complex electrical support room. The licensee will add steel angle braces, where necessary, replace the missing clamp, and tighten all loose items. Such corrective actions will be accomplished as part of the overall AFW system upgrade, which is scheduled concurrent with the Crystal River, Unit 3, refueling outage in the first half of 1983.

* Current seismic capability unknown, but will be upgraded.

2.3 ADDITIONAL INFORMATION

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

The licensee also provided information on the methodologies and acceptance criteria that were used in the seismic design of the seismically-qualified portions of the AFW system. In addition, they stated that, for floors having fundamental frequency less than 25 Hz, the vertical seismic input was taken as two-thirds of the horizontal response spectrum for the respective evaluations.

Additionally, the licensee also performed walkdown of the seismically-qualified areas of the AFW system. Deficiencies were identified, corrective actions were proposed or are to be identified, and the schedule will be consistent with the overall AFW system upgrade as mentioned previously. The results of this walkdown are summarized below:

- Piping - (a) A 4-in. stainless-steel line tied into the main steam line at valve (MSV-440) is supported only for dead weight. Besides, it is not properly attached to one support and a U-bolt is missing. (b) A 6-in. sump-discharge line routed above the AFW system suction line is supported for deadweight only by rod-type hangers. (c) The turbine-pump exhaust line appears to be supported for deadweight only by rod-type hangers. (d) The suction line from the condensate hotwell is routed close to the AFW suction line from the condensate storage tank and there appears to be not enough clearance between the two lines. (e) A portion of the of the pump recirculation lines may not be adequately designed. (f) A line branching off the turbine-pump exhaust line does not appear on drawings. (g) A lateral restraint, designed as a removable support to allow for future disassembly, will be added to one of the seal injection lines routed from the top of the turbine-driven pump casing to valve (EFV-51). (h) One of the two silencers hung over the suction line requires a more adequate support. (i) A clamp is missing from the tubing run for pressure instrument (EF-2-PI) for the pipe routing on the motor-driven AFW pump. It will be replaced.
- Primary Water Source and Supply Path - (a) Some new lines have been connected to the condensate storage tank that must be reviewed for sufficient seismic support. (b) The neutralizing tank appears too close to the condensate storage tank. A review of the neutralizing tank's foundation will be done and, if necessary, a barrier between the two tanks may have to be added.

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 is insufficient for us to determine the present level of seismic capability of some areas of the existing AFW system. The licensee has stated that the AFW system will be upgraded under the general upgrade project. The walkdown conducted by the licensee identified some deficiencies and corrective actions

were planned with completion dates provided. Based on submitted information, we concluded that the AFW system will possess a SSE level of seismic capability upon completion of the on-going general AFW system upgrade project. In conclusion, we recommend that no further action be initiated regarding reanalysis and/or upgrading of the AFW system of this plant under NRC Multiplant Action C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. P. Y. Baynard, Florida Power Corporation, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission (July 14, 1981).
4. J. F. Stolz, U. S. Nuclear Regulatory Commission, letter to D. G. Mardis of the Florida Power Corporation, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Crystal River Nuclear Plant, Unit 3," January 7, 1982.
5. D. G. Mardis, Florida Power Corporation, letter to J. F. Stolz of U. S. Nuclear Regulatory Commission, February 26, 1982.
6. D. G. Mardis, Florida Power Corporation, letter to J. F. Stolz of U. S. Nuclear Regulatory Commission, April 20, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

DAVIS-BESSE NUCLEAR PLANT: UNIT 1

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Davis-Besse Nuclear Plant, Unit 1, responded with a letter dated July 15, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated January 11, 1982.⁴ The licensee provided a supplemental response in a letter dated February 10, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Summary of procedure for switchover to the secondary water source and supply path.
- Discussion of levels of seismic capability of nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, a schematic sketch of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically-qualified components.
- Additionally, identification of areas of modification/upgrade that have been completed or are proposed along with a schedule.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

•	<u>Pumps/motors</u>	None
•	<u>Piping</u>	The auxiliary feedwater pump turbine (AFPT) pipe support. Under IE Bulletin 79-14, reanalysis of the stress associated with the AFPT has indicated an increase in the loads transmitted to the AFPT nozzles. The AFPT supplier indicated that these loads would be acceptable for continued short term operations. Design modifications of the AFPT pipe support have been completed and field installations are in progress.
•	<u>Valves/Actuators</u>	None
•	<u>Power Supplies</u>	None
•	<u>Water Source(s)</u>	The condensate storage tank (CST) and the suction piping from the CST to its entrance to the auxiliary building. However, a secondary water source, i.e., the service water system (SWS) and supply path is seismically qualified for SSE, and an automatic switchover is provided. All equipment required to effect the switchover from the CST to SWS is Seismic Category I.
•	<u>Initiation/Control System</u>	None
•	<u>Structures</u>	Structures supporting or housing safety related portion of the AFW system have been designed at Seismic Category I except for 12 masonry walls/subwalls which did not meet the requirements of IE Bulletin 80-11. The 12 masonry walls/subwalls are Nos. 2297, 3036, 3167, 3177, 3187, 3441, 4016, 4647, 4796, 4826, 4886, and 4896. The modifications to walls 3447, 4647, and 4826 have been completed, and the modifications to the remaining nine walls are in progress, to be completed by January, 1983 or sooner.

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

•	<u>Pumps/Motors</u>	None
•	<u>Piping</u>	None*
•	<u>Valves/Actuators</u>	None
•	<u>Power Supplies</u>	None
•	<u>Water Source(s)</u>	None
•	<u>Initiation/Control System</u>	None
•	<u>Structures</u>	None*

Based on the above evaluation, we conclude that the AFW system will possess a SSE level of seismic capability upon completion of the modifications to the AFPT pipe support and the nine concrete masonry walls/subwalls.

A seismic category I switchover from the primary source to a seismically-qualified secondary water source is provided. Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system will have a SSE level of seismic capability upon completion of all proposed modifications of the presently nonseismically AFW system components.

Regarding the AFW system boundary, all branch lines except one have two valves that are normally closed or capable of automatic closure when safety function of the AFW system is required. The one exception is the alternate-supply-to-startup-feed-pump line, which has only one normally closed valve.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown of the nonseismically-qualified areas of the AFW system has not been conducted since they have been upgraded or are presently under modification.

2.3 ADDITIONAL INFORMATION

The licensee provided a schematic sketch of the AFW system including the water sources, heat sink, suction and discharge piping, major mechanical equipment, and structures supporting and housing the 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 seismically-qualified portions 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:

* Note: Currently not fully seismically qualified, but are being upgraded.

- AFPT pipe support design modifications have been completed, and installation will be completed by the end of the 1982 refueling outage, under facility change request (FCR) 79-421.
- The AFPT exhaust piping has been redesigned and rerouted to provide separate exhaust from each of the turbines. This modification was completed under facility change request (FCR) 79-421.
- Modifications to concrete masonry walls/subwalls No. 3447, 4647, and 4826 have been completed. Modifications to remaining nine masonry wall/subwalls No. 2297, 3036, 3167, 3177, 3187, 4016, 4796, 4886, and 4896 will be completed in January, 1983 or sooner as indicated in licensee's September 29, 1981 letter, Serial No. 1-217.

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 is incomplete since it does not provide sufficient information on the level of seismic capability of the currently nonseismically-qualified areas. The licensee did not conduct a walkdown of the nonseismically-qualified areas of the AFW system. However, these nonseismically-qualified areas have been, or are being, upgraded by the licensee. It is also noted that the licensee's AFW system boundary does not fully conform to the definition specified in GL 81-14. Based on the submitted information, we conclude that the AFW system at Davis-Besse Unit 1 will be able to provide the safety-related function following the occurrence of a SSE to assure safe shutdown of the plant upon completion of the scheduled AFW system upgrade. Therefore, we recommend that no further action be initiated regarding re-analysis and/or upgrading of the AFW system of this plant under NRC Multiplant Action C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. R. P. Crouse, Toledo Edison Company, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission (July 15, 1981).
4. U. S. Nuclear Regulatory Commission, letter to R. P. Crouse, of Toledo Edison Co., "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Davis-Besse Nuclear Power Station, Unit 1" (January 11, 1982).
5. R. P. Crouse, Toledo Edison Company, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission (February 10, 1982).

**SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT**

JOSEPH M. FARLEY: UNITS 1 AND 2

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Joseph M. Farley, Units 1 and 2, responded with a letter dated October 9, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated April 2, 1982.⁴ The licensee provided a supplemental response in a letter dated July 16, 1982.

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of currently nonseismically-qualified components of the AFW system.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, description of methodologies and acceptance criteria for the seismically-qualified components.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

•	<u>Pumps/Motors</u>	None
•	<u>Piping</u>	The underground portions of the pump minimum flow recirculation lines downstream of the minimum flow orifices are not seismic Category I. However, the licensee stated in their responses that the AFW system was designed to accomplish its required function with failure of these minimum flow recirculation lines. Therefore we judge that the AFW system piping possesses an overall seismic capability that will withstand a SSE.
•	<u>Valves/Actuators</u>	None
•	<u>Power Supplies</u>	None
•	<u>Water Source(s)</u>	None
•	<u>Initiation/Control Systems</u>	None
•	<u>Structures</u>	None

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

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

In summary, our evaluation indicates that the licensee's AFW system possesses an overall seismic capability that can withstand a SSE.

Because the primary water source and supply path is seismically qualified, switchover to a secondary water source is not involved. In addition, information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system is fully seismically qualified.

Regarding the AFW system boundary, the licensee's responses stated that it fully conforms to the requirements specified in the Generic Letter.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown is not required because we found that no lack of seismic qualification of the AFW system was indicated.

2.3 ADDITIONAL INFORMATION

The licensee's responses provided, via references to the applicable sections of the FSAR, a description of the methodologies and acceptance criteria that were used in the design of the seismic Category I components of the AFW system.

3. CONCLUSIONS

The licensee's responses provided all the information that was explicitly requested by GL 81-14. Based on this information, we conclude that the AFW system at Joseph M. Farley Nuclear Plant Units 1 and 2 will be able to provide the safety-related function following a SSE to assure safe shutdown of the plant. Therefore, we recommend that no further action be initiated regarding the need of modification/upgrading of the AFW systems of these plants under NRC Multiplant Action C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. F. L. Clayton, Jr., Alabama Power Company, letter to S. A. Varga of U. S. Nuclear Regulatory Commission, "Seismic Qualification of Auxiliary Feedwater System, Joseph M. Farley Nuclear Plant, Units 1 and 2" (October 9, 1981).
4. S. A. Varga, U. S. Nuclear Regulatory Commission, letter to F. L. Clayton, Jr., Alabama Power Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Joseph M. Farley Nuclear Plant, Units 1 and 2" (April 2, 1982).
5. F. L. Clayton, Jr., Alabama Power Company, letter to S. A. Varga of U. S. Nuclear Regulatory Commission, "Seismic Qualification of Auxiliary Feedwater System, Joseph M. Farley Nuclear Plant, Units 1 and 2" (July 16, 1982).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM TECHNICAL EVALUATION REPORT

FORT CALHOUN STATION: UNIT 1

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Fort Calhoun Station, Unit 1, responded with a letter dated July 14, 1981,³ and provided supplemental responses in letters dated September 14, 1981 and January 8, 1982.^{4,5}

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of currently nonseismically-qualified components of the AFW system.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Results of walkdown of the AFW system.
- Additionally, information on overall upgrade of the AFW system.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- Pumps/Motors None
- Piping (a) The rigidity of the small bore piping (cold system) was found to be inadequate due to improper support spacing, and pipe restraints were to be added. (b) The rigidity of the small bore piping (hot system) appeared to be inadequate although the high temperature (350°F) of this piping makes it critical to consider potential negative impacts of additional restraints on thermal displacements and loads. The licensee performed a detailed pipe stress analysis to determine detrimental impact of additional pipe restraints. The corrective actions for both items (a) and (b) were scheduled for completion by the end of 1981. With the incorporation of these corrective actions we conclude that the AFW system piping would have a SSE level of seismic capability.
- Valves/Actuators The operator supports for the valve operators on small bore piping were found to be unstable. The licensee stated that modification work involved replacing the existing support rods with a more stable support by the end of 1981. With the incorporation of this modification we conclude that the valves/actuators would have a SSE level of seismic capability.
- Power Supplies The electrical supply conduit to the AFW pump FW-6 motor had inadequate restraint. An additional support was to be added by the end of 1981 to increase the conduit resistance to seismic movements. With the incorporation of this modification we conclude that the power supplies would have a SSE level of seismic capability.
- Water Source None
- Initiation/Control Systems The instrument air system is not seismically qualified. However, the licensee stated that it is adequately restrained seismically and its failure would not preclude the AFW

system operation. We believe that the instrument air system is nonessential to the safety function of the AFW system and, hence, the initiation/control systems possess a SSE level of seismic capability.

None

- Structures

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

- Pumps/Motors None
- Piping None
- Valves/Actuators None
- Power Supplies None
- Water Source None
- Initiation/Control Systems None
- Structures None

In summary, our evaluation indicated that the AFW system at Fort Calhoun Station Unit 1, with the incorporation of the modifications to the four deficient items identified previously, would have possessed a SSE level of seismic capability.

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

Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system would have a SSE level of seismic capability with the incorporation of the modifications to the seismically deficient areas.

Regarding the AFW system boundary, the licensee's responses indicated that it fully conforms to the requirements specified in Generic Letter 81-14.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

The licensee conducted a walkdown of the AFW system. The walkdown resulted in the identification of the four seismically deficient items along with the corrective actions as previously described in Section (1). The corrective actions were scheduled for completion by the end of 1981.

2.3 ADDITIONAL INFORMATION

The licensee's responses stated that an overall upgrade of the AFW system was being implemented as required by NUREG-0737, which is related to, but not a direct result of, the Generic Letter 81-14.

3. CONCLUSIONS

The information contained in the licensee's responses to the Generic Letter 81-14 is complete. The licensee stated that the AFW system boundary fully conforms to the definitions of the Generic Letter 81-14.

Based on the submitted information, we conclude that, with the incorporation of the modifications to the seismic deficiencies previously identified, the AFW system at Fort Calhoun Station Unit 1 would have been fully seismically qualified and capable of providing the safety related function following a SSE. Therefore, we recommend that no further action be initiated regarding upgrading of the AFW system of this plant under NRC Multiplant Action Plan C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. W. C. Jones, Omaha Public Power District, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission (July 14, 1981).
4. W. C. Jones, Omaha Public Power District, letter to R. A. Clark of U. S. Nuclear Regulatory Commission (September 14, 1981).
5. W. C. Jones, Omaha Public Power District, letter to R. A. Clark of U. S. Nuclear Regulatory Commission (January 8, 1982).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM TECHNICAL EVALUATION REPORT

INDIAN POINT: UNIT 2

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Indian Point, Unit 2, responded with a letter dated August 7, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated April 6, 1982.⁴ The licensee provided a supplemental response in a letter dated May 10, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified by SSE.
- Discussion of levels of seismic capability of nonseismically-qualified AFW system components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Results of walkdown of portions of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically-qualified portions of the AFW system.
- Additionally, summary of recent improvements to the AFW system.
- Additionally, results of previous walkdowns of the AFW system performed both by licensee and resident NRC inspector.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

● <u>Pumps/Motors</u>	None
● <u>Piping</u>	None
● <u>Valves/Actuators</u>	<p>Licensee has stated that seismic requirements for the AFW system were not specifically prescribed in the purchase specifications. However, a licensee's consultant has determined on a generic basis that seismic capacities for the motor and air-operated gate and globe valves range from 0.84 to 23 g in acceleration with a median value of 7.3 g. Regarding Indian Point Unit 2 AFW system valves, the licensee's consultant has determined the median ground acceleration capacity of the water regulator valves and steam inlet valve to be about 5 g. Assuming a log-normal distribution for both the generic and Indian Point Unit 2 data, we have determined that the lower bound ground acceleration capacity of the water regulator valves and steam inlet valve is about 0.58 g, which is much greater than the 0.15 g design ground acceleration for the plant. In light of the large seismic capacities established by the licensee's consultant and the wide scope of his review, the licensee stated that other air-operated valves in the AFW system should also have sufficient seismic resistance to withstand a SSE. The licensee also stated that the pneumatic operators on the water regulator valves and steam inlet valve to the turbine are supplied by instrument air system whose compressors are powered from Class 1E sources. If for some reasons the air supply is lost, valve</p>

operability is assured by an automatic high pressure nitrogen bottle system. The valves also conservatively fail open on loss of power or air supply. In addition, the water regulator valves and steam inlet valve may be opened manually in the extremely unlikely event that the fail-safe designed pneumatic operators do not open the valves. Based on the above information provided by the licensee, we judge that the valves possess a seismic capability that will survive a SSE.

- Power Supplies

The underground power feeders for both motor driven pumps from the 480 V buses. The licensee indicated, however, these underground conduits are encased in concrete and have about 1.5 ft of ground cover, and therefore possess substantial amounts of inherent seismic resistance. In addition, there is an alternate power source for one of the motor driven pumps to assure water delivery to the secondary side of the steam generators if for some reasons the 480 V bus supplies become unavailable. We thus judge that the underground power feeder possess a SSE seismic capability.

- Water Source(s)

None

- Initiation/Control Systems

Instrumentation and control cables are routed in cable trays that are essentially unistrut supported and run to the control building through rigid seismic Category 1 structures where no amplification of the 0.15 g SSE ground acceleration would be expected. Dynamic testing of tray systems similar to those installed at this plant, according to licensee's responses, has indicated that such tray systems have inherent seismic resistant capability in excess of 1 g of zero period acceleration. We therefore judge that the cable tray systems carrying the instrumentation and control cables possess an inherent seismic capability that will survive a SSE.

- Structures

None

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

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

Based on the above evaluation, we conclude that the AFW system possesses a SSE level of seismic capability although portions of the valves, power supplies, and initiation/control system are nonseismically qualified.

Because the primary water source and supply path is seismically qualified, a switchover to a secondary water source is not involved. Additionally, information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system possesses a SSE level of seismic capability.

Regarding the AFW system boundary, the second valve normally closed or capable of automatic closure does not always exist between the AFW system and the nonseismic Category I branch piping. The three specific locations are: (a) the AFW lines to each steam generator join the main feedwater lines downstream of a gate valve and check valve in series on the main feedwater lines (gate valves BFD-7, BFD-7-1, BFD-7-2, BFD-7-3, and check valves BFD-6, BFD-6-1, BFD-6-2, BFD-6-3). These valves provide the boundary between the seismic and nonseismic Category I portions of the main feedwater line. The valves are always open. However, should the check valves fail to close completely, sufficient time is available to manually close the gate valves since the AFW system is not required until at least 30 minutes following a reactor trip to prevent the steam generators from boiling dry. (b) Air-operated butterfly valve LCV-1158 isolates the suction line to the AFW pumps from the nonessential make-up line to the condenser hotwell. The licensee stated that this valve should be capable of operation under SSE loadings. The licensee also stated that the valve is in a vertical line seismically supported to an elevation about 25 feet above the pump inlet and hence failure of the nonseismic Category portion of the line should not adversely affect the water supply to the pumps. (c) Check valve CD-109 provides the boundary between seismic and nonseismic Category I portions of the make-up water line to the condensate storage tank. The recirculation lines for the auxiliary feedwater pumps feed into the seismic Category I portion of this line. The recirculation line for the turbine-driven pump is provided with a normally open globe valve; however, the licensee stated that sufficient time is available to manually close this valve if for some reasons the check valve fails to close completely. Based on the above information, we conclude that the AFW system boundary does not fully conform to the definition specified in GL 81-14; however, such deviation would not adversely affect the AFW system in performing the required safety function.

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.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown of the nonseismically-qualified portions of the AFW system is required. The licensee stated that recent walkdowns of the AFW system were performed to verify the system supports to be in good condition. They did not indicate that the walkdowns specifically covered all nonseismically-qualified portions of the AFW system. However, we conclude that such walkdowns are sufficient because, as discussed later in 2.3 Additional Information, previous walkdowns of the AFW system by the licensee and resident NRC inspector appeared to have included the nonseismically-qualified areas of the system. The walkdown performed by the resident NRC inspector did not identify unacceptable conditions of the AFW system.

2.3 ADDITIONAL INFORMATION

The licensee provided information on the methodologies and acceptance criteria for the seismic design of the seismic Category I portions of the AFW system.

The licensee stated that recent improvements to the AFW system have been made in response to NRC requirements identified during the course of the NRC Bulletins and Orders Task Force review following the accident at Three Mile Island, Unit 2, and set forth in the NRC letter of November 7, 1979 to the licensee. These changes, and other design details of the AFW system, are described in licensee's letters to the NRC on December 14, 1979; December 19, 1979; April 14, 1980; July 30, 1980; August 11, 1980; and November 26, 1980.

The licensee also stated that other recent walkdowns were performed. In response to IE Bulletin 79-02, a field inspection and a testing program were performed to verify proper installation of pipe support plates and expansion anchor bolts, as described in licensee's July 6, 1979 and September 17, 1979 letters to Mr. Grier of Region I Office of Inspection and Enforcement of NRC. In response to IE Bulletin 79-14, walkdowns were performed for seismic Category I lines 2.5 in. and greater to the extent practicable and qualified personnel has verified the existence, location, and integrity of identified supports as well as the overall piping geometry as described in licensee's August 1, 1979, and September 28, 1979 letters to Mr. Grier. In addition, as reported in Inspection Report No. 50-247/80-15, the resident NRC inspector conducted a walkdown of all accessible portions of the AFW system. The inspector concluded that the system was lined up in accordance with licensee's check off list (DWG. 9321-F-2019, Rev. 25); all hangers and supports appeared to be acceptable; electrical equipment was found to be clear of loose material jumpers, and debris; remote position indication on breakers and valves matched the actual position of the breakers and valves; metering associated with the system was calibrated within the proper calibration dates; and no unacceptable conditions were identified.

3. CONCLUSIONS

The information contained in licensee's responses to Generic Letter 81-14 is complete. Based on the submitted information, we conclude that the AFW system at Indian Point Unit 2, although not entirely seismically qualified,

has reasonable assurance to provide the safety-related function following the occurrence of a SSE for safe shutdown of the plant. Therefore, we recommend no further action be initiated regarding reanalysis and/or upgrading modifications of the AFW system of this plant under NRC Multiplant Action C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. J. D O'Toole, Consolidated Edison Company, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission (August 7, 1981).
4. S. A. Varga, U. S. Nuclear Regulatory Commission, letter to J. D. O'Toole, Consolidated Edison Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Indian Point, Unit 2" (January 7, 1982).
5. J. D. O'Toole, Consolidated Edison Company, letter to S. A. Varga, U. S. Nuclear Regulatory Commission (May 10, 1982).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

INDIAN POINT: UNIT 3

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Indian Point, Unit 3, responded with a letter dated August 28, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated April 9, 1982.⁴ The licensee provided a supplemental response in a letter dated September 2, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Discussion of levels of seismic capability of nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Results of walkdown of nonseismically-qualified areas.
- Additionally, schematic sketch of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically-qualified components.
- Additionally, results of seismic interaction study of nonseismically-qualified components outside and in the vicinity of the AFW system.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- Pumps/Motors
- Piping

None

The portion of the 12 in. piping connecting the hotwell to the AFW suction line (No. CT-1070) that is between valves (LCV-1158 and LCV-1128) is seismic Class III. The licensee stated that it is not necessary to rely upon the operability of this pipe during a SSE in order to provide adequate flow from the condensate storage tank to the auxiliary feedwater pumps. They stated that, prior to the condensate storage tank level decreasing to its technical specification low limit, automatic closure of the seismically-qualified valve (LCV-1158) and actuation of low level alarm in the control room will occur and the available water is sufficient to remove heat generated by the reactor for 24 hours at hot shutdown conditions. However, we believe that, if this section of piping should fail during a seismic event and the single failure is assumed to be the isolation valve (LCV-1158), a path is created that would jeopardize the capability of the condensate storage tank to provide adequate water to the AFW system. Since the licensee has not indicated plans to upgrade this pipe, we judge that the present level of seismic capability of AFW system piping is less than OBE. Valve (LCV-1128) is seismic Class III. The licensee has stated that they are not planning any action on upgrading this valve due to the discussion made above in the piping evaluation section. However, we believe that the valve LCV-1128 is the second valve required on the AFW system

- Valves/Actuators

boundary and therefore we judge that the present level of seismic capability of the valves is less than OBE.

- Power Supplies

The licensee has stated that the seismic qualification data is not available for two motor control centers (Nos. 34 and 39), two 480 V switchgear units (Nos. 31 and 32), and three 125 VDC power panels (Nos. 31, 32, and 33). Investigations are currently underway with the vendors and they are scheduled to be completed prior to start-up from the cycle 4/5 refueling outage which would occur in the summer of 1984. However, the licensee did not indicate that identified deficiencies would actually be corrected. We judge that the power supplies currently possess a level of seismic capability less than the OBE. None

- Water Source(s)

- Initiation/Control Systems

(a) The licensee has stated that the seismic qualification data is not available for the speed control system for the turbine AFW pump, the ITT Barton flow control switches (FC-1135S and 1136S), and static "O" ring. The licensee indicated that these deficiencies would be investigated with the vendor, but did not indicate that corrective actions will be taken. (b) Field routed instrument air piping in the AFW pump room is currently supported by rod hangers or frictional clamps which appear to lack sufficient seismic resistance. The licensee plans to provide additional restraints and/or modify the existing ones. (c) Instrumentation and control rack No. 28 is free standing without any bolts. Moreover, the grout is not provided and the bottom of the rack is rusted. Corrective actions are planned. (d) Nitrogen bottles are free standing and tied only with chains and ropes. Additional restraints have been planned. (e) AFW pumps local control panel appears to lack adequate seismic resistance in the lateral direction. The licensee plans to check with the vendor for additional lateral support or X-bracing; however, corrective actions are not committed to.

Actions for all items described above are planned for completion before startup from the cycle 4/5 refueling outage which would occur in the summer of 1984. Because no commitments for upgrade/modification have been identified for items (a) and (e), we conclude that the seismic capability of the initiation/control systems is less than OBE. The turbine building is seismic Class III, and it supports and/or houses the 12 in. pipe (CT-1070), valve LCV-1128, and possibly some other essential AFW system components. The licensee has no plans to upgrade/modify this building. We therefore conclude that the present level of seismic capability of the structures is less than OBE.

- Structures

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

• <u>Pumps/Motors</u>	None
• <u>Piping</u>	Less than OBE
• <u>Valve/Actuators</u>	Less than OBE
• <u>Power Supplies</u>	Less than OBE
• <u>Water Source(s)</u>	None
• <u>Initiation/Control Systems</u>	Less than OBE
• <u>Structures</u>	Less than OBE

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

The primary water source is the condensate storage tank which is seismically qualified. A secondary water source is provided from the nonqualified city water system. However, since 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 requested by the Generic Letter 81-14 if substantial lack of seismic qualification of the AFW system is indicated. We did not find that the licensee's AFW system has a SSE capability, and the licensee's responses did not provide information on any alternate decay heat removal system.

Regarding the AFW system boundary, the licensee stated that it fully conforms to the definitions of GL 81-14. However, the branch line (CT-1070) is a part of AFW system and has a nonqualified second isolation valve (LCV-1128) which the licensee has no plans for upgrading. We therefore believe that the AFW system boundary does not fully conform to the definition of GL 81-14.

The licensee stated that the AFW system was included within the scope of the seismic related NRC Bulletin 79-02, 79-04, 79-07, 79-14, and 80-11. Regarding the IE Information Notice 80-21, nine representative items have been evaluated and the results are generally applicable to the AFW system.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

The licensee stated that a walkdown of the AFW system was jointly performed by the licensee and their consultant, Ebasco Services, and it was limited to the AFW pump building where the major portion of the AFW system is located. Also components of the support system were followed outside the building to maximum possible and practical extent. Walkdown of the Class III pipe (CT-1070) indicated that it has inadequate supports. It has been proposed by the licensee's consultant to provide three orthogonal restraints to the portion of this pipe in the pump building, and the licensee has decided not to perform any action on this item as was previously discussed under the piping evaluation. Walkdown on the initiation/control systems has identified several deficiencies along with corrective actions as previously discussed under the initiation/control systems evaluation. In conclusion, we believe that the walkdown is not complete because it did not cover the nonseismically-qualified turbine building and the valve (LCV-1128).

2.3 ADDITIONAL INFORMATION

The licensee provided a schematic sketch of the AFW system including the water sources, heat sink, suction and discharge piping, major mechanical equipment, and structures supporting and housing the 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 seismically-qualified portions of the AFW system by referring to the appropriate sections of the FSAR.

Additionally, the licensee provided the results of a seismic interaction study of the components outside and in the vicinity of the AFW system, to assess their effect on the AFW system. The components in the following list are considered by the licensee to be the major contributors to unacceptable interaction affecting AFW system functionality: (a) Crane/monorail structure located directly above the two motor driven and the turbine driven AFW pumps. (b) 4-in. nonseismic floor drain pipe directly above the electrical cable trays containing essential safety related equipment. (c) Space heaters and electrical lighting fixtures located directly above essential safety related equipment and structures. (d) Nonseismic electrical cable trays and conduit routed directly above essential safety related equipment and structures. (e) Large nonseismic instrument racks located within close proximity to essential safety related equipment and structures. (f) Large roll-up door located in the shieldwall whose structural failure could affect the flow control stations of the turbine driven AFW pumps. The licensee did not indicate any plans to investigate or correct the above mentioned deficiencies.

3. CONCLUSIONS

The information contained in licensee's responses to the Generic Letter 81-14 is complete. The licensee identified the nonseismically-qualified portions of the AFW system and conducted a partial walkdown of these items. Investigations of the power supplies and initiation/control systems were scheduled by the licensee to be completed before the cycle 4/5 refueling outage in the summer of 1984. No plans were given, however, for any possible actions resulting from such investigations. Also, we conclude that the AFW system boundary does not fully conform to the boundary definitions specified in the Generic Letter 81-14.

Based on the submitted information, we conclude that presently the AFW system at the Indian Point, Unit 3 Nuclear Plant cannot withstand a SSE. Therefore, we recommend that the NRC consider requiring the licensee: (a) to complete the walkdown of the nonseismically-qualified components of the AFW system within a reasonable time, and (b) to upgrade/modify the nonseismically-qualified portions of the AFW system under NRC Multiplant Action Plan C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. J. P. Bayne, Power Authority of the State of New York, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission (August 28, 1981).
4. U. S. Nuclear Regulatory Commission, letter to Power Authority of the State of New York, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Indian Point, Unit 3 Nuclear Power Plant" (April 9, 1982).
5. J. P. Bayne, Power Authority of the State of New York, letter to S. A. Varga of U. S. Nuclear Regulatory Commission (September 2, 1982).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

KEWAUNEE NUCLEAR PLANT

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Kewaunee Nuclear Plant responded with a letter dated August 28, 1981.³ The licensee's response was incomplete and a Request for Additional Information (RAI) was issued by the NRC, dated February 25, 1982.⁴ The licensee provided a supplemental response in a letter dated April 8, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of currently nonseismically-qualified components of the AFW system.
- Description of procedure for switchover to a seismically-qualified secondary water source.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, isometric drawings of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically-qualified components.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the GL 81-14's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- Pumps/Motors None
- Piping The portion of the recirculation line from the discharge of the AFW pumps to the condensate storage tank. This branch line was originally designed to the pipe anchors as a seismic Class I line. A subsequent design change relocated the Class I boundary of this line. As a result, additional piping, i.e., a nonseismically-qualified portion of the recirculation line beyond the pipe anchors was included within the relocated Class I boundary. The licensee stated that they are currently verifying the seismic design and will submit their finding at a future date. Until such information is submitted by the licensee, we cannot determine the seismic capability of the additional piping in question and we judge that it probably possesses a seismic capability that will survive an operating basis earthquake (OBE).
- Valves/Actuators None.
- Power Supplies None.
- Water Source(s) The primary water source, the condensate system, is not entirely seismically qualified. Only a portion of the condensate system from the piping anchor (three orthogonal restraints) through to the coupling to the AFW system is fully qualified seismically. The licensee did not describe the original seismic design level for the condensate system. However, they indicated that it does not present any unanalyzed, seismically-induced loads on the AFW system and that a secondary water source and supply path, the service water system, is available to provide a backup water supply to the AFW system. The portion of the service water system, which supplies water to the AFW system, is seismically qualified, and a

- Initiation/Control Systems
- Structures

procedure (A-FW-05B) includes the remote operation of the service-water supply valves from the control room.

None
None

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

- Pumps/Motors None
- Piping OBE
- Valve/Actuators None
- Power Supplies None
- Water Source(s) None
- Initiation/Control Systems None
- Structures None

In summary, our evaluation indicates that the AFW system at Kewaunee Nuclear Plant does not presently possess an overall level of seismic capability that can survive a SSE, because a portion of the recirculation line is currently nonseismically qualified.

The primary water source and supply path is not wholly seismically qualified and, therefore, switchover to the seismically-qualified secondary water source and supply path is required. A switchover procedure is available.

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. Although we judge that the existing AFW system does not possess a SSE level seismic capability, we conclude that such information for any alternate decay-heat removal system is not required at the present, because the licensee has stated that they are in the process of verifying the seismic design of the additional piping on the recirculation line to the condensate storage tank, and that the conclusion will be submitted at a later date.

Regarding the AFW system boundary, we conclude that it fully conforms to the requirements of GL 81-14.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown of the nonseismically-qualified portion of the branch piping is required. The licensee's responses did not indicate that they conducted the walkdown, although they are presently verifying the seismic design of the nonseismically-qualified portion of the branch piping. We conclude that the information on the required walkdown is not complete.

2.3 ADDITIONAL INFORMATION

The licensee provided four isometric drawings of the AFW system that identify the seismic Class I piping, water sources, heat sinks, and all major mechanical equipment.

Additionally, licensee's responses stated that description of the methodologies used in the seismic qualification of their AFW system is provided in the licensee's letter of July 9, 1979.⁶

3. CONCLUSIONS

The information contained in licensee's responses to the GL 81-14 is not sufficient with regard to seismic qualification of the recirculation line. The licensee did not conduct a walkdown of the non-seismically-qualified portion of the recirculation line. However, they stated that verification of the seismic capability of the recirculation line is underway and the conclusion will be provided at a later date.

Based on the submitted information, we conclude that the AFW system at the Kewaunee Nuclear Plant does not provide a reasonable assurance to perform its required safety function following a SSE, because the nonseismically-qualified portion of the recirculation line is judged to have only a OBE level resistance. Since the licensee is currently verifying the seismic design of the piping in question, we recommend that no action be initiated regarding additional analyses and/or upgrading modifications of the AFW system of this plant under NRC Multiplant Action C-14, pending the licensee's conclusion from their ongoing verification.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. K. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. E. R. Mathews, Wisconsin Public Service Corporation, letter to S. A. Varga of the U. S. Nuclear Regulatory Commission, August 14, 1981.
4. S. A. Varga, U. S. Nuclear Regulatory Commission, letter to E. R. Mathews, Wisconsin Public Service Corporation, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Kewaunee Nuclear Plant", February 25, 1982.
5. E. R. Mathews, Wisconsin Public Service Corporation, letter to S. A. Varga, U. S. Nuclear Regulatory Commission, April 8, 1982.
6. E. R. Mathews, Wisconsin Public Service Corporation, letter to J. G. Keppler, U. S. Nuclear Regulatory Commission, July 9, 1979.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

MAINE YANKEE NUCLEAR PLANT

1. INTRODUCTION

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

To implement the first phase of C-14, the NRC issued Generic Letter 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of Maine Yankee Nuclear Plant responded with a letter dated August 5, 1981.³ The licensee's response was incomplete and a Request for Additional Information (RAI) was issued by the NRC, dated April 2, 1982.⁴ The licensee provided a supplemental response in a letter dated May 27, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's responses include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically-qualified for SSE.
- Discussion of levels of seismic capability of certain nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Results of walkdown of portions of nonseismically-qualified areas.
- Additionally, verification of the program currently being conducted by licensee to reaffirm or qualify the AFW system piping, and the schedules for modifications, if found necessary, as a result of this program.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the GL 81-14's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- Pumps/Motors
- Piping

None

(a) Licensee stated that a small-bore minimum flow recirculation piping from the discharge of the AFW pumps was not fully qualified for SSE. No discussion was given regarding its seismic capability. (b) Licensee stated that the majority of large-bore suction piping from the demineralized-water storage tank to the AFW pumps was analyzed for some seismic loads. However, the specific level of the seismic loads was not discussed. (c) The initial design and construction of small-bore piping did not consider seismic loads, according to the licensee, and there was no discussion on the seismic capacity of the small-bore piping. From the above information, we judge that the seismic capacity of the piping system is presently less than an OBE level. The licensee stated that they are currently reaffirming all previous seismic analyses of the piping system. The scope of the program will be increased to include the seismic qualification of the piping supplying each steam generator to the SSE level. If deficiencies are found in the piping system, corrective actions will be implemented and any necessary physical changes to assure the capability of auxiliary feedwater delivery to the steam generator will be accomplished during the next scheduled refueling outage after August 5, 1981.

-
- Valves/Actuators

Licensee stated that valve actuators were not seismically qualified, but will be either qualified for certain seismic loads or replaced, concurrent with the program for piping seismic qualification. We judge that the actuators presently possess a less than OBE level of seismic capability.

- Power Supplies The seismic capacity of conduit is currently unknown and the licensee will assess the feasibility of qualifying the conduits as time permits. We, therefore, judge that the conduits presently possess a less than OBE level of seismic capability.
- Water Source(s) None
- Initiation/Control Systems None
- Structures None

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

- Pumps/Motors None
- Piping None*
- Valve/Actuators None*
- Power Supplies Less JBE
- Water Source(s) None
- Initiation/Control Systems None
- Structures None

summary, our evaluation indicates that licensee's AFW system does not presently possess an overall seismic capability that can withstand a SSE.

The primary water source is seismically qualified, but the supoply path is not wholly seismically qualified. Therefore, information on switchover to a seismically-qualified secondary water source supply path is required. This information is not available from licensee's responses, and it appears that a seismically-qualified secondary water source and supply path does not presently exist. However, a switchover will not be involved when the licensee completes the upgrade/modification of the primary-water supply line by the next refueling outage.

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 of the AFW system is indicated. We did not find that the licensee's AFW system has a SSE capability. However, we conclude that such information for any alternate decay-heat removal system is not required, because the licensee has stated that they are reanalyzing and/or modifying the AFW system piping and valve actuators, and that they will assess the feasibility of qualifying the conduits as time permits.

Regarding the AFW system boundary, the licensee indicated that the original seismic design criteria considered the first normally-closed isolation valve as the seismic boundary for branch piping, and the licensee's ongoing seismic qualification program for the AFW system piping will verify the seismic integrity of the branch piping beyond the first normally-closed valve to a point of three orthogonal restraints. One exception to this boundary classification is the condensate makeup and spill line connected to the demineralized-water storage tank. Currently, this line is under review for determination of seismic adequacy and/or modification. Based on the above information, we conclude that the AFW system boundary line does not fully conform to the definition specified in GL 81-14.

The licensee stated that the AFW system was included within the scope of IE Bulletins 79-04 and 80-11. The seismically-qualified portions of the AFW system piping were addressed in the licensee's responses to IE Bulletins 79-02, 79-07, and 79-14. The presently nonseismically-qualified portions of the AFW system piping will be included within IE Bulletins 79-02, 79-07, and 79-14 as part of the licensee's ongoing seismic-qualification assessment program. The licensee indicated that initial review of the IE Information Notice 80-21 did not result in recommended actions, and that they will reconsider 80-21 as time permits, through the seismic-qualification assessment program. Based on the above information, we conclude that the licensee's AFW system will comply with all seismic-related NRC bulletins and Information Notices, when the licensee completes their seismic-qualification assessment program.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown of the currently nonseismically-qualified portions of the AFW system is required. The licensee indicated that a field of walkdown was conducted only for the small-bore branch piping. We conclude that the information on the required walkdown is not complete.

2.3 ADDITIONAL INFORMATION

The licensee indicated that they are currently conducting the seismic-qualification assessment program for the AFW system piping and valve actuators. The program will be increased to include qualifying the AFW system piping supplying each steam generator to the SSE level. In the conduct of this program, corrective actions will be implemented, if deficiencies are found and physical changes, if necessary, will be accomplished to assure the capability of feedwater delivery to the steam generator during the next scheduled refueling outage after August 5, 1981.

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 was not sufficient for us to evaluate the overall seismic capability for the existing AFW system. Except for the small-bore branch piping, a walkdown for the presently nonseismically-qualified AFW system piping, actuators, and conduits has not been performed. It is also noted that the AFW system boundary does not fully conform to the definition specified in GL 81-14.

Based on the submitted information, we conclude that the AFW system at the Maine Yankee Nuclear Plant will not be able to perform the safety-related function following the occurrence of a SSE, because the seismic capability of conduit in the power supplies is currently unknown and the licensee has not identified a specific assessment program for the conduit. The current seismic qualification assessment program, which the licensee stated will be completed by the next refueling outage, will reaffirm and/or upgrade the seismic qualification of the AFW system piping and valve actuators. Since the licensee does not presently plan to analyze and/or upgrade the conduit, we recommend that the NRC considers requiring the licensee to provide a reanalysis and/or modification to acquire a SSE capacity for the conduit.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. W. P. Johnson, Maine Yankee Atomic Power Company, letter to Office of Nuclear Reactor Regulation of the U. S. Nuclear Regulatory Commission, August 5, 1981.
4. R. A. Calrk, U. S. Nuclear Regulatory Commission, letter to J. H. Garrity, Maine Yankee Atomic Power Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Maine Yankee Nuclear Plant", April 2, 1982.
5. J. H. Garrity, Maine Yankee Atomic Power Company, letter to R. A. Clark, U. S. Nuclear Regulatory Commission, May 27, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

McGUIRE NUCLEAR STATION, UNITS 1 AND 2

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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.

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",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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 McGuire Nuclear Station, Units 1 and 2, responded with a letter dated July 15, 1981,³ and there was no supplemental response required in order to complete our evaluation.

This report is a technical evaluation based on the information from the licensee's responses to GL 84-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Identification of currently nonseismically-qualified components of the AFW system.
- Description of procedure for switchover to a seismically qualified water source.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, schematic sketches of the AFW system.
- Additionally description of methodologies and acceptance criteria for the design of seismically qualified components.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the GL 81-14's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

•	<u>Pumps/Motors</u>	None
•	<u>Piping</u>	None
•	<u>Valves/Actuators</u>	None
•	<u>Power Supplies</u>	None
•	<u>Water Source(s)</u>	The normal water source, i.e., the condensate storage tank, is not seismically qualified. However, the primary water supply from the Nuclear Service Water (RN) System is seismically qualified. A procedure is available for switching from the normal to the primary water source. Therefore, we conclude that the water sources possess a SSE level of seismic capability.
•	<u>Initiation/Control Systems</u>	None
•	<u>Structures</u>	None

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

•	<u>Pumps/Motors</u>	None
•	<u>Piping</u>	None
•	<u>Valves/Actuators</u>	None
•	<u>Power Supplies</u>	None
•	<u>Water Sources(s)</u>	None
•	<u>Initiation/Control Systems</u>	None
•	<u>Structures</u>	None

In summary, our evaluation indicated that the AFW system at McGuire Nuclear Station, Units 1 and 2, possesses a SSE level of seismic capability.

The normal water supply from the condensate storage tank is not seismically qualified and, therefore, switchover to the seismically qualified primary water supply, the RN System, is required. The switchover procedure consists of automatic alignment of the AFW pumps to the RN System on low-suction pressure, as described in the FSAR, Section 10.4.7.2.2. This procedure has been found acceptable to the NRC in its safety evaluations for the operating licenses for McGuire Nuclear Station, Units 1 and 2.

Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system has a SSE level of seismic capability.

Regarding the AFW system boundary, the licensee's responses indicated that it fully conforms to the requirements specified in GL 81-14 81-14.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown is not required because no lack of seismic qualification of the AFW system is indicated.

2.3 ADDITIONAL INFORMATION

The licensee provided a schematic diagram of the AFW system pump suction and discharge, and a diagram of the steam generator side feedwater piping. Additionally, licensee's responses provided a description of the methodologies and acceptance criteria for the design of the seismically qualified components, including a reference to the applicable sections of the FSAR.

3. CONCLUSIONS

The information contained in licensee's responses to the GL 81-14 81-14 is complete. The licensee stated that the AFW system boundary fully conforms to the definitions of the GL 81-14.

Based on the submitted information, we conclude that the AFW system at McGuire, Nuclear Station, Units 1 and 2, is fully seismically qualified and is able to provide the safety related function following a SSE. Therefore, we recommend no further action be initiated regarding upgrading of the AFW system of this plant under NRC Multiplant Action Plan C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. W. O. Parker, Jr., Duke Power Co., letter to H. R. Denton of U. S. Nuclear Regulatory Commission, July 15, 1981.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

MILLSTONE NUCLEAR POWER STATION, UNIT 2

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Millstone Nuclear Power Station, Unit 2, responded with a letter dated July 24, 1981.³ The licensee's response was found not to be complete and a request for Additional Information (RAI) was issued by the NRC, dated April 15, 1982.⁴ The licensee provided a supplemental response in a letter dated June 4, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Description of methodologies and acceptance criteria for seismic design of the AFW system, which is determined to be seismically qualified to the SSE level by the licensee.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, results of walkdown of the AFW system and identification of areas of modification/upgrade that have been completed or are proposed along with a schedule.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the GL 81-14's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

The AFW system has been designed, constructed, and maintained to withstand a SSE utilizing methods and acceptance criteria consistent with that applicable to other safety-related systems in the plant. All areas of the AFW system, i.e., pumps/motors, piping, valves/actuators, power supplies, water source, instrument/control systems, and structures supporting and housing the AFW system, are seismically qualified to the SSE level.

The licensee provided a description of the methodologies and acceptance criteria used for seismic qualification of the AFW system, and referred to the applicable sections of the FSAR. The description includes seismic analysis methods, seismic input, load combinations, allowable stresses, qualification testing, and engineering evaluations performed.

A switchover procedure to a secondary water source is not involved because the primary water source and supply path is seismically qualified.

Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system is fully seismically qualified.

Regarding the AFW system boundary, we conclude that it fully conforms to that required by GL 81-14. The licensee stated that the AFW system was included within the scope of the seismic related NRC Bulletins 79-02, 79-04, 79-07, 79-14, 80-11, and IE Information Notice 80-21.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown is not required because no lack of seismic qualification of the AFW system is indicated.

2.3 ADDITIONAL INFORMATION

The licensee indicated that a walkdown was performed in response to IE Bulletin 79-14. In addition, licensee opted to complete a walkdown of AFW system. This walkdown included mechanical and electrical equipment, piping, cable trays, and conduit.

In walkdown related to IE Bulletin 79-14, forty-three supports were identified requiring modification. Thirty-five modifications have been completed with the remaining eight scheduled for completion by the end of the next refueling outage after July 24, 1981. Licensee also indicated that there are no major seismic related concerns which could potentially affect the operability of the AFW system during a seismic event.

3. CONCLUSIONS

The licensee's responses provided all the information that was explicitly requested by GL 81-14. Based on the information, we conclude that the AFW system at Millstone Nuclear Power Station, Unit 2, is able to provide the safety-related function following a SSE to assure safe shutdown of the plant. Therefore, we

recommend that no further action be initiated regarding upgrading of the AFW systems of this plant under NRC Multiplant Action C-14.

4. REFERENCES

1. D. G. Eisenhower, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. W. G. Council, Northeast Nuclear Energy Company, letter to D. G. Eisenhower of U. S. Nuclear Regulatory Commission, July 24, 1981.
4. R. A. Clark, USNRC, letter to W. G. Council of Northeast Nuclear Energy Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Millstone Nuclear Power Station, Unit 2," April 15, 1982.
5. W. G. Council, Northeast Nuclear Energy Company, letter to R. A. Clark of USNRC, June 4, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM TECHNICAL EVALUATION REPORT

NORTH ANNA POWER STATION, UNITS 1 AND 2

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 North Anna Power Station, Units 1 and 2, responded with a letter dated July 16, 1981,³ and provided a supplemental response in a letter dated December 1, 1981.⁴

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Description of methodologies and acceptance criteria for seismic design of the AFW system, which is determined to be seismically qualified to the SSE level by the licensee.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

The AFW system has been designed, constructed, and maintained to withstand a SSE utilizing methods and acceptance criteria consistent with

that applicable to other safety-related systems in the plant. All areas of the AFW system (i.e., pumps/motors, piping, valves/actuators, power supplies, water source, instrumentation/control systems, and structures supporting and housing the AFW system) are seismically qualified to the SSE level.

The licensee provided a description of the methodologies and acceptance criteria used for seismic qualification of the AFW system, and referred to the applicable sections of the FSAR. The description includes seismic analysis methods, seismic input, load combinations, allowable stresses, qualification testing, and engineering evaluations performed.

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

Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system is fully seismically qualified.

Regarding the AFW system boundary, the licensee stated that one of the boundaries of North Anna's AFW system is the first isolation check valve outside of the containment in the steam generator feed lines. However, the postulated failure of this single valve in a line is founded by the analysis of a Major Rupture of a Main feedwater Pipe, contained in FSAR, Section 15.4.2.2. Based on this information, we conclude that the AFW system will be able to provide adequate feedwater to the unaffected steam generators for required decay heat removal in the event of a Major Rupture of a Main Feedwater Pipe and, hence, the deviation in the AFW system boundary requirement from the GL 81-14 is acceptable.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown is not required because no lack of seismic qualification of the AFW system is indicated.

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 is complete. The licensee stated that the AFW system boundary does not fully conform to the definitions of GL 81-14 and provided a justification of the deviation, which we conclude to be acceptable.

Based on the submitted information, we conclude that the AFW system at North Anna Power Station, Units 1 and 2, is fully seismically qualified and is able to provide the safety related function following a SSE. Therefore, we recommend that no further action be initiated regarding upgrading of the AFW system of this plant under NRC Multiplant Action Plan C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).

2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. R. H. Leasburg, Virginia Electric & Power Co., letter to H. R. Denton of U. S. Nuclear Regulatory Commission, July 16, 1981.
4. R. H. Leasburg, Virginia Electric & Power Co., letter to H. R. Denton of U. S. Nuclear Regulatory Commission, December 1, 1981.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Oconee Nuclear Station, Units 1, 2, and 3, responded with a letter dated January 28, 1982.³ The licensee's response was found not to be complete and a Request for Additional Information was issued by the NRC, dated April 8, 1982.⁴ The licensee provided a supplemental response in a letter dated May 25, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Discussion of levels of seismic capability of nonseismically-qualified components.
- Specification of overall seismic capability of the Standby Shutdown Facility (SSF) system which will serve as an alternate decay heat removal system.
- Description of methodologies and acceptance criteria for the seismic design of the SSF system, which is determined to be seismically qualified for the SSE level by the licensee.
- Description of the AFW and SSF system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, schematic sketches of the AFW and SSF systems.

- Additionally, identification of areas of modification of the AFW system that will be performed under the SSF project.
- Additionally, description of methodologies and acceptance criteria for seismically qualified components of the AFW system.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

• Pumps/Motors

Portions of the turbine-driven pump oil system and oil cooling system, including the oil pumps and water cooling pumps do not have retrievable seismic documentation. However, we judge by experience that the pumps/motors possess a less than OBE level of seismic capacity.

• Piping

The portion of all connected branch piping beyond the first valve is currently nonseismically qualified. We believe that the AFW system piping is likely to possess an OBE level of seismic capacity.

• Valves/Actuators

(a) Oil valves in the support system. However, the licensee indicated that credit for seismic design is not necessary because they are equipped with handwheels for manual operations. (b) Pneumatic control valves and their backup nitrogen bottles. However, the licensee indicated that these valves will fall open upon loss of gas pressure or they can be bypassed by aligning the AFW flow through the main feedwater startup line into the normal or AFW steam generator nozzles on either steam generator. (c) Certain valves do not have retrievable seismic documentation. The licensee stated, however, that such valves were built to at least the ANSI B 31.1.0 criteria and were modeled into the stress analyses as

equivalent pieces of pipe for structural purposes. Based on the above information, we believe that the valves/actuators are likely to possess an OBE level of seismic capacity.

- Power Supplies

Power to the electric motor-operated valves and pumps, except for the motor-driven AFW pumps and the lower pressure service water pumps, is currently nonseismically qualified. However, the licensee stated that seismic design credit is not necessary for the power to the electric motor-operated valves because these valves can be manually operated with handwheels. We judge that the power supplies possess a less than OBE level of seismic capacity.

- Water Source(s)

None

- Initiation/Control Systems

The control to the motor-operated valves other than those in the auto-initiation and auto-control of the AFW system is not seismically qualified. This includes the control to the branch line isolation valves off the main steam header and the electric motor-operated valves in the AFW suction and discharge lines which are normally aligned for AFW operation but not normally required to operate. However, the licensee stated that no actuation is required of the motor-operated valves for the AFW flow and the valves will fail as-is upon loss of power. We therefore judge that the initiation/control systems possess the capacity to withstand a SSE.

- Structures

The turbine building is seismic Class II. We therefore judge that the structures supporting or housing the AFW system components are capable of withstanding an OBE.

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

• Pumps/Motors	Less than OBE
• Piping	OBE
• Valves/Actuators	OBE
• Power Supplies	Less than OBE

- Water Source(s) None
- Initiation/Control Systems None
- Structures OBE

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

Because the primary water source is seismically qualified for the SSE, a switchover to a seismically qualified secondary water source is not involved.

The Standby Shutdown Facility (SSF) system, being constructed to provide a dedicated separate train of auxiliary feedwater, will provide an alternate decay heat removal system when it becomes operational. No procedure is available at this time to switch from the AFW system to the SSF system. Such procedure will be developed on a schedule commensurate with the SSF system startup. The licensee did not indicate the completion date of the new SSF system.

The SSF system is designed to withstand the SSE. Structures supporting or housing the SSF system components include the reactor building and auxiliary building and are seismic Class I. The licensee provided a description of the methodologies and acceptance criteria used for seismic qualification of the SSF system, referring to applicable sections of the FSAR and licensee's letters of March 28, 1980; February 16, 1981; March 31, 1981; and April 13, 1981.

Regarding the AFW system boundary, all connected branch piping and crossover connections among the three units are seismically qualified only through the first valve. We judge that the AFW system boundary does not fully meet the requirements defined in the Generic Letter.

Regarding the SSF system boundary, some small piping vents and drains, capped lines, tank vents, and a recirculation line from the diesel fuel oil storage tank either have only one normally closed valve or are seismically designed only through the first valve. We judge that the SSF system boundary does not conform to the definition of boundary specified in the Generic Letter. Since the existing AFW system is not fully seismically qualified, we feel that this deviation needs to be evaluated and/or corrected in order to assure the required safety function of the SSF system.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

The licensee stated that no walkdown was performed for the nonseismically-qualified items of the AFW system due to reliance on the SSF system though the walkdown is requested by GL 81-14. We feel that a walkdown is required if the new SSF system does not become operational within a reasonable period of time.

2.3 ADDITIONAL INFORMATION

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

Additionally, licensee's responses provided a description of the methodologies and acceptance criteria that were used in the design of the seismically qualified portions of the AFW system, by referring to the applicable sections in the PSAR.

The licensee identified the areas of the AFW system where modification/upgrade will be performed for the tie-in between the SSF and AFW systems. Because the construction of the SSF system is underway, the licensee stated that no additional modification to the AFW system is necessary due to reliance upon the SSF system.

3. CONCLUSIONS

The information contained in licensee's responses is complete. The licensee did not perform walkdown of the currently nonseismically-qualified areas of the AFW system because the SSF system, being under construction, is designed to withstand the SSE and to serve as the alternate decay heat removal system. The switchover procedure from the AFW to the SSF system will be established commensurate with the startup operation of the SSF system. Both the AFW and SSF system boundaries do not fully meet the definition specified in GL 81-14.

Based upon the submitted information, we conclude that the AFW system does not presently possess the seismic capability to withstand a SSE. The ability of the SSF system to perform the required safety function following the occurrence of a SSE is also in question because the SSF system boundary does not fully conform to the boundary definition specified in GL 81-14. In conclusion, we recommend that the NRC considers requiring the licensee (a) to submit the estimated completion date of the SSF system and perform a walkdown of the existing AFW system if it is determined that the SSF system will not become operational within a reasonable period of time and (b) to evaluate and/or correct the deviation of the SSF system boundary in order to assure the required safety related function.

4. REFERENCES

1. D. C. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. W. O. Parker, Jr., Duke Power Company, letter to H. R. Denton of U. S. Nuclear Regulatory Commission, January 28, 1982.

4. J. F. Stolz, U. S. Nuclear Regulatory Commission, letter to W. O. Parker, Jr., of Duke Power Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Oconee Nuclear Station Units 1, 2, and 3, April 8, 1982.
5. W. O. Parker, Jr., Duke Power Company, letter to H. R. Denton, U. S. Nuclear Regulatory Commission, May 25, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Point Beach Nuclear Plant, Units 1 and 2, responded with a letter dated July 16, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated January 25, 1982.⁴ The licensee provided a supplemental response in a letter dated May 4, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Summary of procedures for switchover to the secondary water source and supply path.
- Discussion of levels of seismic capability of nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, schematic sketch of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically qualified portions of the AFW system.

- Additionally, results of walkdown of seismically qualified areas of the AFW system and identification of areas of modification/upgrade with proposed schedule to upgrade.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

● <u>Pumps/Motors</u>	None
● <u>Piping</u>	Licensee has stated that branch piping Nos. 20 to 28 were not originally required to be seismic. Connections 20 and 21 go to the Unit 1 and 2 Condensers. Connection 22 is a 1.5 in. connection to the Waste and Blowdown Evaporator Distillate Processing System. Connection 23 is a 4-in. connection to the heating boiler feed pump. Connection 24 is a 2-in. diam connection that provides a source of water to the turbine plant chemical addition tanks. Connection 25 is a 3-in. diam connection to the mixed bed demineralizer in the makeup water treatment system. Connections 26, 27 and 28 were not clearly identified in licensee's response. Licensees' response did not discuss the seismic capability of these branch lines, therefore, we judge that they possess a less than OBE level of seismic capability.
● <u>Valves/Actuators</u>	None
● <u>Power Supplies</u>	None
● <u>Water Source(s)</u>	The condensate storage tank of the primary water source is seismic Class II. However, a seismic Class I secondary water and supply path, the service water system, is available and a manual switchover procedure exists.
● <u>Initiation/Control Systems</u>	None
● <u>Structures</u>	Except for the seismic Class I control building, other structures

housing or supporting the AFW system including the turbine building, auxiliary building superstructure and the facade in containment building were not designed to seismic requirements. Licensees' response did not discuss the seismic capability of these nonseismic Class I structures except that recently the turbine building has been analyzed for seismic loading assuming the turbine building crane to be located above the control building and was found to be capable of withstanding a SSE. Classification needs to be made, however, that this is the worst loading condition for the turbine building in the presence of a seismic event. We therefore conclude that the structures in general have a less than OBE level of seismic capacity.

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

• <u>Pumps/Motors</u>	None
• <u>Piping</u>	Less than OBE
• <u>Valves/Actuators</u>	None
• <u>Power Supplies</u>	None
• <u>Water Source(s)</u>	None
• <u>Initiation/Control Systems</u>	None
• <u>Structures</u>	Less than OBE

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

The primary water source and supply path is not seismically qualified, therefore, switchover to the seismically qualified secondary water source and supply path is required. The licensee stated that such procedure is available by warning the operator when the low level (20% or 4 ft) on the condensate storage tank occurs. The operator then opens the auxiliary feedwater pump service water system suction valves following such a warning.

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. Based on the information provided by the licensee we did not find that the licensee's AFW system has a SSE capability. For the purpose of removing decay heat following a SSE, the licensee needs to either reanalyze and/or modify its AFW system, or to provide an alternate decay heat removal system seismically qualified to the SSE level and appropriate operating procedures.

Regarding the AFW boundary, the licensee's responses indicated that piping branch connections 6 through 28 do not comply with GL 81-14 boundary definitions because they do not have a second normally closed valve. Pipe connections 6 through 9 are outlet connections for the pump recirculation piping. Connections 10 through 13 were not clearly identified in licensee's response. Connections 14 through 19 are overflow, drain, and instrument connections on the Condensate Storage Tank. Connections 20 through 28 are described previously in page 3 of this report. 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, except for part of the piping supports identified under IE 79-14 that will be upgraded by the end of June, 1982.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown of the nonseismically-qualified areas of the AFW system is required, but has not been conducted.

2.3 ADDITIONAL INFORMATION

The licensee provided schematic representation of the plant including structures, major AFW system components and piping, and showed sketches of piping in the IE Bulletin 79-14 program with identification of pipe connections. Also included are preliminary piping isometrics from the IE Bulletin 79-14 program.

Regarding the valves, additional information provided by the licensee stated that IE Bulletin 79-14 piping analyses did not analyze the valve itself, but as long as the acceleration level on the valve was less than 3 g, the valve operator was considered acceptable, otherwise, the valve received additional evaluation.

For other items in the AFW system that are seismically qualified, the seismic qualification methodologies are given in the FSAR and are consistent with that applied to other safety-related systems in the plant.

A recent walkdown on seismically qualified items has identified the following deficiencies: (a) Main Piping: The 1.5 in. DB-3 recirculation pipe for each of the four AFW pumps and the discharge piping of each pump are not adequately supported. These deficiencies are planned to be corrected, but no definite schedule is given. (b) Power Supplies: Seismic resistance of the battery racks in the Battery Room is questionable and will be upgraded. Supports for cable conduits in P38A and P38B cubicles will also be upgraded. (c) Initiation/Control System: Conduits D01-2, 2-4001, 1-4000 and 1-4001 and conduits above panels D12, D13 and D14 do not have adequate supports. Clamps will be provided to overcome these deficiencies. Also, the four safeguard motor control centers (1B32, 1B42, 2B32, and 2B42) in auxiliary building are presently not anchored to the floor. Supports will be installed to secure these cabinets. Upgrading of most of the above mentioned items identified in the recent walkdown will be performed by the end of 1982.

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 is incomplete with regard to the seismic capacity of nonseismically-qualified piping and structures. The walkdown conducted by the licensee had been performed for the seismically qualified items and did not cover the nonseismically-qualified branch connections and structures. Most of the deficiencies identified as a result of this walkdown will be upgraded by the end of June, 1982. The licensee also stated that the AFW system boundary does not fully conform to the definition specified in GL 81-14.

Based on the submitted information, we conclude that the AFW system does not provide a reasonable assurance to perform its required safety function following a SSE. Therefore, we recommend that the NRC considers requiring the licensee to provide a reanalysis and/or modification of the AFW system to acquire a SSE level of capacity.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. C. W. Fay, Wisconsin Electric Power Company, letter to H. R. Denton of U. S. Nuclear Regulatory Commission, July 16, 1981.
4. R. A. Clark, U. S. Nuclear Regulatory Commission, letter to C. W. Fay of Wisconsin Electric Power Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Point Beach Nuclear Plant Units 1 and 2," January 25, 1982.
5. C. W. Fay, Wisconsin Electric Power Company, letter to H. R. Denton of U. S. Nuclear Regulatory Commission, May 4, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

PRAIRIE ISLAND NUCLEAR PLANT, UNITS 1 AND 2

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Prairie Island Nuclear Plant, Units 1 and 2, responded with a letter dated July 14, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated April 5, 1982.⁴ The licensee provided a supplemental response in a letter dated May 6, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Description of procedure for switchover to a seismically qualified secondary water source.
- Discussion of the levels of seismic capability of the nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Results of walkdown of nonseismically-qualified areas.
- Additionally, description of methodologies and acceptance criteria for the seismically qualified components.

- Additionally, results of evaluation and walkdown of seismically qualified areas and areas outside of AFW system that have potential of damaging the AFW system in a SSE event.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- Pumps/Motors
- Piping

None

(a) Four 2 in. cooling water branch lines, which have not been seismically analyzed. (b) All drain piping to traps in auxiliary steam system, which have not been seismically analyzed. (c) Most of the primary water source piping are laterally supported in north-south direction only. Additional seismic restraints in the east-west direction are required. The licensee stated that in all areas where modeling and analysis was required as part of the AFW piping modification, analysis work has been initiated and is completed. Where analysis has shown that additional supports are required, installation drawings are being made and installation or modification will commence as system availability and time allow. All identified modifications would be completed prior to or during the units 1 & 2 1983 refueling outages. Based on the above information, we conclude that the piping has a seismic capability less than OBE but will possess a SSE level of seismic capability when the upgrading modification is completed in a timely manner.

- Valves/Actuators

The licensee stated that seismic analysis, review and approval documentation were not found in files for certain VELAN valves. However it

was felt by the licensee that these valves were seismically qualified because they were purchased with design Class I seismic qualification as a specified requirement. We judge that valves/actuators have a SSE level of seismic capability.

- Power Supplies
- Water Source(s)

None

The condensate storage tank, as the primary water source, was designed to Class III and has not been analyzed for seismic loads. However, a seismic Class I secondary water source (the cooling water system) is available and a switchover procedure exists. We therefore judge that the water sources are capable of withstanding a SSE.

- Initiation/Control Systems
- Structures

None

None

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

• <u>Pumps/Motors</u>	None
• <u>Piping</u>	None*
• <u>Valves/Actuators</u>	None
• <u>Power Supplies</u>	None
• <u>Water Source(s)</u>	None
• <u>Initiation/Control Systems</u>	None
• <u>Structures</u>	None

In summary, our evaluation indicates that the licensee's AFW system will possess an overall seismic capability that can withstand a SSE when the proposed upgrading modification is completed by the licensee.

The primary water source (condensate storage tank) is not seismically qualified. Also the primary supply path is not seismically qualified as mentioned in item (c) under the piping evaluation. Presently, the licensee has no plans for upgrading or modifications of these deficiencies. A seismic Class I secondary water source and a switchover procedure are presently available. The switchover is performed by opening one motor operated valve in each AFW pump suction piping. However, the secondary-water supply path is not fully seismically qualified because there are deficiencies in the four 2 in. branch lines mentioned in item (a) under the piping evaluation. The licensee has stated that they have plans to upgrade these secondary water paths as discussed under the piping evaluation.

* Currently less than OBE, but will be upgraded/modified.

Additionally information regarding the seismic capability of any alternate decay heat removal system is not involved because the AFW system will have a SSE level of seismic capability.

Regarding the AFW system boundary, the licensee indicated that the boundary includes all connected branch piping up to at least one valve. The valve(s) in each branch line are either normally closed or capable of automatic or manual closure when the safety function is required. The AFW system boundary also includes any portion of the branch piping beyond the aforementioned valve(s) up to the first structural anchor or equipment connection. Valving arrangements that do not fully conform to the definition given in the GL 81-14 were identified by the licensee as discussed below. (a) The auxiliary feedwater system includes portions of the main feedwater piping up to the first motor operated valve upstream of the AFW piping connection. (b) For piping from Design Class I pump discharge to Auxiliary Feedwater pump suction and the ring header which provides a redundant path of cooling water supply to Units 1 and 2, not all the connected branch piping have the second isolation valve. Branch lines with nominal pipe size of 4 in. and larger are all provided with valves capable of automatic closure with the exception of a supply line to the sprinkler system with a nominal pipe size of 4 in. In addition, branch lines with nominal size smaller than 4 in. can be isolated only by manual closure of the valves. (c) The auxiliary steam system includes portions of the main steam system from the steam generator up to the first isolation valve which is normally closed or capable of automatic closure. Based on the above information, we conclude that the AFW system boundary does not fully conform to the definition specified in the GL 81-14. We also believe that the deviation needs to be evaluated and/or corrected in order to assure the required safety function of the AFW system.

The licensee stated that the AFW system was included within the scope of seismic-related Bulletins 79-02, 79-04, 79-07 and 80-11. IE Bulletin 79-14 is not completely satisfied as some portions of the piping system are still being reviewed for compliance. The licensee stated that the implementation of IE Information Notice 80-21, which involves equipment qualification, could potentially result in modification of a broad range of electrical devices. They stated that in order to avoid duplication of effort, they prefer to defer further action until the NRC comes up with definite rules on this issue.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

The licensee conducted a walkdown of the nonseismically-qualified areas of the AFW system, and identified deficiencies in the AFW system piping, as discussed below. (a) The modeling of the wall sleeve where the 30 in. diameter cooling water header pipes penetrate the screenhouse at Column Row B₁ may not be adequate. (b) Strength of floor anchor plates supporting cooling water strainers Nos. 11, 12, 21, and 22 must be reviewed for increased loading conditions. The licensee stated that in all areas where modeling and analysis was indicated, analysis work has been initiated and in some areas were complete. Where analysis has shown that additional supports are required, installation drawings are being made and installation or modification will start as system availability and time allow. All identified modifications will be completed during the Units 1 and 2 1983 refueling outages.

2.3 ADDITIONAL INFORMATION

The licensee's responses provided a description of the methodologies, loading combinations and acceptance criteria that were used in the design of the seismically qualified portions of the AFW system. Licensees' consultant conducted an evaluation and a walkdown of the power supplies and initiation/control systems, and identified the following deficiencies: (a) Power Supplies: One 4160 V switchgear cabinet needs anchor bolts to unload plug wells; several 480 V switchgear cabinets need replacement of a missing bolt; the anchorage of motor control centers needs to be modified; battery racks need design modifications and batteries need to be protected from ancillary equipment; certain panels, racks and cabinets may need stiffened supports for which testing is required along with stiffening and redesigning the supports for the components for which the fundamental frequency is less than 6 Hz. (b) Initiation/Control Systems: Certain pressure indicators and cabinets may need improved mounting; control room panels may need protection from ancillary equipment; selected cabinets, racks, panels and local control switch for a motor-operated valve may need redesign or stiffening for which testing along with redesigning and stiffening of the supports may be required for components for which the fundamental frequency is less than 6 Hz.

For those deficiencies in the power supplies and the initiation/control system where testing is required as the corrective measures, the licensee stated they are deferring any action pending on the NRC's issuance of a Rule and Regulatory Guide, which is expected in 1984. The remaining identified deficiencies in the power supplies and the initiation/control systems are under review by the licensee, and all modifications will be completed prior to or during the Units 1 & 2 1983 refueling outages.

Additionally, the licensee also performed walkdown of the areas outside of the AFW system that could potentially damage the AFW system during a SSE. Deficiencies were identified, corrective actions were proposed or are to be identified, and the schedule will be consistent with the mechanical and piping system upgrade as mentioned previously. Results of this additional walkdown are summarized below. (a) Attachments of electrical boxes 1185 and 1768 should be evaluated for adequacy. (b) HVAC ductworks in the turbine building and the auxiliary building require re-evaluation for seismic adequacy. (c) Small conduits resting on cooling water supply piping need resupporting. (d) Unit coolers in AFW pump room need evaluation and resupporting.

3. CONCLUSIONS

The information contained in licensee's responses to the GL 81-14 is complete. The walkdown on nonseismically-qualified areas of the AFW system identified some deficiencies. The licensee stated that all the identified modifications of the AFW system will be upgraded prior to or during the refueling outages of Units 1 and 2 in 1983. It is also noted that the licensee's AFW system boundary does not fully conform to the definition specified in the GL 81-14.

Based on the submitted information, we judge that the AFW system will provide a reasonable assurance to perform its required safety function following a SSE provided that the proposed upgrading modification is completed and the AFW boundary deviation is evaluated and/or corrected by the licensee. In conclusion, we recommend that the NRC considers requiring the licensee to evaluate and/or correct the AFW boundary deviation to assure the required safety function of the AFW system following the occurrence of a SSE.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. L. O. Meyer, Northern States Power Company, Letter to the Director of U. S. Nuclear Regulatory Commission, July 14, 1981.
4. U. S. Nuclear Regulatory Commission, teletype to L. O. Meyer of Northern States Power Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Prairie Island Nuclear Plant, Units 1 & 2," April 5, 1982.
5. L. O. Meyer, Northern States Power Company, Letter to the Director of U. S. Nuclear Regulatory Commission, May 3, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

RANCHO SECO NUCLEAR PLANT, UNIT 1

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Rancho Seco Nuclear Plant, Unit 1, responded with letters dated July 17 and October 14, 1981.^{3,4} The licensee's response was found not to be complete and a request for Additional Information (RAI) was issued by the NRC, dated May 7, 1982.⁵ The licensee provided a supplemental response in a letter dated July 9, 1982.⁶

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Discussion of levels of seismic capability of nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, schematic sketch of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically qualified components.
- Additionally, proposed modification of the seismically qualified areas of the AFW system.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

• <u>Pumps/Motors</u>	None
• <u>Piping</u>	None
• <u>Valves/Actuators</u>	Air operated valves FV20526 and 20527 were not qualified to any seismic requirements except the stresses in the body of the valve were kept below the allowable stress limits of the piping code. There are bypasses provided around these air operated control valves, and the bypass line valves SFV 20577 and 20578 are full size, motor operated, seismically qualified engineered safety feature system valves. Based on the above information, we conclude that the present level of seismic capability of the AFW valves is equivalent to SSE.
• <u>Power Supplies</u>	None
• <u>Water Source(s)</u>	None
• <u>Initiation/Control Systems</u>	None
• <u>Structures</u>	None

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

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

In summary, our evaluation indicated that the licensee's AFW system possesses an overall seismic capability that can withstand a SSE.

Because the primary water source and supply path are seismically qualified, switchover to a secondary water source is not involved. In addition, information regarding the seismic capability of any alternate decay

heat removal system is not required because the AFW system is fully seismically qualified.

Regarding the AFW system boundary, the licensee stated the branch lines have been seismically qualified up to the point of three orthogonal restraints. However, the schematic sketch of the AFW system indicated that some of the branch connections do not have the second valve which is normally closed or capable of automatic closure. We therefore conclude that the AFW system boundary does not fully meet the requirements of the GL 81-14.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown is not required because we found that no lack of seismic qualification of the AFW system was indicated.

2.3 ADDITIONAL INFORMATION

The licensee provided a schematic sketch of the AFW system including the water sources, heat sink, suction and discharge piping, major mechanical equipment, and structures supporting and housing the 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 seismically qualified portions of the AFW system. They also referred to the appropriate sections of the FSAR.

The licensee also provided the following information on planned modification/upgrade related to, but not as a direct result of the GL 81-14. The licensee is currently modifying sections of the auxiliary feedwater line inside containment near the steam generators. This modification involves providing six inlet nozzles to the steam generators instead of one. The piping will be reanalyzed and because of added flexibility of the inlet header, rigid supports and snubbers will be added to seismically qualify the piping.

3. CONCLUSIONS

The information contained in licensee's responses to the GL 81-14 is complete. Based on the submitted information, we conclude that the AFW system provides a reasonable assurance to perform its required safety function following a SSE, except that the AFW system boundary does not fully conform to the definition given in the GL 81-14. Therefore, we recommend that no further action be initiated regarding the need of modification/upgrading of the AFW system of this plant under NRC Multiplant Action Plan C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to M. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. J. J. Mattimoe, Sacramento Municipal Utility District, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission, July 17, 1981.
4. W. C. Walbridge, Sacramento Municipal Utility District, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission, October 14, 1981.
5. U. S. Nuclear Regulatory Commission, letter to Sacramento Municipal Utility District, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Rancho Seco Nuclear Generating Station Unit 1," May 7, 1982.
6. J. J. Mattimoe, Sacramento Municipal Utility District, letter to J. F. Stolz of U. S. Nuclear Regulatory Commission, July 9, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM TECHNICAL EVALUATION REPORT

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT 2

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,"¹ which is the subject of this evaluation.

To implement the first phase of Action Plan C-14, the NRC issued GL 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of H. B. Robinson Steam Electric Plant, Unit 2, responded with a letter dated December 31, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated July 21, 1982.⁴ The licensee provided a supplemental response in a letter dated August 20, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Description of methodologies and acceptance criteria for seismic design of the AFW system, which is determined to be seismically qualified to the SSE level by the licensee.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, schematic sketch of the AFW system.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

The AFW system has been designed, constructed, and maintained to withstand a SSE utilizing methods and acceptance criteria consistent with that applicable to other safety-related systems in the plant. All areas of the AFW system, i.e., pumps/motors, piping, valves/actuators, power supplies, water source, initiation/control systems, and structures supporting and housing the AFW system, are seismically qualified to the SSE level.

The licensee provided a description of the methodologies and acceptance criteria used for seismic qualification of the AFW system, and referred to the applicable sections of the FSAR. The description includes seismic analysis methods, seismic input, load combinations, allowable stresses, qualification testing, and engineering evaluations performed.

The condensate storage tank is the primary water supply and it is seismic Class I. Switchover to a secondary water supply, therefore, is not involved. Additionally, the licensee indicated that there are a nonseismic Class I backup water supply, the well water system, and a seismic Class I backup water supply, the service water system. The licensee indicated that the procedure which would be followed to enable a transfer, if required, from the primary to the secondary water sources is outlined in the plant emergency instructions EI-5 and EI-6.

Additional information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system currently is fully seismically qualified for the SSE.

Regarding the AFW system boundary, the licensee's responses indicated that, due to a restriction in the number of node points that could be modeled in one computer run utilizing the codes in existence at the time of the original analysis, specific guidelines for modeling of the branch line connections to the AFW system did not exist. During licensee's IE Bulletin 79-14 analysis, the additional effects of branch line loading were reviewed on a case-by-case basis and were judged to be insignificant. However, the licensee's responses did not clarify whether (a) the branch lines have been seismically analyzed and qualified up to a point of three orthogonal restraints in order to assure the structural integrity of the branch lines, and (b) all branch lines have a second valve normally closed or capable of automatic closure when safety function is required. Therefore, it is not clear to us whether the AFW system boundary fully conforms to the definitions given in the GL 81-14.

The licensee stated that the AFW system was included within the scope of the seismic related NRC Bulletins 79-02, 79-04, 79-07, 79-14, 80-11. The licensee is currently evaluating the adequacy of anchorage and support of safety related electrical equipment as described in IE Information Notice 80-21. As part of this analysis the adequacy of the seismic qualification of electrical cables and motor control centers will be assessed. The licensee stated that the evaluation is scheduled to be completed by the end or 1982.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown is not required because no lack of seismic qualification of the AFW system is indicated.

2.3 ADDITIONAL INFORMATION

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

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 is complete except that it did not clarify whether the AFW system boundary fully conforms to the definitions specified in GL 81-14.

Based on the submitted information, we conclude that the AFW system is fully seismically qualified and is able to provide the safety related function following a SSE assuming that the AFW system boundary currently fully conforms to the boundary definitions specified in GL 81-14. Therefore, we recommend that no further action be initiated regarding upgrading of the AFW system of this plant under NRC Multiplant Action Plan C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. S. R. Zimmerman, Carolina Power & Light Company, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission, December 31, 1981.
4. U. S. Nuclear Regulatory Commission, letter to Carolina Power & Light Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, H. B. Robinson Steam Electric Plant, Unit 2," July 21, 1982.
5. S. R. Zimmerman, Carolina Power & Light Company, letter to S. A. Varga of U. S. Nuclear Regulatory Commission, August 20, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

SALEM NUCLEAR PLANT, UNITS 1 AND 2

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Salem Nuclear Plant, Units 1 and 2, responded with a letter dated August 11, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information was issued by the NRC, dated January 7, 1982.⁴ The licensee provided a supplemental response in a letter dated March 1, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Description of methodologies and acceptance criteria for seismic design of the AFW system, which is determined to be seismically qualified to the SSE level by the licensee.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, a schematic sketch of the AFW system.
- Additionally, proposed measures to protect two valves that are part of the AFW system boundary.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

The AFW system has been designed , constructed, and maintained to withstand a SSE utilizing methods and acceptance criteria consistent with that applicable to other safety-related systems in the plant. All areas of the AFW system (i.e., pumps/motors, piping, valves/actuators, power supplies, water source, instrumentation/control systems, and structures supporting and housing the AFW system) are seismically qualified to the SSE level.

The licensee provided a description of the methodologies and acceptance criteria used for seismic qualifications of the AFW system, and referred to the applicable sections of the FSAR. The description includes seismic analysis methods, seismic input, load combinations, allowable stresses, qualification testing, and engineering evaluations performed.

A switchover procedure to a secondary water source is not involved because the primary water source and supply path is seismically qualified.

Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system is fully seismically qualified. Regarding the AFW system boundary, licensee's responses indicated that valves (1AF71) and (1AF72) are not anchored with three orthogonal restraints. However, these valves are anchored to the Seismic Category I auxiliary building wall, and a stress review performed by the licensee showed that the anchors meet the intent of the AFW system boundary definition given in the Generic Letter. We therefore conclude that the AFW system boundary conforms to the definition in 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 and 80-11. IE Information Notice 80-21 was not mentioned in licensee's responses. However, a detailed review performed by the licensee showed that all electrical and control equipment are fully seismically qualified, and further clarification is provided in the information provided by the licensee to the NRC Seismic Qualification Review Team. We conclude that the AFW system meets the intent of Information Notice 80-21.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown is not required because no lack of seismic qualification of the AFW system is indicated.

2.3 ADDITIONAL INFORMATION

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

Additionally, the licensee indicated that a protective steel structure will be provided off the Seismic Category I wall of the auxiliary building to which valves (1AF71) and (1AF72) are anchored. This new steel structure will also

incorporate seismic guides for additional protection of these valves, with the existing anchor serving as an axial restraint in addition to its original function.

3. CONCLUSIONS

The licensee's responses provided all the information that was explicitly requested by the Generic Letter. Based on this information, we conclude that the AFW systems at the Salem Nuclear Plant, Units 1 and 2, will be able to provide the safety-related function following a SSE to assure safe shutdown of the plant. Therefore, we recommend that no further action be initiated regarding upgrading of the AFW systems of these plants under NRC Multiplant Action Plant C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. R. L. Mittl, Public Service Electric and Gas Company (PSEG), letter to S. A. Varga of U. S. Nuclear Regulatory Commission, August 11, 1981.
4. S. A. Varga, USNRC, letter to R. L. Mittl of PSEG, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Salem Nuclear Generating Station, Units 1 and 2," January 7, 1982.
5. E. A. Liden, PSEG, letter to S. A. Varga of USNRC, March 1, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

ST. LUCIE, UNIT 1

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,"¹ which is the subject of this evaluation.

To implement the first phase of Action Plan C-14, the NRC issued GL 81-14 to all operating PWR licensees, "Seismic Qualification of AFW Systems" dated February 10, 1981.² This letter requested that each licensee (1) conduct a walkdown of nonseismically-qualified portions of the AFW system and identify deficiencies amenable to simple actions to improve seismic resistance and (2) provide design information regarding their specific AFW system seismic capabilities to facilitate NRC backfit decisions.

The licensee of St. Lucie, Unit 1, responded with a letter dated September 18, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated April 2, 1982.⁴ The licensee provided a supplemental response in a letter dated May 6, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Identification of currently nonseismically-qualified components of the AFW system.
- Discussion of the levels of seismic capability of the nonseismically-qualified AFW system components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Results of walkdown of nonseismically-qualified portions of the AFW system.
- Additionally, description of methodologies and acceptance criteria for the seismically qualified components.

- Additionally, results of walkdown performed for the anchorages/ supports for all Class IE electrical equipment.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- Pumps/Motors None
- Piping None
- Valves/Actuators None
- Power Supplies None
- Water Source(s) None
- Initiation/Control Systems (a) Local gauges are not seismically qualified but the licensee stated that they are not essential for safety system operation. (b) The control grade automatic initiation circuitry, installed as a post-TMI modification, is not seismically qualified but the licensee stated that it would be upgraded to safety grade and seismic Category I during their outage in September 1981. We conclude that the initiation/control systems possesses a SSE level of seismic capability upon completion of the upgrade of the control grade automatic initiation circuitry.
- Structures The conduit supports and mounting of certain electrical boxes were not qualified by rigorous analysis. However, the licensee inspected the above items in the field. They indicated in their response letter that this inspection verified that, in general, the support systems have conservative support spans and were installed in accordance with National Electrical Code Standards using standard commercially available strut material, clamps, U-bolts, and various steel shapes, in conjunction with ANSI C80.1 rigid steel conduit. This level of design for

miscellaneous electrical component supports is consistent with industry practices for plants of the St. Lucie Unit 1 era. The licensee also stated that these support designs and materials are used universally throughout the nuclear and fossil power plant field as well as other industries and were considered to have adequate seismic resistance at the time of installation. Also, the licensee indicated that industry tests on cable tray/conduit support assemblies based on worst case models indicated that systems supported by commercial grade components similar to those used at St. Lucie Unit 1 remained functional after being subjected to tests which simulated earthquake conditions. In their best judgment, the licensee believed that the system would remain functional after a SSE. In conclusion, we judge that the conduit supports and mounting of certain electrical boxes possess a SSE level of seismic capacity.

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

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

In summary, our evaluation indicated that the AFW system at St. Lucie, Unit 1, possesses an overall level of seismic capability that can withstand a SSE.

Because the primary water source and supply path is seismically qualified, switchover to a secondary water source is not involved. Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system will have a SSE level of seismic capability upon the completion of the ongoing upgrade of the initiation/control systems.

Regarding the AFW system boundary, licensee indicated that there is no branch piping in the flowpath which is required to be isolated in order to perform the AFW system function. There are no other branch piping connections

to the AFW system. Only normal small bore vents, drains and instrument taps all with root valves, are provided as an integral part of the AFW system piping. These portions were seismically analyzed with the AFW system piping to meet seismic Category I requirements. Therefore, we conclude that the AFW system boundary fully conforms to that required by the Generic Letter.

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

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A field inspection was conducted covering all system components that could not be readily qualified by existing documentation. These items consisted of nonseismically-qualified miscellaneous conduit and electrical box supports. The licensee indicated that the as-built support system has considerable seismic resistance, and in their best engineering judgment the licensee believed that the system would remain functional following a SSE.

2.3 ADDITIONAL INFORMATION

The licensee provided information on the methodologies and acceptance criteria that were used in the seismic design of the seismically qualified portions of the AFW system.

Additionally, licensee decided to extend the inspection and review of electrical equipment support/anchorage to include all major Class IE components for the balance of safety related systems. All major electrical equipment anchorages and cable tray supports were found to be satisfactory.

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 is complete. The licensee conducted a walkdown to cover all nonseismically-qualified portions of the AFW system and did not find any deficiencies. In addition, we conclude that the AFW system boundary fully conforms to the boundary definition specified in the Generic Letter.

Based on the submitted information, we conclude that the AFW system provides a reasonable assurance to perform its required safety function following the occurrence of a SSE upon completion of the ongoing upgrade of the initial/control systems. Therefore, we recommend that no further action be initiation regarding re-analysis and/or modification of the AFW system of St. Lucie under NRC Multiplant Action C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).

3. R. E. Uhrig, Florida Power and Light Company, Letter to D. G. Eisenhower of U. S. Nuclear Regulatory Commission, September 18, 1981.
4. R. A. Clark, USNRC, letter to R. E. Uhrig of Florida Power and Light Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, St. Lucie Unit 1," April 2, 1982.
5. R. E. Uhrig, Florida Power and Light Company, Letter to R. A. Clark of USNRC, May 6, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

SURRY NUCLEAR PLANT, UNITS 1 AND 2

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Surry Nuclear Plant, Units 1 and 2, responded with a letter dated July 16, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated January 6, 1982.⁴ The licensee provided a supplemental response in a letter dated February 12, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Description of methodologies and acceptance criteria for the AFW system, which is determined to be seismically qualified to the SSE level by the licensee.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Schematic sketch of the AFW system.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

The AFW system has been designed, constructed, and maintained to withstand a SSE utilizing methods and acceptance criteria consistent with that applicable to other safety-grade systems in the plant. All areas of the AFW system (i.e., pumps/motors, piping, valves/actuators, power supplies, water source, instrumentation/control systems, and structures housing and supporting the AFW system) are seismically qualified to the SSE level.

The licensee provided a description of the methodologies and acceptance criteria used for seismic qualification of the AFW system by referring to the applicable sections of the FSAR. The description includes seismic analysis methods, seismic input, load combinations, allowable stresses, qualification testing, and engineering evaluations performed.

A switchover procedure to a secondary water source is not involved because the primary water source and supply path is seismically qualified.

Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system is fully seismically qualified.

Regarding the AFW system boundary, the licensee's responses did not provide sufficient information. Therefore, it is not clear that the licensee's AFW system boundary fully meets the boundary requirements specified in GL 81-14.

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. It is noted that documentation of the reanalyses of the Seismic Class I piping within the Scope of IE 79-14 was being completed, and the final reports were scheduled to be prepared by November 1991.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

A walkdown is not required because no lack of seismic qualification of the AFW system is indicated.

2.3 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 the AFW system items.

3. CONCLUSIONS

The licensee's responses provided all the information that was explicitly requested by GL 81-14. Based on the information, we conclude that the AFW systems at Surry Nuclear Plant, Units 1 and 2, will be able to provide the safety-related function following a SSE to assure safe shutdown of the plant. Therefore, we recommend that no further action be initiated regarding upgrading of the AFW systems of these plants under NRC Multiplant Action C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. R. H. Leasburg, Virginia Electric and Power Company (VEPCO) letter to H. R. Denton of U. S. Nuclear Regulatory Commission, "Seismic Qualification of Auxiliary Feedwater Systems, Surry Power Station Units 1 and 2," July 16, 1981.
4. S. Varga, U. S. Nuclear Regulatory Commission letter to R. H. Leasburg, VEPCO, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Surry Nuclear Plant Units 1 and 2," January 6, 1982.
5. R. H. Leasburg, Virginia Electric and Power Company, letter to H. R. Denton of U. S. Nuclear Regulatory Commission, "Auxiliary Feedwater System Seismic Qualification, Surry Power Station Units 1 and 2," February 12, 1982.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM TECHNICAL EVALUATION REPORT

THREE MILE ISLAND NUCLEAR STATION, UNIT 1

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Three Mile Island Nuclear Station, Unit 1, responded with letters dated September 29 and December 8, 1981, and February 16, 1982.³⁻⁵ The licensee's responses were found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated April 5, 1982.⁶ The licensee provided supplemental responses in letters dated July 7, September 14, and September 29, and December 20, 1982.⁷⁻¹⁰ The information in Ref. 10 substantially altered the conclusion from our evaluation of the information provided in Refs. 3 to 5 and 7 to 9. For this reason, a meeting was held between the NRC staff and licensee on January 7, 1983, in order to clarify certain issues on the seismic capability and operating procedures of the AFW system at this plant.¹¹ The licensee responded with additional letters dated February 4, March 22, and May 2, 1983.¹²⁻¹⁴

This report is a technical evaluation based on the information from the licensee's responses to the Generic Letter, and includes a recommendation regarding the need for additional analysis and/or upgrading modifications of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Description of procedure for switchover to a seismically qualified secondary water source.
- Discussion of levels of seismic capability of nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.

- Results of walkdown of nonseismically-qualified areas.
- Additionally, schematic sketch of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically qualified components.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- Pumps/Motors
- Piping

None

(a) The portion of the recirculation lines for the emergency feedwater pumps, between the manual isolation valves (EFV-20 A/B and EFV-22) and the condensate storage tank (CST) "B", were not seismically designed. However, we believe that according to the licensee's statement a failure of these lines would cause only an inplant spill and not a loss of safety function. In addition, the licensee indicated that these lines will be upgraded to seismic Class I at the next refueling outage. (b) The condenser hotwell supply lines are nonseismic Class I. However, we believe that according to the licensee's statement a postulated break of these lines does not cause a safety concern, because the plant operating procedures will be revised to assure the closure of isolation valves between the hotwell and the AFW suction line (CO-V-14 A/B) and the valves on the cross-tie line between the two CSTs (CO-V-111 A/B); hence, the condenser hotwell supply lines will be isolated when the water level of either CST reaches the technical specification limit during the interim period before the long-term modifications are completed. (c) Based on the submitted sketches, not all connected branch lines from the AFW system are seismic Class I beyond the first valve and up to a point of three

orthogonal restraints. However, we believe, that according to the licensee's walkdown of these branch lines, they are seismically adequate. (d) The instrument air-supply line from valve (IA-V27) to the AFW system is not seismically qualified. However, the licensee indicated that seismically-qualified check valves are provided to maintain the integrity of the Class I two-hour air backup supply (bottled) for (EFW 30 A/B), (EFV 8 A/B/C), (MSV 6), and (4 A/B). Based on the given information above, we judge that the AFW system piping presently possesses an SSE level of seismic capability. All valves were designed such that the OBE stresses would be below yield and SSE stresses would be within ultimate strength. The valve functional operability during and after a SSE has been assured based on calculations. Based on the given information, we judge that the valves/actuators presently have a seismic capacity equivalent to the SSE level.

- Valves/Actuators

- Power Supplies

Portions of the power supplies have been identified by the licensee as nonseismic Class I in a recent evaluation. They include: (a) Power supplies for auxiliary steam to the EF turbine pump and motor operators for the condensate storage tanks (CST) A/B. Isolation valves (CO-V-10 A/B) were not designed to seismic requirements; however, the licensee indicated that they are not part of the emergency power supply system and, therefore, are nonessential items. (b) The power supply from the motor operated valves (CO-V-111 A/B) in the cross tie between the condensate storage tanks A/B will be changed from the existing nonvital power sources to Class 1E vital power sources. (c) Cable routing for the power supply to motor operated valves (CO-V-14 A/B) between the hotwell and the AFW suction line will be upgraded to meet seismic Class I requirement. Upgrading modifications to items (b) and (c) have been proposed by the licensee, and are planned to be

implemented before the startup from the next (Cycle No. 6) refueling. Also, we believe that according to the licensee's statement, a failure of the power supplies noted in (b) and (c), will not prevent the AFW system from initially performing its safety function and adequate time exists for manual action to be taken to preserve minimum CST inventory. Based on the given information above, we conclude that the present level of seismic capability of the power supplies to be equivalent to the SSE. None

- Water Source(s)
- Initiation/Control Systems

Firstly, items identified by the licensee as nonseismically qualified, but judged by us as nonessential, include: (a) Cable routing of motor operators for the main steam supply isolation valves to the turbine-driven pump (MS-V2 A/B) and the main steam bypass to the condensate valves (MS-V8 A/B); (b) Solenoid valves and limit switch that control the valves (MS-V13 A/B) to provide main steam to the turbine; (c) Cable routing of motor operators for the main steam isolation valves (MS-V1 A/B/C/D); (d) Cable routing of motor operators of the main steam to the EF turbine-pump valves (MS-V10 A/B); (e) Local starter for the (MS-V10 A/B) motor operators; (f) Limit switch on the EF turbine-pump steam-supply regulating valve; and (g) Flow switches and control circuitry of recirculation flow-control valves (EF-V8 A/B/C). Items (a) to (f) are judged nonessential based on the licensee's statement that the AFW system safety function can be achieved with the electric pumps and without relying on the turbine-driven pump, and Item (g) is judged nonessential because of the licensee's commitment to lock "open" the recirculation line valve (EF-V8 A/B/C). Secondly, those nonseismically-qualified items with modifications to be completed by the first refueling after the restart include: (h) Converter (EP-V-5A) for control valve (EF-V-30A); and (i) Low

- Structures

The turbine building is Class II, and with some stiffening it could withstand an OBE. However, we believe that, according to the licensee's statement, those AFW power supplies and initiation/control systems routed through this building could fail without impairing the safety function of the AFW system. We, therefore, judge that the turbine building is nonessential and, hence, all structures supporting or housing the AFW components possess a SSE level of seismic capability.

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

• <u>Pumps/Motors</u>	None
• <u>Piping</u>	None
• <u>Valves/Actuators</u>	None
• <u>Power Supplies</u>	None
• <u>Water Source(s)</u>	None
• <u>Initiation/Control Systems</u>	None*
• <u>Structures</u>	None

In summary, our evaluation indicated that the licensee's AFW system will possess an SSE level of overall seismic capability when their planned modifications are completed at the next refueling outage.

The primary water source is the condensate storage tank. This tank and the suction piping to the AFW pumps are seismic Class I. However, in two cases, there is only a single isolation valve (CO-V-14) between the seismic Class I water-supply piping and the nonseismic Class I piping to the condenser hotwell. In either case, failure of that valve to isolate the condensate storage tank from the nonseismic Class I piping could result in that particular condensate storage tank draining to the condenser hotwell or turbine building. The licensee had therefore conducted an evaluation of the condensate system and identified some necessary modifications and changes of operating procedures, as discussed earlier, that will be implemented prior to startup from the next (Cycle No. 6) refueling. Modifications recommended by the licensee include: (a) Power supply modifications that have been mentioned under the power supplies evaluation. (b) Plant operating procedures for AFW system would be changed to provide guidance to the operator to isolate the CST from the AFW system by closing valves (CO-V-III A/B) and (CO-V-14 A/B) from the control room whenever the CST reaches the technical specification limit following AFW system initiation. Additionally, the licensee stated that a secondary water supply of river water is available from the reactor building emergency cooling pumps and it is entirely seismic Class I. This water supply enters the AFW pump common-suction header between two sectionalizing valves (EF-V-1 A/B). Manual actions are required to access this backup water supply. Two series motor-operated valves (EF-V-4 & 5) to the river water system are normally locked "closed" and the motor control-center breakers

* Will be fully qualified when the licensee's planned upgrade/modifications are completed at the next refueling outage.

for these valves are locked "open". If the backup supply of river water to the AFW system is needed, these locks will be removed and the breakers "closed." The switchover procedure to use the backup water sources is still under review by the licensee.

Seismic qualification information for any alternate decay-heat removal system was requested by the GL 81-14, if substantial lack of seismic qualification of the AFW system is indicated. We believe such information for any alternate decay-heat removal system is not required, because the AFW system will possess an SSE level capability by the next refueling outage.

Regarding the AFW system boundary, the schematic sketches provided by the licensee show that there are branch lines without a second isolation valve, which is normally "closed" or capable of automatic closure. However, we believe that according to the licensee's statement,¹⁴ the lack of the double valve isolation is acceptable. We, therefore, concluded that the AFW system boundary does not fully conform to the definitions of GL 81-14, but the deviation is nonessential.

The AFW system was included within the scope of IE Bulletin 79-02, 79-04, 79-07, 79-14, 80-11 and IE Information Notice 80-21.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

Walkdown has been performed in conjunction with IE Bulletins 79-02 and 79-14. The licensee identified six deficiencies that have been corrected: (a) Support EF-8, repair completed on 4/7/81, (b) Support EF-72, repair completed on 7/27/81, (c) Support EF-125, repair completed on 7/31/81, (d) Conduit to MSV-6 has loose clamp that needs to be tightened, (e) Conduit to EFV 8B had no clamps to hold it to existing steel and needs clamp for security, (f) Unistrut supporting conduit to (EF-V-8C) is loose at the base and needs to be tightened. The licensee stated that items (d) to (f) have been or will be completed prior to restart.

2.3 ADDITIONAL INFORMATION

The licensee provided schematic sketches of the AFW system including the water sources, heat sink, suction and discharge piping, major mechanical equipment, and structures supporting and housing the 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 seismically qualified portions of the AFW system, by referring to the appropriate sections of the FSAR.

3. CONCLUSIONS

The information contained in licensee's responses to the GL 81-14 is complete. The licensee conducted a partial walkdown of the nonseismically-qualified areas of the AFW system. The valve arrangement in the AFW system branch lines does not fully conform to the boundary definitions specified in GL 81-14, but we judge the deviation acceptable.

Based on submitted information, we conclude that presently the AFW system will possess an SSE level of seismic capability when the scheduled modifications are completed by the Cycle No. 6 refueling outage. Therefore, we recommend that no further action be initiated regarding upgrading of the AFW system of this plant under the NRC Multiplant Action Plan C-14.

4. REFERENCES

1. D. G. Eisenhut, U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton, "Multiplant Action Plan 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. H. D. Hukill, Metropolitan Edison Company, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission, September 29, 1981.
4. H. D. Hukill, Metropolitan Edison Company, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission, December 8, 1981.
5. H. D. Hukill, Metropolitan Edison Company, letter to D. G. Eisenhut of U. S. Nuclear Regulatory Commission, "EFW Seismic Qualification - Electrical," February 16, 1982.
6. U. S. Nuclear Regulatory Commission, Letter to Metropolitan Edison Company, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Three Mile Island Nuclear Station, Unit 1," April 5, 1982.
7. H. D. Hukill, Metropolitan Edison Company, letter to J. F. Stolz of U. S. Nuclear Regulatory Commission, July 7, 1982.
8. H. D. Hukill, General Public Utility Nuclear Corporation, letter to J. F. Stolz of U. S. Nuclear Regulatory Commission, September 14, 1982.
9. H. D. Hukill, General Public Utility Nuclear Corporation, letter to J. F. Stolz of U. S. Nuclear Regulatory Commission, September 29, 1982.
10. H. D. Hukill, General Public Utility Nuclear Corporation, letter to J. F. Stolz of the U. S. Regulatory Commission, December 20, 1982.
11. Minutes of Meeting between U. S. Nuclear Regulatory Commission and General Public Utility Nuclear Corporation on January 7, 1983.
12. H. D. Hukill, General Public Utility Nuclear Corporation, letter to J. F. Stolz of the U. S. Nuclear Regulatory Commission, February 4, 1983.
13. H. D. Hukill, General Public Utility Nuclear Corporation, letter to J. F. Stolz of the U. S. Nuclear Regulatory Commission, March 22, 1983.
14. H. D. Hukill, General Public Utility Nuclear Corporation, letter to J. F. Stolz of the U. S. Nuclear Regulatory Commission, May 2, 1983.

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM TECHNICAL EVALUATION REPORT

TURKEY POINT NUCLEAR PLANT, UNITS 3 AND 4

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Turkey Point Nuclear Plant, Units 3 and 4, responded with a letter dated September 8, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC dated April 9, 1982.⁴ The licensee provided a supplemental response in a letter dated May 25, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Identification of AFW system components that are currently nonseismically qualified for SSE.
- Discussion of levels of seismic capability of nonseismically-qualified components.
- Description of the AFW system boundary.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, schematic sketch of the AFW system.
- Additionally, description of methodologies and acceptance criteria for seismically qualified components.
- Additionally, modification associated with installation of new turbines along with schedules for such modifications.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

- Pumps/Motors

Condensate transfer pump and the condensate recovery transfer pump are not seismically qualified. The licensee indicated these pumps are not required to function and will be disconnected from the AFW pump suction as a result of the new demineralized water system modifications during the Unit 4 steam generator repair outage. We judge that the present seismic capability of pumps/motors is less than OBE because the licensee did not discuss the seismic capability of the condensate transfer pump and the condensate recovery transfer pump; however, the pumps/motors will possess a SSE level of seismic capacity when the new demineralized water system modifications are completed.

- Piping

The condenser make-up line, a branch line from the AFW pump suction, is not seismically qualified. Currently, a new demineralized water system is being installed which will include a new make-up line. The existing branch line from the AFW suction will be cut and capped when the new demineralized water system is placed in service during the Unit 4 generator repair outage in October 1982. We judge the seismic capacity of piping is presently less than OBE, but will be at the SSE level when the new make-up line is in place and the existing one cut and capped.

- Valves/Actuators

The 3/4-in. air-operated vent valves located downstream of the motor-operated steam admission valves to

the AFW turbines are provided to prevent the AFW turbines from turning due to valve leakage. Failure of these valves in the open position will affect these valves in performing the required function. However, the licensee stated that the inability of these valves to perform their required function will not prevent the AFW system from performing its safety function. Therefore, we conclude that the present level of seismic capability of the valves/actuators is equivalent to the SSE.

- Power Supplies

The power supplies for the flow indication and flow control for Unit 4 are not seismically qualified. The licensee stated that modifications are planned to be performed in Unit 4 during the next scheduled outage of sufficient duration. We judge that the seismic capability of the power supplies in Unit 4 is presently less than OBE, but will be upgraded to SSE level upon completion of modifications.

- Water Source(s)

The licensee stated that the primary water source and path includes a nonseismically-qualified condensate recovery tank, which supports the condensate recovery pump acting as a seismic pipe anchor. The condensate recovery line will be disconnected from the AFW pump suction as a result of the new demineralized water system modifications. Regarding the installation of the new demineralized water system, the DWDS storage tank is complete. The tie-ins to Unit 3 were completed prior to its start up from its steam generator repair outage. The tie-ins to Unit 4 will be completed during the Unit 4 steam generator repair outage starting in October 1982. We conclude that the entire primary water source and path will possess a SSE level seismic capacity when the licensee completes the new demineralized water system.

- Initiation/Control Systems

Nonseismically qualified areas are discussed as follows. (a) The condensate storage tank level

transmitter was procured to control grade. The licensee stated that loss of function of the transmitter and indicator will not prevent the AFW system from performing its function. In addition, redundant safety grade indication is being added. (b) Local pressure indicators were procured to control grade. The licensee stated that loss of the pressure indicator function will not prevent the AFW system from performing its required function. (c) Pressure switches located upstream of the AFW turbine trip and throttle valves are currently used to initiate the air supply to the normally closed turbine pressure reducing valve. However, the need for these pressure switches with the new high pressure AFW turbines has yet to be determined by the licensee since the normally closed turbine pressure reducing valves will be replaced by normally open trip and

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

• <u>Pumps/Motors</u>	None*
• <u>Piping</u>	None*
• <u>Valves/Actuators</u>	None
• <u>Power Supplies</u>	None**
• <u>Water Source(s)</u>	None
• <u>Initiation/Control Systems</u>	Less than OBE
• <u>Structures</u>	None

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

The primary water source and supply path is currently not seismically qualified but will possess a SSE capacity when the licensee completes the new demineralized water system modifications. Therefore, information on switchover to a seismically qualified secondary water source and supply path is not involved.

* Presently less than OBE, and will be fully qualified when licensee's proposed upgrade/modification is completed.

** Presently less than OBE for Unit 4, and will be fully qualified when licensee's proposed upgrade/modification is completed.

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. Based on the information provided by the licensee we did not find that the licensee's AFW system has a SSE capability. However, we judge that information on an alternate decay heat removal system seismically qualified to the SSE level and appropriate operating procedures are not needed if the licensee is required to reanalyze and/or modify the existing AFW system to a SSE capacity.

3. CONCLUSIONS

The information contained in licensee's responses to GL 81-14 is complete except that regarding the present level of seismic capability of some areas of the initiation/control systems. The walkdown conducted by the licensee identified some deficiencies and corrective actions were planned with completion dates provided. The licensee has stated that the AFW system will be upgraded during the Unit 4 steam generator repair outage commencing in October 1982. However, no plan is given of modification of the nonseismically-qualified portion in the initiation/control systems. The licensee has also stated that the AFW system boundary extends to only the first normally closed valves on branch lines and therefore it does not fully conform to the definition specified in the GL 81-14.

Based on the submitted information, we conclude that the AFW system does not provide a reasonable assurance to perform its required safety function following a SSE because presently portions of the initiation/control systems do not have a SSE seismic capability and the AFW system boundary does not conform to GL 81-14's requirements. In conclusion, we recommend that the NRC considers requiring the licensee (a) to provide a reanalysis and/or modification to acquire a SSE capacity for the initiation/control systems, and (b) to evaluate and/or correct the AFW system boundary deviation to assure the required safety function.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEM
TECHNICAL EVALUATION REPORT

ZION STATION, UNITS 1 AND 2

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,"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,"² dated February 10, 1981, to all operating PWR licensees. This letter requested each licensee (1) to conduct a walkdown of nonseismically 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 Zion Station, Units 1 and 2, responded with a letter dated July 14, 1981.³ The licensee's response was found not to be complete and a Request for Additional Information (RAI) was issued by the NRC, dated January 6, 1982.⁴ The licensee provided a supplemental response in a letter dated July 12, 1982.⁵

This report is a technical evaluation based on the information from the licensee's responses to GL 81-14, including recommendations for additional analysis and/or upgrading modification of this plant's AFW system.

2. EVALUATION

Information provided in the licensee's response include:

- Specification of the overall seismic capability of the AFW system.
- Identification of currently nonseismically-qualified components of the AFW system.
- Description of procedure for switchover to a seismically qualified secondary water source.
- Status of compliance with seismic related NRC Bulletins and Information Notices.
- Additionally, isometric drawings of the AFW system piping and a diagram of the steam generator feedwater piping.
- Additionally, description of methodologies and acceptance criteria for the design of seismically qualified components.

We have reviewed the licensee's responses, and a point-by-point evaluation of the licensee's responses against the Generic Letter's requirements as shown below.

2.1 SEISMIC CAPABILITY OF THE AFW SYSTEM

Except for those items identified in the following, the AFW system has been designed, constructed, and maintained to withstand a 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 seismically qualified are evaluated below.

● <u>Pumps/Motors</u>	None
● <u>Piping</u>	The system piping from the condensate storage tank to a motorized valve at suction of the AFW pumps. However, the licensee indicated in their responses that a seismically qualified secondary water source (the service water system) and supply path exists in the plant. Therefore, we judge that the AFW system pipings in Zion Station Units 1 and 2 possess an overall seismic capability that will withstand the SSE.
● <u>Valves/Actuators</u>	None
● <u>Power Supplies</u>	None
● <u>Water Source(s)</u>	The primary water source, i.e., the condensate storage tank, is not seismically qualified. However, a secondary water and supply path exists and it is designed as seismic Class 1. A procedure is available for switching from the primary to the secondary water source. Therefore, we conclude that the water source(s) possess a SSE level of seismic capability.
● <u>Initiation/Control Systems</u>	None
● <u>Structures</u>	None

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

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

In summary, our evaluation indicated that the AFW system at Zion Station Units 1 and 2 possesses a SSE level of seismic capability.

The primary water source and supply path is not seismically qualified and, therefore, switchover to the seismically qualified secondary water source

and supply path is required. A switchover procedure in Zion Station Units 1 and 2 is available and is maintained on file at the plant as part of Zion Station's abnormal operating procedure program. The procedure is based on the condensate storage tank level and consists of two sections. The first section describes the procedure for a slow, steady loss of condensate storage tank level, and the second section describes the procedure for a sudden, uncontrolled loss of condensate storage tank level.

Information regarding the seismic capability of any alternate decay heat removal system is not required because the AFW system has a SSE level of seismic capability.

Regarding the AFW system boundary, the licensee's responses did not provide sufficient information. It is not clear whether the licensee's AFW system boundary fully meets the boundary requirements specified in GL 81-14.

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.

2.2 WALKDOWN OF NONSEISMICALLY-QUALIFIED PORTION OF THE AFW SYSTEM

The licensee conducted a walkdown of the nonseismically-qualified portion of the AFW system, i.e., the primary water supply path. The licensee stated that the results of the walkdown indicated that the nonseismically-qualified primary water supply line is adequately designed and installed in accordance with the original plant requirement. In addition, station personnel will conduct a general maintenance program for all hangers on the primary water supply path, by tightening or replacing bolts, tightening turn buckles, and adjusting pipe attachments.

2.3 ADDITIONAL INFORMATION

The licensee provided six isometric drawings of the AFW system piping and a diagram of the steam generator feedwater piping. Additionally, licensee's responses provided a description of the methodologies and acceptance criteria for the design of the seismically qualified components.

3. CONCLUSIONS

The information contained in licensee's responses to the GL 81-14 is complete except that it did not clarify whether the AFW system boundary fully conforms to the definitions of the GL 81-14.

Based on the submitted information, we conclude that the AFW system is fully seismically qualified and is able to provide the safety related function following a SSE assuming that the AFW system boundary fully conforms to the boundary definitions specified in the GL 81-14. Therefore, we recommend that no further action be initiated regarding reanalysis and/or modification of the AFW system of this plant under NRC Multiplant Action Plan C-14.

4. REFERENCES

1. D. G. Eisenhut, "Multiplant Action Plan C-14; Seismic Qualification of Auxiliary Feedwater System," U. S. Nuclear Regulatory Commission, memorandum to H. R. Denton (February 20, 1981).
2. U. S. Nuclear Regulatory Commission, Generic Letter to all operating pressurized water reactor licensees, "Seismic Qualification of Auxiliary Feedwater System," (February 10, 1981).
3. T. R. Tramm, Commonwealth Edison, letter to H. R. Denton of U. S. Nuclear Regulatory Commission, July 14, 1981.
4. S. A. Varga, USNRC, letter to L. O. DelGeorge of Commonwealth Edison, "Request for Additional Information on Seismic Qualification of the Auxiliary Feedwater System, Zion Station, Units 1 and 2," January 6, 1982.
5. F. G. Lentine, Commonwealth Edison, letter to H. R. Denton of USNRC, July 12, 1982.