

FEB 10 1981

Central files

TO ALL OPERATING PRESSURIZED WATER REACTOR LICENSEES

SUBJECT: SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEMS
(Generic Letter No, 81-14)

Our letter to you dated October 21, 1980, identified concerns regarding the seismic qualification of Auxiliary Feedwater (AFW) systems. That letter outlined the continuing evaluation program being conducted by the staff with regard to this issue to assure conformance of each plant with General Design Criteria 2 and 34, of Appendix A to Part 50. As a result of the NRC's continuing review of this issue, including the completion of site visits described in our previous letter, we have determined that it is necessary to request certain information from PWR licensees and to request that certain actions be performed by PWR licensees, as described below. The purpose of our information request is to obtain sufficient information that identifies the extent to which AFW systems are seismically qualified. We are also requesting that PWR licensees perform a walk-down of the non-seismically qualified portions of their AFW systems to identify apparent and practically correctable deficiencies that may exist.

For plants with AFW systems that are not seismically qualified either in whole or in part, our plan involves increasing the seismic resistance of the systems in a timely, systematic manner to ultimately provide reasonable assurance, where necessary, that they are able to function following the occurrence of earthquakes up to and including the design Safe Shutdown Earthquake (SSE) for the plant. This plan is a result of a study of the seismic requirements which should be applied to AFW systems for those not presently seismically qualified, as discussed in NUREG-0667, "Transient Response of Babcock and Wilcox-Designed Reactors."

Enclosure 1 to this letter contains a request for information from all operating PWRs concerning AFW system seismic design. We have determined that docketed information from licensees is not sufficient to allow us to conduct a detailed review of this aspect of AFW systems. In addition, for a number of older plants, this information is likely not to be current. Furthermore, since the safety significance of the system may not have been defined for all plants, the AFW system may not have been adequately maintained and considered to be included within the scope of IE Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-21. Therefore, the existing AFW systems, either in total or in part, may have as-built characteristics which result in uncertain seismic design characteristics. For plants with AFW systems, or portions thereof, which are not seismically qualified, Enclosure 1 also requests information concerning systems which provide an alternate decay heat removal path.

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*IDAR-5
INFO-4R*

We are also requesting that you conduct a walk-down by personnel experienced in the analysis, design and evaluation of such structures, systems and components, of the non-seismically qualified portions of the AFW system for the purpose of identifying more readily recognized deficiencies in seismic resistance. These walk-downs are requested for only those portions of the AFW system which have not been designed, constructed, and maintained as seismically qualified systems in accordance with the criteria for safety-grade systems at the facility. The scope of the walk-down should include the types of equipment, components, and piping described in Enclosure 2. Enclosure 1 describes what we consider to comprise the bounds of the AFW system, and any alternate decay heat removal paths.

For plants with AFW systems that are not seismically qualified, we consider that actions should be taken soon to ensure a reasonable level of earthquake resistance. This applies to both the AFW system and the alternate system used for decay heat removal if portions of it are not seismically qualified. Based upon the consideration of the past performance of nuclear and fossil power plants, and other non-nuclear facilities subject to large earthquakes, we note that well engineered structures, equipment, components and piping possess a substantial amount of inherent seismic resistance, even without the rigorous seismic qualification performed for safety-grade portions of nuclear facilities. Of the failures of structures, piping, equipment and components noted in these past earthquakes, a large fraction have been due to brittle failure, lack of restraint, large displacements, or some other obvious deficiency which would have been easily identified before the failure caused by the seismic event. Such identified deficiencies could have been corrected to significantly enhance reliability without detailed seismic analyses but by exercising careful engineering judgement. These considerations were factored into the development of Enclosure 2. In addition, certain of these deficiencies were noted as existing at the several facilities for which we conducted AFW system walk-downs (see Enclosure 3 for details of the visits). Accordingly, your walk-down of the non-seismically qualified portions of the AFW system and other alternate decay heat removal systems should identify any appropriate modifications in the context of the above discussion.

Enclosure 2 identifies in more detail the actions we consider appropriate for plants with AFW systems, or portions thereof, that are not seismically qualified. Although we are not at this time requesting that the AFW system be modified to be in conformance with the facility design seismic requirements, we have stated that our plan is to increase the seismic resistance, where necessary, to ultimately provide reasonable assurance that the system will function after the occurrence of earthquakes up to and including the SSE.

Accordingly, the following actions are requested by this letter:

1. In accordance with 10 CFR 50.54(f) of the Commission's regulations, all PWR licensees are requested to provide the information contained in Enclosure 1 within 720 days of receipt of this letter; and
2. The results of any walk-downs are requested within 720 days of receipt of this letter. These results should include all identified deficiencies and all corrective actions taken, or planned along with the schedules for such. Such modifications, if any, shall be handled in the customary manner consistent with the provisions of your license and the Commission's regulations.

Responses should be submitted to enable us to determine whether or not your license should be modified, suspended, or revoked.

Original signed by
Darrell G. Eisenhut

Darrell G. Eisenhut, Director
Division of Licensing

Enclosures:
As stated

"This request for information was approved by GAO under a blanket clearance number R0072 which expires November 30, 1983. Comments on burden and duplication may be directed to the U.S. General Accounting Office, Regulatory Reports Review, Room 5106, 441 G Street, N.W., Washington, D. C. 20548."

the 45 days may be too tight for the licensee

DL:AD/OR
TNOAK
2/2/81

DL:AD/
RTedesco
2/2/81

ORAB:DL
KHerring:dn
1/22/81

OELD
EChristenberry
1/1/81

C:SPB/DST
R: [initials]
1/23/81

I have no objection, but subject is entirely outside my area of cognizance.

OELD
LChandler
1/24/81

OFFICE	C/SEPB:DL	AD-SA:DL	D:DE	D:DSI	D:DHFS	D:DST	D:DI
SURNAME	WRussel	GLamas	R[initials]	DRoss	SHanauer	[initials]	DEisenhut
DATE	1/22/81	1/22/81	1/26/81	1/23/81	1/1/81	1/23/81	1/10/81



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

FEB 10 1981

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For plants with AFW systems that are not seismically qualified either in whole or in part, our plan involves increasing the seismic resistance of the systems in a timely, systematic manner to ultimately provide reasonable assurance, where necessary, that they are able to function following the occurrence of earthquakes up to and including the design Safe Shutdown Earthquake (SSE) for the plant. This plan is a result of a study of the seismic requirements which should be applied to AFW systems for those not presently seismically qualified, as discussed in NUREG-0667, "Transient Response of Babcock and Wilcox-Designed Reactors."

Enclosure 1 to this letter contains a request for information from all operating PWRs concerning AFW system seismic design. We have determined that docketed information from licensees is not sufficient to allow us to conduct a detailed review of this aspect of AFW systems. In addition, for a number of older plants, this information is likely not to be current. Furthermore, since the safety significance of the system may not have been defined for all plants, the AFW system may not have been adequately maintained and considered to be included within the scope of IE Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-21. Therefore, the existing AFW systems, either in total or in part, may have as-built characteristics which result in uncertain seismic design characteristics. For plants with AFW systems, or portions thereof, which are not seismically qualified, Enclosure 1 also requests information concerning systems which provide an alternate decay heat removal path.

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We are also requesting that you conduct a walk-down by personnel experienced in the analysis, design and evaluation of such structures, systems and components, of the non-seismically qualified portions of the AFW system for the purpose of identifying more readily recognized deficiencies in seismic resistance. These walk-downs are requested for only those portions of the AFW system which have not been designed, constructed, and maintained as seismically qualified systems in accordance with the criteria for safety-grade systems at the facility. The scope of the walk-down should include the types of equipment, components, and piping described in Enclosure 2. Enclosure 1 describes what we consider to comprise the bounds of the AFW system, and any alternate decay heat removal paths.

For plants with AFW systems that are not seismically qualified, we consider that actions should be taken soon to ensure a reasonable level of earthquake resistance. This applies to both the AFW system and the alternate system used for decay heat removal if portions of it are not seismically qualified. Based upon the consideration of the past performance of nuclear and fossil power plants, and other non-nuclear facilities subject to large earthquakes, we note that well engineered structures, equipment, components and piping possess a substantial amount of inherent seismic resistance, even without the rigorous seismic qualification performed for safety-grade portions of nuclear facilities. Of the failures of structures, piping, equipment and components noted in these past earthquakes, a large fraction have been due to brittle failure, lack of restraint, large displacements, or some other obvious deficiency which would have been easily identified before the failure caused by the seismic event. Such identified deficiencies could have been corrected to significantly enhance reliability without detailed seismic analyses but by exercising careful engineering judgement. These considerations were factored into the development of Enclosure 2. In addition, certain of these deficiencies were noted as existing at the several facilities for which we conducted AFW system walk-downs (see Enclosure 3 for details of the visits). Accordingly, your walk-down of the non-seismically qualified portions of the AFW system and other alternate decay heat removal systems should identify any appropriate modifications in the context of the above discussion.

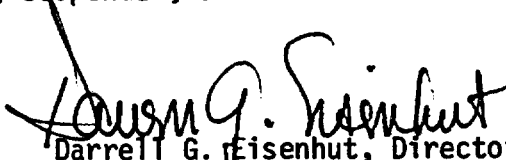
Enclosure 2 identifies in more detail the actions we consider appropriate for plants with AFW systems, or portions thereof, that are not seismically qualified. Although we are not at this time requesting that the AFW system be modified to be in conformance with the facility design seismic requirements, we have stated that our plan is to increase the seismic resistance, where necessary, to ultimately provide reasonable assurance that the system will function after the occurrence of earthquakes up to and including the SSE.

FEB 10 1981

Accordingly, the following actions are requested by this letter:

1. In accordance with 10 CFR 50.54(f) of the Commission's regulations, all PWR licensees are requested to provide the information contained in Enclosure 1 within 120 days of receipt of this letter; and
2. The results of any walk-downs are requested within 120 days of receipt of this letter. These results should include all identified deficiencies and all corrective actions taken, or planned along with the schedules for such. Such modifications, if any, shall be handled in the customary manner consistent with the provisions of your license and the Commission's regulations.

Responses should be submitted to enable us to determine whether or not your license should be modified, suspended, or revoked.


Darrell G. Eisenhut, Director
Division of Licensing

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REQUEST FOR INFORMATIONAUXILIARY FEEDWATER SEISMIC DESIGN

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

- A. Specify whether your AFW system is (a) designed, constructed, and maintained (and included within the scope of seismic related Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-21), in accordance with Seismic Category I requirements (e.g., conformance to Regulatory Guides 1.29 and the applicable portions of the Standard Review Plan or comparable criteria) or (b) designed, constructed and maintained (and included within the scope of seismic related Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-21) to withstand a Safe Shutdown Earthquake (SSE) utilizing the analytical, testing, evaluation methods and acceptable criteria consistent with other safety-grade systems in your plant. To assist the staff in an expeditious assessment of your plant, if your AFW system, or portions thereof, is not qualified to withstand an SSE utilizing the analytical, testing and evaluation criteria consistent with other safety-grade systems in your plant, we request that you identify those components and structures not seismically qualified in the appropriate row of the attached Table 1.
- B. Where seismic qualification is indicated by leaving Table 1 blank, provide a description of the methodologies and acceptance criteria used to support your conclusion of seismic qualification, including: Seismic analyses methods employed, seismic input, load combinations which include the SSE, allowable stresses, qualification testing and engineering evaluations performed.

In addition, where seismic qualification of a secondary water supply or path is relied upon, provide a summary of the procedures which would be followed to enable you to switch from the primary to secondary source.

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- A. Specify whether your AFW system is (a) designed, constructed, and maintained (and included within the scope of seismic related Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-21), in accordance with Seismic Category I requirements (e.g., conformance to Regulatory Guides 1.29 and the applicable portions of the Standard Review Plan or comparable criteria) or (b) designed, constructed and maintained (and included within the scope of seismic related Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and IE Information Notice 80-21) to withstand a Safe Shutdown Earthquake (SSE) utilizing the analytical, testing, evaluation methods and acceptable criteria consistent with other safety-grade systems in your plant. To assist the staff in an expeditious assessment of your plant, if your AFW system, or portions thereof, is not qualified to withstand an SSE utilizing the analytical, testing and evaluation criteria consistent with other safety-grade systems in your plant, we request that you identify those components and structures not seismically qualified in the appropriate row of the attached Table 1.
- B. Where seismic qualification is indicated by leaving Table 1 blank, provide a description of the methodologies and acceptance criteria used to support your conclusion of seismic qualification, including: Seismic analyses methods employed, seismic input, load combinations which include the SSE, allowable stresses, qualification testing and engineering evaluations performed.

In addition, where seismic qualification of a secondary water supply or path is relied upon, provide a summary of the procedures which would be followed to enable you to switch from the primary to secondary source.

- C. If a lack of seismic qualification is indicated for items 1, 2, 3, 4, 5 and 6, 7, or 8 in Table 1, provide additional information which specifies the level of seismic qualification afforded in the original design for each of these areas.

- D. If substantial lack of seismic qualification is indicated for items 1, 2, 3, 4, 5 and 6, 7, or 8 in Table 1, provide the same information requested in A through C for any alternate decay heat removal system. The bounds of these systems shall be considered to a similar extent as that described for the AFW system. Provide a summary of the procedures by which operation of these alternate heat removal systems will be accomplished.

TABLE 1

AUXILIARY FEEDWATER SEISMIC QUALIFICATION

- (1) Pumps/Motors
- (2) Piping
- (3) Valves/Actuators
- (4) Power Supplies
- (5) Primary Water and Supply Path
- (6) Secondary Water and Supply Path*
- (7) Initiation and Control System
- (8) Structures Supporting or Housing these AFW System Items

*Applicable only to those plants where the primary water supply or path is not provided, however, a seismically qualified alternate path exists.

ACTIONS REQUESTED OF PRESSURIZED
WATER REACTOR LICENSEES WITHOUT
A SEISMICALLY QUALIFIED
AUXILIARY FEEDWATER SYSTEM

1. For all mechanical and electrical equipment and components including battery racks, controls, instruments, motors, compressors, tanks electrical supplies and the cabinets containing such items, note all items which are not securely attached to their supporting structures such that there is substantial resistance to movement caused by seismically induced forces.
2. For piping, note cases where relatively large deflections cannot be accommodated without impairing system function. Where such displacements will lead to loss of system function, note where sufficient amounts of restraint could be afforded, thus significantly reducing stresses that would be imparted to such items as pump nozzles and branch connections, as appropriate. Further, note eccentric valve operators that are not sufficiently supported and act to severely overload the pipe. Where such support is lacking, you should note where substantial restraints could be added to the extent practical. Also, where pipes are resting on existing supports, note where substantial resistance to the pipe moving off these supports could be added where it does not already exist.
3. For cable trays and conduits, assure that relatively large displacements can be accommodated without impairing system function where seismic restraint is substantially less than required for these which are seismically qualified. Focus particular attention on preventing the breakage of the electrical and control cables they contain at such places as points of attachment of the cables to equipment or other relatively fixed points. Note where any deficiencies exist.

Given the time frame we are recommending for the completion of these actions, no explicit analyses are requested to demonstrate system qualification unless deemed necessary by you. However, sound engineering judgement should be applied considering the level of seismicity specified for your site and the design requirements for other seismically qualified systems in the facility when judging the necessity for and adequacy of any modifications (e.g., piping, cable trays, conduit, equipment and component restraints, and estimations of displacement levels). Further, these actions shall be accomplished using personnel who are experienced in the analysis, design and evaluation of such structures, systems and components.

Where you have determined that it is prudent to institute modifications, no modifications should be instituted which will detrimentally affect the function of the piping, equipment and components of the system, considering all other loads in addition to seismic. For example, when providing additional restraints to piping systems, assure that they do not have a detrimental impact on the system considering all loads, in addition to seismic, including thermal loads and support displacement induced loads.

Similar considerations as described above should be given to other non-seismically qualified piping, equipment and components in the vicinity of the non-seismically qualified portions of the AFW and the alternate decay heat removal systems to provide for a substantial decrease in their susceptibility to failure if such failure could impact the function of the AFW and alternate decay heat removal systems.

RESULTS OF NRC STAFF
WALK-DOWNS OF AFW SYSTEMS

Plant 1 - Seismically Qualified AFW System (Operating License issued in 1975)

Several locations were found in which the supports for the control-air for the auxiliary feedwater pumps or for the auxiliary feedwater control valve were disconnected from their intended mounting locations. These were examples of important, but non-essential systems (i.e., local manual control of the pumps and valves could be used if the air-system were damaged) which could be easily upgraded to increase the plants ability to remove decay heat following an SSE.

Plant 2 - Non-Seismically Qualified AFW System (Operating License issued in 1963)

At least two supports to the auxiliary feedwater piping were either not connected to piping or not connected at the mounting location. The bolts securing the auxiliary feedwater water supply tank (demineralized water tank) to its pad were rusted and not tightened down (i.e., 3/4 inch space between the support and nut intended to hold it down). Also, a long span of 2-inch piping was found having vertical support only to which lateral support could easily be provided.

Plant 3 - Non-Seismically Qualified AFW System (Operating License issued in 1967)

Three areas were identified for which remedial actions could be implemented in a reasonably short time. The first of these was one of the station's battery racks. While the existing racks provided for some degree of lateral seismic resistance, the configuration did not appear to have a level of integrity commensurate with the importance of the batteries to plant safety. These racks appeared flimsy in comparison to those which were installed to current seismic design criteria prescribed by the licensee for safety related systems.

The second area was the suction side of the Auxiliary Feedwater pumps which consists of a single header from the condensate storage tank. The header has some lateral support, however, the condensate storage tank was not qualified. The tank is not anchored at its base and the permanent alternate supply is through the tank. There is a capability to install a hose from a qualified water source to the pump suction and bypass the condensate storage tank. Keeping such a hose in place would enhance system reliability.

The third area was the main instrumentation and control panels in the control room. These are supported at the bottom by a concrete channel and at the top by steel knee braces anchored to the concrete ceiling with expansion anchors. The requirements of IE Bulletin 79-02 had not

been applied to these anchor bolts and base plates. Conformance with the IE Bulletin requirements for the factors of safety and considering base plate flexibility for the original seismic loads would increase reliability. Also, some loose and missing screws were noted in these panels which could be easily tightened and replaced.