UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 20, 1995

MEMORANDUM TO: James E. Dyer, Director
Division of Reactor Projects
Region IV

FROM: William H. Bateman, Director
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

SUBJECT: RESPONSE TO TASK INTERFACE AGREEMENT (95-TIA-002) REGARDING APPLICABILITY OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) CODE SECTION XI TO BOILING WATER REACTOR EMERGENCY CORE COOLING SYSTEM WATERLEG PUMPS (TAC NO. M91577)

You requested assistance from NRR to address whether or not waterleg (also referred to as "keep-fill") pumps located in boiling water reactor (BWR) emergency core cooling systems should be included within the scope of ASME Section XI. The issue was raised to address an item in NRC Inspection Report 50-397/94-29 for Washington Nuclear Power Unit 2 (WNP-2). The inspection report stated that there appeared to be inconsistencies in the application of inservice testing (IST) requirements for waterleg pumps at different BWR facilities. The inspection report specifically questioned the exclusion of the waterleg pumps from the WNP-2 IST program. Our evaluation of this issue is provided in the attachment.

The technical specifications, final safety analysis reports and IST programs of most BWRs have been reviewed to determine the IST scope of waterleg pumps for these plants. Based on this review, it appears that licensees are not consistent in the evaluation of the status of waterleg pumps in their IST programs. Guidance has been included in the evaluation to assist inspectors in determining if a waterleg pump should be included or excluded from an IST program. We applied this guidance to address the specific concern related to the WNP-2 waterleg pumps, and determined that the licensee appropriately has not included the waterleg pumps in its IST program.

This evaluation has been coordinated with Region IV through the Walnut Creek Field Office. This completes our activity on this TIA.

Attachment: Evaluation of ECCS Waterleg Pumps

cc w/att: R. Cooper, Region I
E. Merschoff, Region II
W. Axelson, Region III
K. Perkins, Region IV WCFO

CONTACT: James Clifford, DRPW/NRR
415-1352

9512280052 XA

A/1

ATTACHMENT

RESPONSE TO REQUEST FOR TECHNICAL ASSISTANCE FROM REGION IV REGARDING BWR EMERGENCY CORE COOLING SYSTEM WATERLEG PUMPS

Introduction

Waterleg pumps are used in BWR emergency core cooling systems (ECCS) such as core spray and high pressure safety injection. These pumps are also used in the reactor core isolation cooling system. The discharge lines of these systems are pressurized by waterleg pumps to keep the lines filled with water. Maintaining the discharge lines filled with water accomplishes two functions: 1) facilitates quick injection of water into the reactor vessel, and 2) prevents potential damage from momentum forces generated by high velocity water (water hammer) moving through empty pipe.

Current Inclusion of Waterleg Pumps in IST Programs

Most BWR final safety analysis reports (FSARs) state that a requirement of emergency core cooling systems is that the coolant be delivered to the reactor rapidly when a particular ECCS system is called upon to function. In addition, these reports also cite the potential physical damage that could occur from large momentum forces generated by water moving through empty ECCS discharge lines. Therefore, many BWR technical specifications (TS) require that ECCS discharge lines be filled with water and specify surveillance requirements to verify the filled condition. Waterleg pumps (also referred to as keep-fill, line-fill, holding, jockey, stay-fill and safeguards pipe-fill pumps) are used during normal plant operation in most BWRs to maintain the discharge lines full of water from the pump discharge check valve to the last block valve in the discharge line. After initiation of an ECCS pump, the associated waterleg pump generally does not have any other function. Some BWRs designs do not have installed waterleg pumps and therefore employ other systems to maintain the discharge lines full of water.

In reviewing BWR IST programs, we found that 11 of 36 plants included waterleg pumps within the scope of their IST program. Of these 11 plants, three plants conduct complete IST of waterleg pumps on a quarterly frequency in accordance with the Code requirements. The remaining 8 plants have been granted relief from some of the Code testing requirements to perform testing at cold shutdowns. Relief has been approved from the Code testing with the alternative that the ECCS discharge line pressure be monitored for conformance with the plant TS. Some licensees have stated in their relief requests that it is impractical to perform hydraulic testing of these pumps because there is no installed flow instrumentation. However, other licensees use ultrasonic flow instrumentation, either quarterly or during cold shutdowns, to determine flow. Several plants have notes in their IST programs which state that these pumps are exempt from the requirements of inservice testing.

Based on the review of BWR TSs and FSARs, inclusion of waterleg pumps in IST programs appears to be inconsistent. In some cases, when comparing plants with similar TSs and FSARs, one plant would have the waterleg pumps included in their IST program, while the other plant would either have the pumps exempt

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 20, 1995

MEMORANDUM TO: James E. Dyer, Director
Division of Reactor Projects
Region IV

FROM: William H. Bateman, Director
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

SUBJECT: RESPONSE TO TASK INTERFACE AGREEMENT (95-TIA-002) REGARDING APPLICABILITY OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) CODE SECTION XI TO BOILING WATER REACTOR EMERGENCY CORE COOLING SYSTEM WATERLEG PUMPS (TAC NO. M91577)

You requested assistance from NRR to address whether or not waterleg (also referred to as "keep-fill") pumps located in boiling water reactor (BWR) emergency core cooling systems should be included within the scope of ASME Section XI. The issue was raised to address an item in NRC Inspection Report 50-397/94-29 for Washington Nuclear Power Unit 2 (WNP-2). The inspection report stated that there appeared to be inconsistencies in the application of inservice testing (IST) requirements for waterleg pumps at different BWR facilities. The inspection report specifically questioned the exclusion of the waterleg pumps from the WNP-2 IST program. Our evaluation of this issue is provided in the attachment.

The technical specifications, final safety analysis reports and IST programs of most BWRs have been reviewed to determine the IST scope of waterleg pumps for these plants. Based on this review, it appears that licensees are not consistent in the evaluation of the status of waterleg pumps in their IST programs. Guidance has been included in the evaluation to assist inspectors in determining if a waterleg pump should be included or excluded from an IST program. We applied this guidance to address the specific concern related to the WNP-2 waterleg pumps, and determined that the licensee appropriately has not included the waterleg pumps in its IST program.

This evaluation has been coordinated with Region IV through the Walnut Creek Field Office. This completes our activity on this TIA.

Attachment: Evaluation of ECCS Waterleg Pumps

cc w/att: R. Cooper, Region I
E. Merschoff, Region II
W. Axelson, Region III
K. Perkins, Region IV WCFO

CONTACT: James Clifford, DRPW/NRR
415-1352

A/1

ATTACHMENT

RESPONSE TO REQUEST FOR TECHNICAL ASSISTANCE FROM REGION IV REGARDING BWR EMERGENCY CORE COOLING SYSTEM WATERLEG PUMPS

Introduction

Waterleg pumps are used in BWR emergency core cooling systems (ECCS) such as core spray and high pressure safety injection. These pumps are also used in the reactor core isolation cooling system. The discharge lines of these systems are pressurized by waterleg pumps to keep the lines filled with water. Maintaining the discharge lines filled with water accomplishes two functions: 1) facilitates quick injection of water into the reactor vessel, and 2) prevents potential damage from momentum forces generated by high velocity water (water hammer) moving through empty pipe.

Current Inclusion of Waterleg Pumps in IST Programs

Most BWR final safety analysis reports (FSARs) state that a requirement of emergency core cooling systems is that the coolant be delivered to the reactor rapidly when a particular ECCS system is called upon to function. In addition, these reports also cite the potential physical damage that could occur from large momentum forces generated by water moving through empty ECCS discharge lines. Therefore, many BWR technical specifications (TS) require that ECCS discharge lines be filled with water and specify surveillance requirements to verify the filled condition. Waterleg pumps (also referred to as keep-fill, line-fill, holding, jockey, stay-fill and safeguards pipe-fill pumps) are used during normal plant operation in most BWRs to maintain the discharge lines full of water from the pump discharge check valve to the last block valve in the discharge line. After initiation of an ECCS pump, the associated waterleg pump generally does not have any other function. Some BWRs designs do not have installed waterleg pumps and therefore employ other systems to maintain the discharge lines full of water.

In reviewing BWR IST programs, we found that 11 of 36 plants included waterleg pumps within the scope of their IST program. Of these 11 plants, three plants conduct complete IST of waterleg pumps on a quarterly frequency in accordance with the Code requirements. The remaining 8 plants have been granted relief from some of the Code testing requirements to perform testing at cold shutdowns. Relief has been approved from the Code testing with the alternative that the ECCS discharge line pressure be monitored for conformance with the plant TS. Some licensees have stated in their relief requests that it is impractical to perform hydraulic testing of these pumps because there is no installed flow instrumentation. However, other licensees use ultrasonic flow instrumentation, either quarterly or during cold shutdowns, to determine flow. Several plants have notes in their IST programs which state that these pumps are exempt from the requirements of inservice testing.

Based on the review of BWR TSs and FSARs, inclusion of waterleg pumps in IST programs appears to be inconsistent. In some cases, when comparing plants with similar TSs and FSARs, one plant would have the waterleg pumps included in their IST program, while the other plant would either have the pumps exempt

or not referenced indicating that these pumps were not considered within the scope of IST. Only one plant FSAR specifically identifies the waterleg pumps as safety-related (i.e., required in shutting down the reactor, maintain the reactor in a safe shutdown condition, or mitigate the consequences of an accident - for IST). Several FSARs state that the power supply to their waterleg pumps is from an emergency power source. Therefore, there does not appear to be a consistent methodology employed by licensees to determine if waterleg pumps should be included within the scope of their IST programs.

Evaluation of Waterleg Pumps for Inclusion in the Scope of IST

It is the responsibility of the licensee to establish the IST program scope for pumps. ASME (American Society of Mechanical Engineers) Section XI, Subsection IWP-1100, provides the scope requirements for safety-related code class pumps in IST programs. It states that pumps which are included in licensees' IST programs "perform a specific function in shutting down a reactor or in mitigating the consequences of an accident, and that are provided with an emergency power source." The 1989 edition of ASME Section XI references ASME/ANSI (American National Standards Institute) Operations and Maintenance Standard, Part 6 (OM-6), for testing of pumps. Paragraph 1.1 of OM-6 states that pumps included within the scope of IST are "...provided with an emergency power source, [and] which are required in shutting down a reactor to the cold shutdown condition, maintaining the cold shutdown condition, or mitigating the consequences of an accident."

Components associated with maintaining the ECCS discharge lines filled in order to satisfy the requirements for injection time should be considered either safety-related or could not be credited in the plant's safety analysis. Maintaining the ECCS lines full of water in order to facilitate a quick injection of water into the reactor vessel is a function that mitigates the consequences of an accident. This does not directly imply that the waterleg pumps should be included in the licensee's IST program unless it is specifically stated in the FSAR that waterleg pumps are safety-related components. The waterleg pumps may not have a safety-related function, even though this is their primary function, if there are other methods to maintain the lines in a filled condition and the components associated with these methods are classified as safety-related. For example, if the pressure in a particular ECCS line falls below a specific value, plant procedures may require another component, such as the associated ECCS pump, to be utilized in order to maintain the discharge line full of water. In this example, the waterleg pump may not be safety-related and therefore may be excluded from the licensee's IST program.

For a pump to be included in the IST program, it must be connected to an emergency power source. A waterleg pump must be included in the IST program if it is designated as a safety-related component in the FSAR and supplied with emergency power. When no specific designation exists, then the inclusion in the IST program should be based on whether there are other means to maintain the discharge line full of water. The waterleg pumps should be included in the licensee's IST program if they are the only means available to maintain the ECCS lines full of water during plant operation. If there are

other safety-related components that are credited to maintain the discharge lines filled with water, and the waterleg pumps are not credited, inclusion of the waterleg pumps in the IST program is at the discretion of the licensee.

WNP-2 Waterleg Pumps

WNP-2 has four waterleg pumps, one in each of the three ECCS divisions and a fourth in the reactor core isolation cooling (RCIC) system. None of the pumps are included in the licensee's IST program and therefore are not subject to the Code hydraulic and vibration acceptance criteria. Vibration measurements are taken monthly on all waterleg pumps as part of the licensee's predictive maintenance program. However, vibration levels in the Code alert or required action range would not require the licensee to initiate corrective action.

The WNP-2 TS Section 4.5.1.a.1 requires a monthly surveillance of the low pressure core spray, low pressure coolant injection, and high pressure core spray to verify, by opening the high point vents, that the discharge lines of these systems are filled with water. The TS Bases state that the discharge lines of these systems are "maintained full [of water] to prevent water hammer damage to piping and to start cooling at the earliest moment." Prevention of water hammer is to protect the piping from large momentum forces that would be generated from high velocity water traveling through empty pipe. Quick initiation of an ECCS system is a safety function to mitigate the consequences of an accident. There are no TS requirements directly referencing the waterleg pumps. In addition, there were no requirements found in the TS to monitor the discharge pressure in the ECCS lines.

The WNP-2 Final Safety Analysis Report, Section 6.3.2.2.5, states that "the power supply to these pumps is essential when the main ECCS pumps are deactivated." However, the pumps are identified as Safety Class 2 pumps and are supplied with emergency power. The FSAR also states that "the initiation of flow into the reactor pressure vessel can be minimized by keeping the core cooling pump discharge lines full."

The licensee stated in discussions with NRR and in internal memorandum related to the inclusion of waterleg pumps in the IST program that the pumps were not safety-related because they did not have a specific safety function. In addition, there are procedures in place to satisfy TS requirement 4.5.1.a.1 if the waterleg pumps are not available. Upon the occurrence of a low pressure alarm in an ECCS or RCIC discharge line, abnormal operating procedures would direct the operators to fill and vent the line and start the ECCS or RCIC pump to maintain the line filled.

Although the waterleg pumps are classified as Safety Class 2, are powered by an emergency power source and operate to keep the ECCS and RCIC lines full during normal power operation, there are other means to meet the TS that have been proceduralized at WNP-2. Those alternate methods employ safety-related components. In addition, the FSAR does not explicitly state that these pumps are safety-related. Therefore, the licensee's determination that these pumps are not within the scope of their inservice testing program is acceptable.

Conclusion

The inclusion of waterleg pumps in BWR IST programs must be evaluated on a plant-specific basis. Waterleg pumps must be included in the IST program if the licensee's FSAR states that these pumps are safety-related and powered by an emergency power source. If the safety analysis concludes that the ECCS discharge lines must be filled with water, the waterleg pumps are the only means to maintain the lines full, and the power to the waterleg pumps is supplied from an emergency source, then the pumps should be included in the IST program. Maintaining the ECCS discharge lines filled with water mitigates the consequences of an accident by facilitating quick injection of water into the reactor vessel. Inclusion of waterleg pumps in an IST program is left to the discretion of the licensee if there are other means to maintain the discharge lines filled with water, and components associated with those alternate methods are safety-related. Exclusion of these pumps from the licensee's IST program should be documented.

Based on our evaluation, the waterleg pumps at WNP-2 are not required to be included in the licensee's IST program because there are alternate means which the licensee can rely on to maintain the ECCS discharge lines filled with water when the pressure of a particular ECCS line decreases. This is done by activating the associated ECCS pump to maintain pressure in the discharge line without injecting water into the reactor vessel.

Principal Contributor: J. Colaccino, EMEB/DE
415-2753