INL USQ PROCESS
REASONABILITY DETERMINATION/POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
(DO NOT USE FOR PROPOSED CHANGES)

Facility or Activity: Advanced Test Reactor

USQ Process No.: ATR Complex-USQ-2009-320

Subject: Emergency Coolant Pump Discrepancies in SAR-153

Describe the New Information/Discovery:
ECAR-4, "Advanced Test Reactor Emergency Coolant Pump Hardwired Auto Start Technical Bases," was completed in October 2007 to provide a technical basis for the ATR emergency coolant pumps (ECPs) hardwired auto start circuitry. During preparation of ECAR-4, a number of discrepancies and questions were identified. These were documented in Appendix A of ECAR-4. A number of tracking-only ICARE actions were created to drive the resolution of the discrepancies and questions. Belatedly, it was realized that some of the discrepancies might constitute Potential Inadequacies in the Safety Analysis (PISAs) for the ATR. These include the following:

1) Emergency Coolant Pump Single Failure Description

SAR-153 Section 3.1.4.5 discusses the general design criterion (GDC) for residual heat removal and how the ATR meets the criterion. For residual heat removal, the system safety function must be accomplished assuming a single failure. Table 3.1-3 lists the redundant and diverse systems available at the ATR for removing residual heat from the ATR core. Coolant flow through the core is required for the first 30 minute period after reactor shutdown; loss of this flow is called an early complete loss of flow accident (CLOFA). Of the six residual heat removal methods credited in SAR-153, only two – primary coolant pumps or emergency coolant pumps – can be available in the first 30 minutes after reactor shutdown. For some scenarios (loss of commercial power, loss of all AC power, seismic events), the primary coolant pumps are not available, leaving only the emergency coolant pumps for residual heat removal.

The emergency coolant pumps require different power sources to operate: 670-M-10 requires AC power whereas 670-M-11 requires DC power. If, as indicated in EDF-5622, "Interim Seismic Probabilistic Risk Assessment for the Advanced Test Reactor," power cannot be restored to 670-M-10 in a timely fashion following a seismic event, only 670-M-11 is available to provide emergency flow through the core for the first 30 minutes after reactor shutdown. A single failure of 670-M-11, its power supply, or the safety-related hardwired auto start circuits would result in a loss of residual heat removal. This design does not meet the single failure criterion imposed by GDC 34.

The emergency coolant pump hardwired auto start circuitry (for 670-M-11) has been shown to be sufficient to keep the probability of the early CLOFA less than 1.0 E-6/yr (i.e., beyond design basis) even with the single failure vulnerabilities. The issue here is that the discussion of the emergency coolant pumps in SAR-153 does not properly characterize the single failure vulnerability of the system, the probabilistic basis for the system's acceptability, and how the probabilistic evaluation satisfies GDC 34.

2) Emergency Coolant Pump Alternate Lineup Standby Operation

Several places in SAR-153 (Sections 3.1.4.6, 5.4.7.4) and TSR-186 (LCO 3.3.3) indicate that, during reactor operations, either emergency coolant pump can be operating as the in-service pump; the other emergency coolant pump would be in the standby mode of operation. The standby pump is expected to start, when needed, on a signal from the associated hardwired auto start circuitry. Normally, 670-M-10 is the operating pump and 670-M-11 is in standby. The alternate lineup (670-M-11 operating with 670-M-10 in standby) is allowed but is not typically used.

Acceptability of the design of the hardwired auto start circuitry is based on a probabilistic evaluation (TRA-ATR-1229). This evaluation concluded that the design of the circuitry was sufficient to keep the probability of an early CLOFA beyond design basis. This evaluation, however, only modeled the hardwired auto start circuitry for 670-M-11. While the circuitry for 670-M-10 is the same, the differences in power supply for the two pumps prevent directly applying the results for 670-M-11 to 670-M-10. Thus, the ability of the hardwired auto start circuitry for 670-M-10 (i.e. the alternate lineup) to keep the probability of an early CLOFA beyond design basis has not been demonstrated. Use of the alternate lineup, as allowed by the safety basis, may not meet the necessary acceptance criteria.

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3) Emergency Coolant Pump Setpoint Discrepancies

The ATR Plant Protection System (PPS) Emergency Pump Recirculation Flow (EPRF) scram setpoint was originally based on pressurized operating conditions. Recently, the basis for the setpoint was changed to depressurized operating conditions. SAR-153 is unclear regarding the basis for the setpoint as it discusses both bases as if they were currently applicable.

During development of the PPS, it was intended, for depressurized operations, that a reactor scram be initiated by the PPS if emergency pump recirculation flow decreased below the setpoint following failure of the running emergency pump. A 10 second scram delay was incorporated to allow for startup of the standby emergency coolant pump . The standby pump start signal, which is provided by the hardwired auto start circuitry, has a different setpoint than the PPS trip. Thus, the signals will be initiated at different times after a loss of the operating emergency coolant pump. Additionally, the PPS scram signal has a time delay of 10 seconds or less. When these factors are combined, it is not clear that the reactor trip will be initiated within 10 seconds of a loss of the running emergency coolant pump, as was the original design intent. Note that this lack of clarity is partially mitigated by the fact that the 10 second value is not a critical value since the reactor trip is purely anticipatory.

4) Emergency Coolant Pumps as an Engineered Safety Feature

SAR-153 does not include the emergency coolant pumps as part of the Engineered Safety Features (ESFs) at the ATR. According to comments made during the development of SAR-153, the emergency coolant pumps are not considered ESFs because they act to ensure reactor safety limits are not exceeded during Condition 2 events. This is different than ESFs, which act to limit the consequences of Condition 3 and Condition 4 events. The long-term complete loss of flow accident (CLOFA), which is a Condition 4 event, relies on emergency coolant pump 670-M-11 to prevent fuel damage. So does the seismically-induced PCS leakage event, a Condition 3 event. This suggests that 670-M-11, at least, should be considered an ESF. Additionally, the definition of an ESF in Section 1.1.3 of SAR-153 – an ESF is an essential protective system or subsystem that functions to mitigate the consequences of an incident by providing protection other than scram – seems applicable to the emergency coolant pumps.

5) Timing of Flow from Emergency Coolant Pump 670-M-10

An additional concern relates to the timing of flow from 670-M-10. Consider a loss of commercial and diesel power with a failure of emergency coolant pump 670-M-11 to start (if in standby) or to continue to run (if operating at the time of the accident). In this scenario, the only pump that can provide coolant flow to the reactor core in the short term is 670-M-10. Before the pump can provide flow, emergency diesel generator 674-M-6 must start and load. This occurs within a nominal 20 seconds after a bus undervoltage condition occurs. 670-M-10 must then spin-up to operating speed. This is typically considered to occur in 10 seconds, although it may be less. Thus, 670-M-10 would be ready to provide flow at nominally 30 seconds after the loss of power. By this time, however, PCS flow would have decreased to nearly 0% flow. 670-M-10 would have to accelerate the water in the primary system to re-establish flow. This will take some amount of additional time.

To prevent unstable flow in certain fuel elements, and, consequently, fuel damage, as primary flow coasts down, forced flow must be provided at approximately 26 seconds after primary pump trip. Given that 670-M-10, under nominal conditions, will not provide flow until approximately 30+ seconds, it is not clear that 670-M-10 can prevent fuel damage in these scenarios when powered by emergency diesel generator 674-M-6.

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Identify the applicable safety basis document(s) (e. g., DSA, SAR, BIO, TSRs, etc.):

SAR-153, "Upgraded Final Safety Analysis Report for the Advanced Test Reactor"
TSR-186, "Technical Safety Requirements for the Advanced Test Reactor"

I. REASONABILITY DETERMINATION (Reasonability determinations made as part of the ATR Design Basis Reconstitution effort may be documented per SP-10.2.4.9)

Is it reasonable that the potential for an inadequate safety analysis exists based on the new information or discovery described above? ☒ Yes ☐ No

If "Yes," proceed to Sections II, III, and IV.
If "No," provide an explanation and basis for the reasonability determination.

S. D. Winter / J. C. Chapman		
USQ Evaluator Print/Type Name	USQ Evaluator Signature	Date
E. J. Schuebert		
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

If the answer to the question above is "No," file the completed form. Do not complete Section II, III, or IV.

If the answer to the question above is "Yes," complete Section II, III, and IV.

II. PISA DECLARATION

What is the basis for concern that the safety basis may not be bounding or may be otherwise inadequate? Provide an explanation.

1) Emergency Coolant Pump Single Failure Description

This is a documentation issue in that SAR-153 does not adequately describe the existing probabilistic failure evaluation for the emergency coolant pumps hard wired auto start circuitry.

2) Emergency Coolant Pump Alternate Lineup Standby Operation

The emergency coolant pump hardwired auto start circuitry (for 670-M-11) has been shown to be sufficient to keep the probability of the early CLOFA less than 1.0 E-6/yr (i.e., beyond design basis) even with the single failure vulnerabilities. The ability of the hardwired auto start circuitry for 670-M-10 (i.e. the alternate lineup) to keep the probability of an early CLOFA beyond design basis has not been demonstrated. Use of the alternate lineup, as allowed by the safety basis, may not meet the necessary acceptance criteria.

3) Emergency Coolant Pump Setpoint Discrepancies

This is a documentation issue in that the basis for various emergency coolant pump PPS and auto start setpoints are not clearly and consistently described in SAR-153. There is no indication that the existing setpoints are incorrect.

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4) Emergency Coolant Pumps as an Engineered Safety Feature

This is a documentation issue in that the emergency coolant pumps, which are described as part of the primary coolant system, should possibly also be considered to be Engineered Safety Features (ESFs) by virtue of the accident mitigation function they perform. SAR-153 does not describe the emergency coolant pumps as ESFs.

5) Timing of Flow from Emergency Coolant Pump 670-M-10

Emergency coolant flow through the core is required for the first 30 minutes after reactor shutdown. It especially must be provided by 26 seconds following primary pump trip. If the alternate emergency coolant pump lineup is in service, as allowed by the safety basis, 670-M-10 will be in standby, awaiting a start signal. Given that 670-M-10, under nominal conditions, will not provide flow until approximately 30+ seconds after primary pump trip, when 670-M-10 is powered by emergency diesel generator 674-M-6, it is not clear that 670-M-10 can prevent fuel damage in those scenarios when the alternate lineup is in service.

As summarized above, items 2 and 5 identify the potential to allow ATR operations outside of the assumptions of the safety basis analyses and are considered PISAs. Items 1, 3 and 4, however, are documentation issues and are not considered PISAs.

A PISA exists. Complete the following actions

- Nuclear Facility Manager document actions (below) including interim operating restrictions taken to place or maintain the facility in a safe condition.
- Nuclear Facility Manager execute reporting process for PISA per LWP-9301 and LWP-13830.
- Qualified USQ evaluator proceed to Section III.

ACTIONS TAKEN TO PLACE OR MAINTAIN FACILITY IN A SAFE CONDITION AND THE BASIS FOR THE SELECTION OF ANY INTERIM CONTROLS.

At the time of discovery, 670-M-10 was the running emergency coolant pump (ECP) and 670-M-11 was the standby pump. Since this is the pump lineup that is supported by the safety basis, no action is needed to place the plant in a safety condition.

The PISA indicates that ATR operation with M-11 as the running ECP with M-10 as the standby is not supported by the analysis, An interim control shall be established that M-10 is the running ECP during power operations, as defined in TSR-186, and for 30 minutes following power operations. No additional action statements or surveillance requirements are needed.

S. D. Winter / J. C. Chapman	**Signature on original**	**4/23/2009**
Safety Analyst Print/Type Name	Safety Analyst Signature	Date
E. J. Schuebert	**Signature on original**	**4/24/2009**
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

Is independent technical review required? Yes ☐ No ☒

Nuclear Facility Manager Signature or Initials

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Independent Reviewer Print/Type Name	Independent Reviewer Signature	Date

III. USQ DETERMINATION

Identify applicable section(s) of the safety basis document(s) (e.g., DSA, SAR, BIO, TSRs, etc.).

SAR-153:

Section ES-1.5 describes the emergency coolant pumps as one of the safety features and mitigative measures available at the ATR. The pumps provide the necessary forced flow decay heat removal capability that ensures adequate fuel cooling when the primary coolant pumps are not functioning.

Section 1.1.3 describes the safety features of the ATR. The emergency coolant pumps are not included in this section.

Section 3.1.4.5 describes how the ATR satisfies General Design Criterion 34, which requires the plant to have a system to remove residual heat from the reactor core. The system shall function, assuming a single failure, with either on-site electrical power or off-site electrical power. Five decay heat removal (DHR) methods are discussed. One of the two closed-loop methods listed involves using the emergency coolant pumps to circulate primary coolant through the primary coolant system to transfer heat from the reactor core to the normal heat sink. This section also mentions that DHR using the emergency firewater injection system (in an open-loop cooling mode) ensures that the ATR Plant Protection Criteria are met for Chapter 15 accidents.

Section 3.1.4.6 describes how the ATR satisfies General Design Criterion 35, which requires the plant to have a system that provides abundant emergency core cooling. Such a system is intended to remove heat from the reactor core following any credible loss of primary coolant. The system shall function, assuming a single failure, with either on-site electrical power or off-site electrical power. The emergency coolant pumps provide this function after primary coolant pump coastdown and before the emergency firewater injection system is activated. It is noted that one emergency coolant pump operates during reactor operations. A particular pump is not specified. During depressurized operation, both emergency coolant pumps are typically operated although a single pump is adequate for reactor heat removal.

Section Table 3.1-3 lists the means of decay heat removal at the ATR. Item #2 is the emergency coolant pumps.

Section 3.2.2 discusses System Quality Group classification. Table 3.2-1 lists ATR systems that contain Seismic Category I components and structural elements. The emergency flow system, which includes the emergency coolant pumps, is listed as part of the primary coolant system, not as an engineered safety feature.

Section 3.11.2 lists those safety-related systems or equipment required after reactor shutdown for design-basis events. The emergency coolant pumps are on this list.

Section 5.1.4 describes the primary coolant system. The emergency coolant pumps are included in this description. It is noted that 670-M-10 is normally operating during reactor operation in the pressurized mode; 670-M-11 is normally in standby. It is also noted that one emergency coolant pump is operated continuously during reactor operation to ensure the required flow after primary pump coastdown without reliance on emergency coolant pump start-up.

Section 5.4.7.4 discusses the emergency coolant pumps in the context of decay heat removal. The signals that will start each pump (when in standby) are discussed. If the standby pump does not start in 10 seconds, the reactor is scrammed. It is noted that operation of the emergency coolant pumps protect the fuel element cladding from adverse effects resulting from low PCS flow (in addition to the safety limits on core thermal performance parameters).

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Section 7.2.1.1.2.4 describes the emergency coolant flow discharge trip of the reactor shutdown system. This trip is functional during reactor depressurized operation.

Section 7.2.1.1.2.5 describes the emergency coolant pump recirculation flow trip of the reactor shutdown system. It is stated that, during pressurized operations, one emergency coolant pump is operating (which pump is not specified) and the other pump will start and reach full speed within ten seconds of failure of the operating pump. If the recirculation flow delivered by the standby pump does not exceed the low flow limit within 10 seconds of loss of the running pump, a reactor trip signal is generated. Loss of all primary coolant pumps will also start both emergency coolant pumps. The 10 second delay does not affect this trip when the reactor is in the depressurized mode of operation.

Section 7.2.1.1.5 discusses operation of the low emergency pump recirculation flow trip.

Section 7.4 indicates that emergency coolant flow is required to be available during reactor operation greater than 3 MW and for the first 30 minutes after reactor shutdown. One of the two emergency coolant pumps is operating continually during normal reactor operation. The other pump will automatically start on low emergency coolant recirculating flow.

Section 7.6.7 discusses the emergency coolant pump hardwired auto start circuitry. It is stated that the hardwired auto start control circuitry is designed to fail to a safe condition.

Section 8.1.6 states that the analysis of the low flow events in the updated accident analysis requires the operation of one emergency coolant pump for at least 30 minutes following power operation if operation of the primary pumps is lost.

Section 8.3.1.4 indicates that a PRA-based evaluation demonstrated that loss of both emergency coolant pumps within 30 minutes after a loss of flow event is beyond design basis. Changes to the systems analyzed in the PRA-based evaluation will require a risk evaluation to ensure that the reliability assumed for these systems is maintained.

Table 15.0-7 lists the plant systems and equipment available for transient and accident conditions. The emergency coolant pumps are not on this list. The low emergency discharge flow reactor shutdown trip is listed for a momentary loss of flow accident in depressurized operations.

Table 15.0-9 lists the limiting single failures assumed in the UFSAR reanalysis of accidents. For a loss of commercial power, the limiting single failure is that of the standby emergency coolant pump. For a complete loss of flow, the limiting single failure is loss of the diesel generator powered emergency coolant pump (670-M-10) followed by failure of 670-M-11 after 30 minutes as a result of battery depletion.

Section 15.3.1 describes the limiting Condition 2 accident that results in a decrease in reactor primary coolant flow rate at the ATR. This event, a loss of commercial power, assumes that a complete loss of emergency flow within 30 minutes from reactor shutdown is beyond design basis. This assumption is based on the presence of the two emergency coolant pumps, their safety-related power supplies, and the standby startup capability provided by the hardwired auto start circuitry.

Section 15.3.4 describes the limiting Condition 4 accident that results in a decrease in reactor primary coolant flow rate at the ATR. This event, a long-term complete loss of flow, assumes that a complete loss of emergency flow within 30 minutes from reactor shutdown is beyond design basis. The basis for the assumption is the same as that described in Section 15.3.1.

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Section 15.6.6 describes the seismically-induced PCS leakage accident. Because the seismic event causes a loss of commercial and diesel AC power, the evaluation assumes that emergency coolant pump 670-M-11 starts automatically and provides flow for the first 30 minutes of the event.

Section 15.6.7 describes the very small seismic LOCA accident. From the standpoint of the emergency coolant pumps, the event is the same as the seismically-induced PCS leakage accident described in Section 15.6.6.

Section 15.9.1.1 describes the evaluation of a momentary loss of flow due to an emergency coolant pump failure or inadvertently turned off during depressurized operation. It is assumed that the operators are able to restore flow from at least one emergency coolant pump within several hours and before core cooling is lost. Both emergency coolant pumps are assumed to be operating at the start of the event. It is noted that the analyses for this event assumed a reactor power of 2.5 MW and that, currently, depressurized operations are allowed up to 500 kW. The bases for the low emergency flow and low emergency pump recirculation flow reactor scram setpoints are also discussed.

Section 15.11.9.2 describes the evaluation of a momentary total commercial power failure (for less than one hour). This event assumes that primary system flow coasts down to emergency coolant pump flow. The identity of the assumed operating emergency coolant pump is not specified.

Section 15.11.9.3 describes the evaluation of an extended commercial power failure (more than one hour) event. It is noted that "the diesel generator" continues to supply power for the emergency coolant pumps.

Section 15.11.9.4 describes the evaluation of a loss of power from the 250V DC utility bus. It is noted that a failure of this bus, which could fail switchgear controls normally powered from this bus, would prevent standby pumps from starting, with the exception of emergency coolant pump 670-M-10.

Section 15.11.9.5 describes the evaluation of a momentary diesel power failure (until the standby diesel generator is started). It is noted that the DC-powered emergency coolant pump will start if in standby mode and will keep running if in-service at the time of the event.

Section 15.11.9.12 describes the evaluation of momentary (15 minutes to 1 hour) complete losses of power combinations (loss of commercial and diesel power). The evaluation takes credit for operation of the DC-powered emergency coolant pump to provide forced flow through the reactor core.

Section 15.11.9.13 describes the evaluation of extended (longer than 1 hour) complete losses of power combinations (loss of commercial and diesel power). The evaluation notes that a complete loss of commercial and diesel power will result in an extended complete loss of PCS flow after the battery-backed power supply for the DC powered emergency coolant pump is depleted. During depressurized operations, the event will result in an extended complete loss of emergency coolant flow.

Section 16.1.2 describes the derivation of certain safety limits for the ATR. It is noted that, for depressurized operation, the low flow safety limit that ensures at least 3 sigma to flow instability is 302 gpm.

Section 16.2.1 describes the derivation of limiting control settings for the ATR reactor shutdown system. Included in this description is that for the low emergency flow scram and the low emergency pump recirculation flow scram.

Section 16.2.2.4 describes the derivation of the limiting conditions for operation (LCOs) for the primary coolant system. Included in this description is a discussion of emergency coolant pump operation following a loss of the primary coolant pumps and a list of associated LCOs.

Section 16.2.2.8 describes the derivation of the limiting conditions for operation for the electrical systems at the

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ATR. Included in this description is a discussion of the battery-backed power supply for the DC powered emergency coolant pump. It is stated that DC pump is either operating when a loss of commercial and diesel power occurs or it starts when the ac-powered emergency coolant pump stops after the loss of power.

Table 16.6-1 lists UFSAR limits for automatic safety function actuation. The reactor shutdown system setpoints for low emergency flow and low emergency pump recirculation flow are listed here.

Table 16.6-2 lists UFSAR limits for plant protection system settings. The setpoints for low emergency flow and low emergency pump recirculation flow are listed here.

TSR-186

Section 1.1 contains the definition of an Engineered Safety Feature – an essential protective system or subsystem that functions to mitigate the consequences of an incident by providing protection other than scram.

Safety Limit 2.1.4 indicates that reactor coolant flow shall not be less than 302 gpm during depressurized operation.

LCS 3.1.1 Table 3.1.1-1 SR (06), SR (15); LCS 3.1.1 Bases – these sections present the reactor shutdown system setpoints, and their bases, for the low emergency flow and low emergency pump recirculation flow scram subsystems.

LCO 3.3.3, LCO 3.3.3 Bases – these sections provide the operability requirements, and their bases, for the emergency coolant pumps during power operations and for 30 minutes following power operations. Included in the operability requirements is the setpoint for the hardwired auto start circuitry for the emergency coolant pumps.

IIIa: POTENTIAL FOR AN INCREASE IN PROBABILITY OR CONSEQUENCE OF AN ACCIDENT OR MALFUNCTION EVALUATED IN THE SAFETY BASIS

1. Could the PISA increase probability of occurrence of an accident previously evaluated in the safety basis?
Yes ☐ No ☒
Explain:

The issues presented in this PISA are considered in the context of a "backward-looking" USQ determination for all seven questions. Assume that the only allowed lineup of the emergency coolant pumps is the normal lineup – 670-M-10 in service and 670-M-11 in standby. The first proposed 'change' would be allowing the use of the alternate lineup (670-M-11 in service and 670-M-10 in standby), which corresponds to item (2) in the PISA. The second proposed 'change' would be the recognition that the combination of emergency diesel generator 674-M-6 and emergency coolant pump 670-M-10 to potentially initiate flow after the first 26 seconds after reactor scram, which is considered too late to prevent possible fuel damage. This corresponds to item (5) in the PISA. When discussed separately, the designators (2) and (5), respectively, will be used in this USQD for the items.

The ATR accident analyses consider a complete failure of primary system flow within the first 30 minutes after a reactor scram (early CLOFA) to be beyond the design basis for the reactor. This conclusion is based on a probabilistic frequency analysis of all accidents that could lead to an early CLOFA. The analysis considers the normal emergency coolant pump lineup, the battery-backed power supply for 670-M-11, the normal and emergency diesel generator power supplies for 670-M-10, the hardwired auto start circuitry for the emergency coolant pumps, and other features and systems of the ATR. Because the early CLOFA is considered to be beyond design basis, it is not evaluated within SAR-153. For those accidents where emergency flow is important, the analyses in SAR-153 assume that 670-M-10 is operating at prior to the accident and either continues to operate during the accident or

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that 670-M-11 starts from the standby condition to provide primary coolant system flow, as necessary.

(2) Emergency Coolant Pump Alternate Lineup Standby Operation

Use of the alternate emergency-coolant pump lineup does not affect any identified accident initiator. It could potentially affect the progression of previously evaluated accidents if the reliability of the alternate lineup were different than that of the normal emergency coolant pump lineup. Any adverse effect would be to turn a previously evaluated accident into an early CLOFA, which has not been evaluated. For this reason, this issue does not increase the probability of occurrence of an accident previously evaluated in the safety basis.

(5) Timing of Flow from Emergency Coolant Pump 670-M-10

Operation of the standby emergency coolant pump, regardless of it's power source, occurs only after the initiation of an accident. Similarly, the scenario involving operation of emergency coolant pump 670-M-10 following startup of emergency diesel generator 674-M-6 occurs only after the initiation of an accident. For these reasons, this issue cannot increase the probability of occurrence of a previously evaluated accident.

2. Could the PISA increase the consequences of an accident previously evaluated in the safety basis?
Yes ☒ No ☐
Explain:

2) Emergency Coolant Pump Alternate Lineup Standby Operation

This issue involves the fact that the alternate emergency coolant pump lineup has not been shown to keep the frequency of an early CLOFA beyond the design basis for the ATR. The use of the alternate lineup, by itself, does not increase the consequences of an accident previously evaluated in the safety basis.

5) Timing of Flow from Emergency Coolant Pump 670-M-10

This issue involves the concern that flow from the 674-M-6/670-M-10 diesel/pump combination could potentially arrive at the reactor core too late to prevent fuel damage in an accident scenario that requires the alternate lineup. While this diesel/pump combination is not explicitly credited in SAR-153, it is important to the more frequent, less severe seismic events that are evaluated probabilistically at the ATR (Reference TRA-ATR-1615 pg 10). The possible delay in flow from 674-M-6/670-M-10 could result in fuel clad damage that could increase the consequences of these seismic events.

3. Could the PISA increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the safety basis? Yes ☒ No ☐
Explain:

2) Emergency Coolant Pump Alternate Lineup Standby Operation

Use of the alternate emergency coolant pump lineup merely changes which emergency coolant pump is normally operating and which is normally in standby. This change could result in emergency coolant pump 670-M-11 operating more frequently or for longer durations than currently occurs. Additional operating time could potentially degrade 670-M-11 and increase the probability of occurrence of a malfunction of this emergency coolant pump. While the accident analyses in the safety basis do not explicitly assume that 670-M-11 fails, failure of the pump is a component of the probabilistic analysis that demonstrate that an early CLOFA is beyond the design basis of the ATR. Thus, the failure of the pump has been previously evaluated in the safety basis.

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5) Timing of Flow from Emergency Coolant Pump 670-M-10

The 670-M-10 flow timing issue could increase the probability that the fuel cladding on one or more fuel elements could fail or be damaged in one or more of the more frequent, less severe seismic accidents evaluated in the PRA. Fuel element cladding damage or failure is a malfunction of the primary barrier to the release of radioactivity from the fuel that has been previously evaluated the safety basis. The 670-M-10 flow timing issue could increase the probability of a malfunction of this equipment that is important to safety

4. Could the PISA increase the consequences of a malfunction of equipment important to safety previously evaluated in the safety basis? Yes ☒ No ☐
Explain:

2) Emergency Coolant Pump Alternate Lineup Standby Operation

This issue involves the fact that the alternate emergency coolant pump lineup has not been shown to keep the frequency of an early CLOFA beyond the design basis for the ATR. The use of the alternate lineup, by itself, does not increase the consequences of a malfunction of equipment important to safety previously evaluated in the safety basis.

5) Timing of Flow from Emergency Coolant Pump 670-M-10

For this issue, there is no specific equipment malfunction. Instead, even if everything functions properly, the flow from 670-M-10 could occur too late to prevent fuel clad damage in the more frequent, less severe seismic accidents evaluated in the PRA. Such fuel clad damage could result in the release of radioactive material from the fuel and possible consequences. These consequences represent an increase in those currently predicted (i.e., none).

IIIb: POTENTIAL FOR CREATION OF AN UNANALYZED ACCIDENT OR MALFUNCTION OF A DIFFERENT TYPE

5. Could the PISA create the possibility of an accident of a different type than previously evaluated in the safety basis? Yes ☒ No ☐
Explain:

2) Emergency Coolant Pump Alternate Lineup Standby Operation

The early CLOFA is not evaluated in the safety basis because it has been determined to be beyond the design basis for the ATR. The alternate emergency coolant pump lineup, however, was not explicitly considered in this determination. Use of the alternate lineup could potentially make the probability of occurrence of the early CLOFA greater than 1.0×10^{-6}/yr, or not beyond design basis, which would require an evaluation of the accident. Because the early CLOFA is not currently evaluated, this situation would create the possibility of an accident of a different type than previously evaluated in the safety basis.

5) Timing of Flow from Emergency Coolant Pump 670-M-10

The 670-M-10 timing issue represents a scenario in which emergency coolant pump flow is potentially too late to prevent fuel clad damage following a loss of primary coolant system flow. Fuel clad damage due to a loss of flow, especially in the short time frame postulated in this issue, is essentially an early CLOFA. As indicated above, this is an accident of a different type than previously evaluated in the safety basis.

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6. Could the PISA create the possibility of a malfunction of equipment important to safety of a different type than previously evaluated in the safety basis? Yes ☐ No ☒

Explain:

2) Emergency Coolant Pump Alternate Lineup Standby Operation

Use of the alternate emergency coolant pump lineup does not expose the pumps or associated equipment to any operating condition or environment different than currently evaluated or envisioned. Thus, this issue does not create the possibility of a malfunction of equipment important to safety of a different type than previously evaluated in the safety basis.

5) Timing of Flow from Emergency Coolant Pump 670-M-10

This issue is one of flow timing; it does not involve equipment malfunction. The only malfunction of equipment important to safety that could potentially be affected by this issue is fuel clad damage, which has been previously evaluated in the safety basis. Thus, this issue does not create the possibility of a malfunction of equipment important to safety of a different type than previously evaluated in the safety basis.

IIIc: POTENTIAL FOR REDUCTION IN A MARGIN OF SAFETY

7. Could the PISA reduce a margin of safety as defined in the safety basis? Yes ☒ No ☐

Explain:

2) Emergency Coolant Pump Alternate Lineup Standby Operation

This issue involves use of the alternate emergency coolant pump lineup and the fact that it has not been shown to keep the probability of occurrence of an early CLOFA beyond the design basis of the ATR. The issue does not involve setpoints, physical parameters, or conditions. The margins of safety as defined in the safety basis are not reduced.

5) Timing of Flow from Emergency Coolant Pump 670-M-10

The Bases for TSR-186 LCO 3.3.3 describe how the operation of the emergency coolant pumps, along with the setpoints for the hardwired auto start circuitry, help ensure that the margins to flow instability and critical heat flux are greater than three standard deviations for loss of heat sink and loss of coolant events. The flow timing issue for emergency coolant pump 670-M-10 could potentially lead to fuel clad damage if the flow from 670-M-10 does not arrive at the core within 26 seconds after loss of PCPs. This scenario, which implicitly results in less than three standard deviations from flow instability or critical heat flux, could be applicable to the more frequent but less severe seismic events evaluated in the PRA. Thus, this issue could potentially reduce a margin of safety as defined in the safety basis.

IIId: USQ DETERMINATION CONCLUSION

8. Based on the responses to questions 1 – 7 above, does the PISA constitute an Unreviewed Safety Question?
Yes ☒ No ☐

Explain:

2) Emergency Coolant Pump Alternate Lineup Standby Operation

Use of the alternate emergency coolant pump lineup is an Unreviewed Safety Question. The lineup has not been

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shown to keep the probability of an early CLOFA beyond design basis for the ATR. If the early CLOFA is not beyond design basis, it needs to be evaluated and the possible consequences need to be determined.

5) Timing of Flow from Emergency Coolant Pump 670-M-10

The timing of flow from 670-M-10 has the potential to result in fuel clad damage if flow is late in reaching the reactor core. Because of the possibility of fuel clad damage, and the potential for subsequent consequences, this issue constitutes an Unreviewed Safety Question.

If "No," is a Safety Basis document revision required at next annual update? ☐ Yes ☐ No

NOTE: If USQ determination result is positive, additional notification for ORPS is required per LWP-9301.

IV. APPROVAL/CONCURRENCE SIGNATURES

APPROVAL:

S. D. Winter / J. C. Chapman USQ Evaluator Print/Type Name	Steven D Winter / J C Chapman USQ Evaluator Signature	13 May 2009 Date
E. J. Schuebert Nuclear Facility Manager Print/Type Name	E J Schuebert Nuclear Facility Manager Signature	5/14/09 1040 Date

CONCURRENCE:

A P Hoskins (alternate) J. A. Jacobi Independent Review Committee Chair Print/Type Name	Alan P Hoskins Independent Review Committee Chair Signature	5-14-09 Date