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-2010-667

Subject: Emergency Coolant Pump Auto-start Assumption for LOCA with Failed LOCA ESF Analysis

Describe the New Information/Discovery:

The accident analysis of the 3-in. loss-of-coolant-accident (LOCA) with the concurrent failure of the LOCA primary coolant pump (PCP) shut-off Engineered Safety Feature (ESF) assumed that the standby emergency coolant pump (ECP) started at 70 s after reactor scram (§15.6.5.2). That assumption is apparently inconsistent with actual ECP automatic start logic.
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, Revision 28
TSR-186, Technical Safety Requirements for the Advanced Test Reactor, Revision 24

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.

Engineering Design File (EDF) TRA-ATR-1487 is the supporting analysis for Section 15.6.5.2 accident analysis summary. TRA-ATR-1487 lists modification to the base analysis computer model. The analysis software application used was RELAP5/MOD2.5 thermal-hydraulic analysis software. The modification to the ATR base analysis model were: (a) the surge tank was initialized with 60 cubic feet (cf) of air (the maximum air volume now [SAR-153 Revision 28] permitted), (b) all but one PCP was assumed to trip at 70 s after reactor scram, (c) the standby ECP was started 70 s after reactor scram. The additional head and flow produced by the standby ECP causes additional drawdown of the surge tank. EDF TRA-ATR-951 documents the base RELAP5 ATR model used in LOCA analyses. TRA-ATR-951 states that the initially operating ECP is tripped when the PCPs were tripped, however, the input file for the calculations indicates that the running ECP was not tripped, and the standby ECP would start on low (90 gpm) recirculation flow. Based on EDFs TRA-ATR-1487 and TRA-ATR-951, the initially operating ECP was tripped at 70 s after reactor scram, and at the same time the standby pump was started. The ATR RELAP5 plant model includes both ECPs each with its recirculation line and check valves.

The ECP automatic starts are SAR-153, Section5.4.7.4):

1. If the operation ECP is M-10, the standby ECP (M-11) will start upon
   a. mechanical or electrical failure of M-10 or low M-10 recirculation flow
   b. loss or under-voltage of diesel power
   c. loss of commercial power (indirectly by the loss of all PCPs).

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2. If the operating ECP is M-11, the standby ECP (M-10) will start upon
   a. low M-11 recirculation flow
   b. all PCP off
   c. under-voltage on diesel bus
   d. loss of power to ECP M-11

The accident scenario is that the LOCA PCP shutoff ESF fails and one PCP remains running. With one PCP running, the standby ECP would not receive a start signal unless the running ECP recirculation flow decreases to the low recirculation setpoint. The analysis assumes that the running ECP remains running, but the analysis also starts the standby ECP at 70 s with a 10second ramp-up to full speed. The actual plant condition could either be that the running ECP continues to run or it fails to run, which would generate a start signal to the standby ECP. In either case, even though the RELAP5 model start logic misrepresent the actual ECP automatic start logic, the RELAP5 model bounds the expected plant conditions. Two running ECPs produce additional flow and pressure

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which result in additional drawdown in the surge tank, which is conservative for this analysis.

Reference:
Analysis of ATR Small Break LOCA with Engineered Safety Feature to Automatically Trip Primary Coolant Pumps, EDF TRA-ATR-1487

RELAP5 Analysis of the Upper Head 5.3 inch LOCA with Three-Pump Operation for the Advanced Test Reactor Upgraded Final Safety Analysis Report, EDF TRA-ATR-951

J. C. Chapman USQ Evaluator Print/Type Name	JC Chapman USQ Evaluator Signature	26 Aug 2010 Date
E. J. Schuebert Nuclear Facility Manager Print/Type Name	EJ Schuebert Nuclear Facility Manager Signature	8/26/10 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.

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.

Safety Analyst Print/Type Name	Safety Analyst Signature	Date
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

Is independent technical review required? Yes ☐ No ☐