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 (ATR)

USQ Process No.: ATR Complex-USQ-2008-805

Subject: Experience-Based Seismic Qualification of ATR Seismic Category 1 Equipment (ARES Corporation Report No. 060230101-002 Rev. 0 Sep. 2008)

Describe the New Information/Discovery:

Part of the scope of the recently completed ATR seismic assessment[(a)] was an experience-based seismic qualification of ATR Seismic Category 1 Equipment (ARES Corporation Report No. 060230101-002 Rev. 0 Sep. 2008). Seismic Category I systems, structures, and components (SSCs) are safety-related SSCs that are relied upon in the ATR safety basis to mitigate the effects of the safe shutdown earthquake (SSE). The acceptance criteria for the experience-based qualification were the Department of Energy's Natural Phenomena Hazards Design and Evaluation Criteria (DOE-STD-1020) for Performance Category (PC) 4 SSCs. The ARES report identified several Seismic Category I SSCs that were judged to have insufficient capacity to satisfying the PC-4 seismic criteria.

Reference:
(a) S. R. Jensen letter to P. Henslee, [ATR] Life Extension Manager, "Seismic Assessment Project Qualification Status Summary," SRJ-02-08, September 30, 2008

Identify the applicable safety basis document(s) (e. g., DSA, SAR, BIO, TSRs, etc.):
SAR-153 Chapters 3A.

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.

USQ Evaluator Print/Type Name	USQ Evaluator Signature	Date
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.

The results of ATR Seismic Category I experience-based seismic qualification were screened by ATR Programs personnel, which included the ATR Operations Manager, ATR Programs Engineering managers, the Independent Management Review Committee Chair, and ATR Programs Engineering subject matter experts.[(b,c)] The team categorized the equipment that were judged to have insufficient capacity to satisfy PC-4 seismic design and evaluation criteria into those that do not meet the current ATR safety basis, and those that meet the current safety basis but will need additional engineering efforts related to upgrading

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to a more stringent PC-4 criteria. Equipment that were screened into the first group are potential discrepant SSCs that constitute a potential inadequacies in the safety analysis (PISA). Equipment that were screened into the remaining group do not constitute a PISA. Seven SSCs were identified as potential discrepancies: a) utility uninterruptible power supply (UPS) battery room block wall, b) primary coolant pump motor floor area wall, c) plant protection system (PPS) cabinet anchorage, d) emergency firewater supply diesel pumps battery racks, e) dc emergency coolant pump (ECP) starting relay, f) deepwell #3 lube oil pump mounting, and g) six-tier cable tray mounting.

References:

(b) Technical Evaluation Study, ATR Engineering Review Process of the ARES Experience-Based Seismic Qualification Report, TEV-350, October 2008

(c) Technical Evaluation Study, Engineering Technical Authority Review of Response of ATR Programs Engineering to Experience-Based Seismic Qualification Report, TEV-345, October 2008

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.

ATR was in critical operation at the time of the discovery. ATR critical operation was shut down; irradiated fuel was removed from the core. The Reactor Operating Condition is "Reactor Defueled."

TSR-186 equipment operability requirements must be satisfied to change Reactor Operating Conditions; no additional controls are required.

J. C. Chapman		
Safety Analyst Print/Type Name	Safety Analyst Signature	Date
M. B. McDonough		
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

Is independent technical review required? Yes ☐ No ☐

Nuclear Facility Manager Signature or Initials

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, Chapter 2 Appendix A - Geology and Seismology of the INL and Region
SAR-153, Chapter 3 - Design of Structures, Components, Equipment, and Systems
SAR-153, Chapter 3 Appendix A - Master List of Safety Related Equipment
SAR-153, Chapter 6 - Engineered Safety Features
SAR-153, Chapter 7 - Instrumentation and Controls
SAR-153, Chapter 8 - Electric Power

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SAR-153, Chapter 9 - Auxiliary Systems, Section 9.5.1 Fire Protection Systems
SAR-153, Chapter 15.6 - Accident Analysis Decrease in Primary Coolant Inventory
SAR-153, Chapter 15.8 - Fuel Storage Canal and Cask Handling Events
TSR-186, Section 3.4.1 - Utility Battery Backed Power Systems
TSR-186, Section 3.3.3 - Emergency Coolant Pumps
TSR-186, Section 3.2.1.1 – Emergency Firewater Injection Actuation System
TSR-186, Section 3.2.1.2 - Emergency Firewater Injection Supply System
TSR-186, Section 3.5.5 - Cask Handling and Irradiated Fuel Element Storage

A seismic assessment of seismic category 1 systems, structures and components (SSC) was performed as a part of the Life Extension Project. An interoffice memorandum, SEISMIC ASSESSMENT PROJECT QUALIFICATION STATUS SUMMARY, SRJ-02-08, identified a concern with the west and south walls of the ATR first basement uninterruptible power supply (UPS) battery room as having inadequate anchorage to the ceiling and therefore seismic vulnerability to affect the operability of the M-11 emergency coolant pump SSC. The Nuclear Facility Manager imposed immediate actions to place the facility in a safe condition consistent with the Actions in TSR-186 LCO 3.2.1.1, 3.2.1.2, and 3.3.3 and ATR was shutdown and defueled.

ATR Engineering assembled a team to evaluate all of the issues in SRJ-02-08, in an extent of conditions review, as noted in Section II, seven SSCs were identified as potentially not conforming to safety analysis assumptions and are the subject of this unreviewed safety question determination. In addition, the team determined what additional actions needed to be taken to restore the SSCs' operability prior to resumption of ATR operations. As a result of this review the following corrective actions have been taken to address those seismic issues involving nonconformance with the existing ATR safety basis and therefore need to be addressed prior to startup:

- The west and south block walls for the battery room in the first basement of ATR did not have adequate anchorage to the ceiling. Engineering modifications documented in EJ 7.0-1 provided for design and installation of additional metal braces attached to the ceiling with concrete anchors and attached to the top of the wall with through-wall threaded anchors. Completion of this engineering modification resolves this seismic vulnerability.
- The PPS Logic and Comparator cabinet anchorage was not sufficient to handle seismic loads. Engineering modifications associated with EJ 7.0-1 provides for design and installation of seismically qualified anchors to the base of the cabinets to ensure secure seismically qualified bases. Completion of this engineering modification resolves this seismic vulnerability.
- The block wall containing the power cables for the M-11 emergency pump did not have adequate capacity in the brackets at the south end of the wall at the interface between the canal structure and Door D-323. Engineering modifications associated with EJ 7.0-1 provide for additional brackets with concrete anchors attached to the canal structure and attached to the motor floor area wall with through-wall bolts and backing plates. Analysis shows that the anchor embedment in the storage canal structure will have no effect on the canal strength. Completion of this engineering modification resolves this seismic vulnerability.
- The ATR second basement 6-tier cable tray requires a seismically qualified anchorage. Work Order WO 122819 and Drawing 600849 provide for installation of additional anchorage for this cable tray. Completion of this work order resolves this seismic vulnerability.
- Additional mechanical restraint was needed to keep the starting batteries for the TRA-688 diesel firewater pumps from tipping and rolling during a seismic event, which may allow contact between adjacent batteries within a rack. Engineering modifications documented in EJ 7.0-1 and engineering calculations documented in Engineering Calculations and Analysis Report ECAR-415, "Analysis of TRA-688 Battery Holddown Straps", provide for installation of additional holddown straps to prevent seismic interaction. Completion of the installation of these straps resolves this seismic vulnerability.
- A concern was identified with the anchors for the Deep Well #3 oil coolers that the shells of the expansion anchors were not fully embedded in the concrete, rather a portion is protruding into the unistrut. This embedment may compromise the tensile capacity of these anchors. This concern was evaluated by ATR engineering and documented in Technical Evaluation TEV-343. These anchors, as installed, provide adequate embedment to achieve the required 124 pounds of pullout force. The oil cooler plate was subjected to a pull test on 22 October

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2008, with an estimated 250 pounds of force applied in the vertical direction, with no movement of the plate and cooler assembly. Thus, this condition has been evaluated and does not require modification or replacement of the existing anchors. The existing anchors are adequate.

- A concern was identified with respect to the monitoring relay CR2 that must function properly to start the M-11 emergency coolant pump on demand. This concern was that a seismic event may cause the CR2 relay to chatter, and that chatter may inhibit relay TDA1 pickup, and delay the emergency pump startup. ATR Engineering evaluated this concern as documented in TEV-346. This evaluation concludes that any seismically induced contact chatter on CR2 will not impede relay TDA1 from energizing and starting the emergency coolant pump. This TEV-346 has resolved the concern for delayed start of the M-11 emergency coolant pump during a seismic event.

Each of the modifications identified above were reviewed using the proposed change USQ process and were determined to not constitute an Unreviewed Safety Question. The applicable USQ documentation is ATR Complex-USQ-2008-786, -794, -798, -803, and -804.

The INL Engineering Technical Authority assembled an independent team of senior engineering leadership and performed a review of the process used by ATR engineering to perform the extent of conditions review of the ARES report. The independent Engineering Technical Authority team agreed with both the approach and the results of the ATR Engineering review.

Completion of these actions and modifications resolve non-conformance issues with the existing ATR safety basis.

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:
   Resolution of the seismic non-conformances with the identified equipment, and completion of the technical evaluations has placed the ATR facility within the assumptions of the safety basis. Because these resolutions restore the operability of the identified equipment as assumed in the safety basis, there is no increase in the probability of occurrence of an accident previously evaluated in the safety basis.
2. Could the PISA increase the consequences of an accident previously evaluated in the safety basis?
   Yes ☐ No ☒
   Explain:
   Resolution of the seismic non-conformances with the identified equipment, and completion of the technical evaluations has placed the ATR facility within the assumptions of the safety basis. Because these resolutions restore the operability of the identified equipment as assumed in the safety basis, there is no increase in the consequences of an accident previously evaluated in the safety basis.
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:
   Resolution of the seismic non-conformances with the identified equipment, and completion of the technical evaluations has placed the ATR facility within the assumptions of the safety basis. Because these resolutions restore the operability of the identified equipment as assumed in the safety basis, there is no increase in the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the safety basis.

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

   Explain:
   The affected safety SSCs are identified in Section II. Resolution of the seismic non-conformances with the identified equipment, and completion of the technical evaluations has placed the ATR facility within the assumptions of the safety basis. Because these resolutions restore the operability of the identified equipment as assumed in the safety basis, there is no increase in the consequences of a malfunction of equipment important to safety previously evaluated in the safety basis.

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:
   All of the modifications to resolve the seismic issues were reviewed using the proposed change USQ process. Resolution of the seismic non-conformances with the identified equipment, and completion of the technical evaluations has placed the ATR facility within the assumptions of the safety basis. Because these resolutions restore the operability of the identified equipment as assumed in the safety basis, this does not create the possibility of an accident of a different type than previously evaluated in the safety basis.

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:
   All of the modifications to resolve the seismic issues were reviewed using the proposed change USQ process. Resolution of the seismic non-conformances with the identified equipment, and completion of the technical evaluations has placed the ATR facility within the assumptions of the safety basis. Because these resolutions restore the operability of the identified equipment as assumed in the safety basis, this 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:
   Resolution of the seismic nonconformances restores the ATR facility to the margin of safety 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:
   With resolution of the seismic issues identified, the facility will again be within the assumptions of the safety basis. Thus, continued operation of the ATR does not constitute an Unreviewed Safety Question.

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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:

Alan P. Hoskins USQ Evaluator Print/Type Name	Alan P. Hoskins USQ Evaluator Signature	11-4-08 Date
Martin B. McDonough Nuclear Facility Manager Print/Type Name	Martin B. McDonough Nuclear Facility Manager Signature	11/4/08 Date

CONCURRENCE:

Jack A. Jacobi Independent Review Committee Chair Print/Type Name	Jack A. Jacobi Independent Review Committee Chair Signature	11/4/08 Date