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.: RTC-USQ-2007-729

Subject: Operability Requirements for ATR Confinement Isolation Dampers (GAP-014-07)

Describe the New Information/Discovery:

The Advanced Test Reactor (ATR) Technical Safety Requirements (TSR) for operability of the primary and backup dampers only require the primary or the backup confinement isolation damper to be in-service. This is not consistent with the original design requirements for the backup isolation dampers or the SAR-153 general design criteria (GDC).

The backup confinement isolation dampers were upgraded to provide the same function as the primary dampers as a result of corrective actions from lessons learned from the Three Mile Island reactor accident, findings from the September 1988 Department of Energy (DOE) Office of Environmental, Safety and Health (ESH) Technical Safety Appraisal, and the August 1995 DOE ESH Intense Inspection. The purpose of the modification was to improve redundancy eliminating single failure vulnerabilities (PG-T-89-007). After installation the backup dampers were not qualified until additional testing of the confinement identified deficiencies in the confinement leak rate test procedure (TRA-USQ-SE-1998-026). After correction of these deficiencies it was verified that the backup dampers provide a function equivalent to the primary dampers; however, the TSR only requires a primary or a backup damper (not both) to be in-service.

SAR-153 General Design Criterion 21, Protection System Reliability and Testability, requires the protection system be designed for high functional reliability and in-service testability commensurate with the safety functions to be performed. Redundancy and independence designed into the protection system shall be sufficient to assure that (1) no single failure results in loss of the protection function, and (2) removal from service of any components or channel does not result in loss of the required minimum redundancy unless the acceptable reliability of operation of the protection system can be otherwise demonstrated.

SAR-153 General Design Criterion 22, Emergency Core Cooling, and Criterion 41, Confinement Atmosphere Cleanup, require suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and confinement capabilities be provided to assure that for on-site electric power system operation (assuming off-site power is not available), and for off-site electric power system operation (assuming on-site power is not available), the system safety function can be accomplished, assuming a single failure.

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

Tomberlin, T.A., Advanced Test Reactor (ATR) Responses to NUREG-0737 (Clarification of TMI Action Plan Requirements), PG-T-89-007, March 1989

Confinement Fission Product Release Rate, TRA-USQ-SE-1998-026, May 7, 1998

SAR-153, Advanced Test Reactor Upgraded Final Safety Analysis Report, Revision 26, June 5, 2007

TSR-186, Advanced Test Reactor Technical Safety Requirements, Revision 11, June 5, 2007

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

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.: RTC-USQ-2007-729

Subject: Operability Requirements for ATR Confinement Isolation Dampers (GAP-014-07)

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 radiation monitoring and seal system that actuates the confinement isolation is an Engineered Safety Features (i.e., part of the plant protective system) and subject to GDC 21. The confinement structure is safety-related. The isolated confinement leak rate is used in the radiological consequence analysis in SAR-153 Section 15.12.10, Radiological Analysis, to establish the evacuating worker, co-located worker, exclusion area boundary, and low-population zone exposures for the ATR. The Section 15.12.10 analysis is used to envelop all ATR fuel damage events in SAR-153 Chapter 15, Accident Analyses. The isolated confinement leak rate is also used in the analysis of radiological consequences of a pressurized water loop fueled experiment failure in SAR-153 Section 15.7, Radioactive Release from a Subsystem or Component. Without both the primary and backup isolation damper operable there is a single failure vulnerability in establishing confinement isolation. The backup damper upgrade was completed to establish redundancy but the TSR does not require that redundancy to eliminate single failure vulnerabilities.

As noted in Section 6.2.2.9 *(Confinement System)* Failure Analysis of SAR-153, successful operation of the backup dampers will significantly reduce the potential for confinement isolation system failure. Operation without operable backup dampers significantly increases potential for confinement isolation failure.

The backup dampers were installed as a result of commitments made to DOE to provide single failure redundancy not to provide operational flexibility as allowed by the TSR. The TSR does not adequately implement the design and safety basis or commitments made to DOE.

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.

The reactor was operating in Cycle 140A-1 at the time of discovery. All primary and backup confinement isolation dampers were verified operable. No additional action was necessary to place the facility in a safe condition.

The interim control is to require both the primary and backup dampers operable prior to entering MODE applicability for the Confinement and Radiation Monitoring and Seal System. The parenthetical clarifications in TSR LCO 3.2.2d and LCO 3.8.1f are superseded by this interim control. In an applicable MODE with either the primary or backup damper of any damper pair inoperable restore operability prior to entering mode applicability during to the next scheduled REACTOR OUTAGE.

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.: RTC-USQ-2007-729

Subject: Operability Requirements for ATR Confinement Isolation Dampers (GAP-014-07)

The basis for the interim control is that is meets the original design basis for the backup damper modification, the commitments made to DOE for confinement damper redundancy, and SAR-153 general design criteria. The allowance for continued operation until the next scheduled reactor outage is based on the low-probability of a confinement isolation event during any single operating cycle coupled with the failure of the redundant damper to establish confinement isolation.

J.C. Chapman	**(See PISA declaration)**	**10/24/07**
Safety Analyst Print/Type Name	Safety Analyst Signature	Date
M. B. McDonough	**(See PISA declaration)**	**10/24/07**
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, Section 6.2, Confinement Systems
Section 7.3.3, Radiation Monitoring & Seal System
TSR-186, Section 3.2.2, Radiation Monitoring & Seal System
Section 3.8.1, Confinement Requirements

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 safety function of the confinement isolation dampers is to provide the mitigative function of isolating the confinement when excessive radioactivity is released into the confinement atmosphere. As such, the dampers have no affect on the probability of any accidents previously evaluated in the safety basis.

Therefore, the PISA could not increase the probability of an accident.

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

The vulnerability described in the PISA could lead to the situation where one of a pair of confinement isolation dampers is not operable as currently allowed by TSR-186 and a failure anywhere in the equipment for the other damper in the pair prevents the second damper from closing due to a confinement isolation signal from the RMSS. This is not contrary to the commitment in SAR-153, Section 7.3.3.2.1.3, Defense Against Failures, which states:

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"Thus, any single failure within a channel or logic train will not prevent protection at the system level when required."

The condition described in the PISA still would lead to undesirable conditions in spite of not being contrary to the SAR-153 statement above. Depending on which pair(s) of confinement isolation dampers was affected, the effect would range from minimal, if any, such as for most exhaust dampers, to major, especially the exhaust stack confinement isolation dampers. Since the exhaust stack dampers require an active signal to close, do not fail closed, and could offer a direct path from the confinement to the environment, the worst case would be expected to be those dampers. The other ventilation dampers do fail closed on lose of solenoid power or instrument air, but also offer a potential release path to the atmosphere. Any of these would increase the consequences of any accident releasing excessive amounts of radioactivity to the confinement atmosphere if the pair of dampers failed to close.

Therefore, the PISA could increase the consequences of an accident previously evaluated.

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:

The PISA affects when the confinement isolation dampers are required to be operable and does not affect the functionality of the dampers themselves, therefore the PISA does not affect the failure probability of the dampers or their components.

Therefore, the PISA could not increase the probability of occurrence of a malfunction of equipment important ot 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:

Similar to Question 2 above, considering the function of confinement isolation dampers as a pair, the consequences of a malfunction to one of the exhaust stack confinement isolation dampers could lead to a direct release path to the atmosphere from the the confinement if the other damper was not operable as allowed by TSR-186. Such as direct release path would be unacceptable.

Therefore, the PISA could increase the consequences of a malfunction of equipment important to safety.

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:

SAR-153, Section 6.2.2.9, Failure Analysis, describes the results of the ATR Level 2 probabilistic risk assessment for the confinement and the RMSS. The backup confinement isolation dampers were not included in that analysis since they had yet to be qualified and preliminary results indicated that confinement isolation system was not a significant contributor to risk. The single confinement isolation damper configuration that was analyzed in the PRA is the configuration of interest in the PISA and is discussed in Section 6.2.2.9.

Therefore, the PISA could not create the possibility of an accident of a different type than previously analyzed.

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Subject: Operability Requirements for ATR Confinement Isolation Dampers (GAP-014-07)

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:

The PISA only affects when one damper of a pair of confinement isolation dampers is potentially operable when the confinement is required to be available. The PISA does not provide any information about what malfunctions might actually occur.

Therefore, the PISA 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:

If confinement isolation dampers were not available as described above, and a LOCA occurs which causes EFIS to actuate and subsequently results in firewater flow into the confinement, then there could exist a direct flow path from the confinement atmosphere to the environment with a driving function available to force any confinement airborne activity out to the environment at a rate greater than currently analyzed in ATR's safety bases. In that case, a reduced margin to safety would exist.

Therefore, the PISA could 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:

Since the answers to questions 2, 4, and 7 above are positive, the PISA constitutes an Unreviewed Safety Question. If one of the two confinement isolation dampers in a pair is not operable as currently allowed by TSR-186, and the other damper fails to close if an RMSS signal demanded a confinement isolation, then release paths of varying increased affects would exist. That would result in a path for an increased release of any airborne radioactivity from the confinement atmosphere to the environment, which is an unacceptable condition.

Therefore, the PISA does constitute an Unreviewed Safety Question.

An additional interim control is required. The bottled gas backup supply for both of the stack confinement isolation dampers shall be OPERABLE for the RMSS to be considered OPERABLE. This supersedes TSR LCO 3.2.2f. If the backup supply for one stack confinement isolation damper is inoperable, operability must be restored prior to

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entering the applicable mode.

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:

W. E. Kohn (trainee)/ **J. C. Chapman**	Wm E Kohn / JC Chapman	5 NOV 07
USQ Evaluator Print/Type Name	USQ Evaluator Signature	Date
M. B. McDonough	M. B. McDonough	7 NOV 07
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

CONCURRENCE:

Alan P Hoskins	Alan P Hoskins	11-7-07
Independent Review Committee Chair Print/Type Name	Independent Review Committee Chair Signature	Date

INL USQ PROCESS
REASONABILITY DETERMINATION/POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
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Facility or Activity: Advanced Test Reactor

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Subject: Operability Requirements for ATR Confinement Isolation Dampers (GAP-014-07)

Describe the New Information/Discovery:

The Advanced Test Reactor (ATR) Technical Safety Requirements (TSR) for operability of the primary and backup dampers only require the primary or the backup confinement isolation damper to be in-service. This is not consistent with the original design requirements for the backup isolation dampers or the SAR-153 general design criteria (GDC).

The backup confinement isolation dampers were upgraded to provide the same function as the primary dampers as a result of corrective actions from lessons learned from the Three Mile Island reactor accident, findings from the September 1988 Department of Energy (DOE) Office of Environmental, Safety and Health (ESH) Technical Safety Appraisal, and the August 1995 DOE ESH Intense Inspection. The purpose of the modification was to improve redundancy eliminating single failure vulnerabilities (PG-T-89-007). After installation the backup dampers were not qualified until additional testing of the confinement identified deficiencies in the confinement leak rate test procedure (TRA-USQ-SE-1998-026). After correction of these deficiencies it was verified that the backup dampers provide a function equivalent to the primary dampers; however, the TSR only requires a primary or a backup damper (not both) to be in-service.

SAR-153 General Design Criterion 21, Protection System Reliability and Testability, requires the protection system be designed for high functional reliability and in-service testability commensurate with the safety functions to be performed. Redundancy and independence designed into the protection system shall be sufficient to assure that (1) no single failure results in loss of the protection function, and (2) removal from service of any components or channel does not result in loss of the required minimum redundancy unless the acceptable reliability of operation of the protection system can be otherwise demonstrated.

SAR-153 General Design Criterion 22, Emergency Core Cooling, and Criterion 41, Confinement Atmosphere Cleanup, require suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and confinement capabilities be provided to assure that for on-site electric power system operation (assuming off-site power is not available), and for off-site electric power system operation (assuming on-site power is not available), the system safety function can be accomplished, assuming a single failure.

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

Tomberlin, T.A., Advanced Test Reactor (ATR) Responses to NUREG-0737 (Clarification of TMI Action Plan Requirements), PG-T-89-007, March 1989

Confinement Fission Product Release Rate, TRA-USQ-SE-1998-026, May 7, 1998

SAR-153, Advanced Test Reactor Upgraded Final Safety Analysis Report, Revision 26, June 5, 2007

TSR-186, Advanced Test Reactor Technical Safety Requirements, Revision 11, June 5, 2007

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

INL USQ PROCESS
REASONABILITY DETERMINATION/POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
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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 radiation monitoring and seal system that actuates the confinement isolation is an Engineered Safety Features (i.e., part of the plant protective system) and subject to GDC 21. The confinement structure is safety-related. The isolated confinement leak rate is used in the radiological consequence analysis in SAR-153 Section 15.12.10, Radiological Analysis, to establish the evacuating worker, co-located worker, exclusion area boundary, and low-population zone exposures for the ATR. The Section 15.12.10 analysis is used to envelop all ATR fuel damage events in SAR-153 Chapter 15, Accident Analyses. The isolated confinement leak rate is also used in the analysis of radiological consequences of a pressurized water loop fueled experiment failure in SAR-153 Section 15.7, Radioactive Release from a Subsystem or Component. Without both the primary and backup isolation damper operable there is a single failure vulnerability in establishing confinement isolation. The backup damper upgrade was completed to establish redundancy but the TSR does not require that redundancy to eliminate single failure vulnerabilities.

As noted in Section 6.2.2.9 *(Confinement System)* Failure Analysis of SAR-153, successful operation of the backup dampers will significantly reduce the potential for confinement isolation system failure. Operation without operable backup dampers significantly increases potential for confinement isolation failure.

The backup dampers were installed as a result of commitments made to DOE to provide single failure redundancy not to provide operational flexibility as allowed by the TSR. The TSR does not adequately implement the design and safety basis or commitments made to DOE.

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.

The reactor was operating in Cycle 140A-1 at the time of discovery. All primary and backup confinement isolation dampers were verified operable. No additional action was necessary to place the facility in a safe condition.

The interim control is to require both the primary and backup dampers operable prior to entering MODE applicability for the Confinement and Radiation Monitoring and Seal System. The parenthetical clarifications in TSR LCO 3.2.2d and LCO 3.8.1f are superseded by this interim control. In an applicable MODE with either the primary or backup damper of any damper pair inoperable restore operability prior to entering mode applicability ~~prior to~~ the next scheduled REACTOR OUTAGE.

BFC DURING

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Subject: Operability Requirements for ATR Confinement Isolation Dampers (GAP-014-07)

The basis for the interim control is that is meets the original design basis for the backup damper modification, the commitments made to DOE for confinement damper redundancy, and SAR-153 general design criteria. The allowance for continued operation until the next scheduled reactor outage is based on the low-probability of a confinement isolation event during any single operating cycle coupled with the failure of the redundant damper to establish confinement isolation.

J.C. Chapman Safety Analyst Print/Type Name	JC Chapman Safety Analyst Signature	BPC 24 ~~23~~ Oct 2007 Date
M. B. McDonough Nuclear Facility Manager Print/Type Name	M. B. McDonough Nuclear Facility Manager Signature	24 BPC ~~23~~ OCT 2007 Date

Is independent technical review required? Yes ☐ No ☒

M. B. McDonough
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.): DATES CORRECTED AFTER VERIFYING WITH J. CHAPMAN AND M. McDONOUGH

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:

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

INL USQ PROCESS
REASONABILITY DETERMINATION/POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
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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:

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

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:

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:

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REASONABILITY DETERMINATION/POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
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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:

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:

   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:

USQ Evaluator Print/Type Name	USQ Evaluator Signature	Date
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

CONCURRENCE:

Independent Review Committee Chair Print/Type Name	Independent Review Committee Chair Signature	Date