INL USQ PROCESS
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-2006-656

Subject: Section 15.12 Maximum Hypothetical Accident Analysis Used to Bound Canal Accidents

Describe the New Information/Discovery:

The ATR Design Basis Reconstitution Program (DBRP) review of the radiological consequence analysis in Section 15.12, Severe Accident Analyses, of SAR-153 resulted in numerous observations.

The exposures resulting from the radiological consequence analyses in Section 15.12 of SAR-153 are scaled to determine exposures from fuel failure events in the ATR canal area. The analytical basis for the exposures in Section 15.12 is a detailed analysis of molten fuel relocation and quenching in the reactor vessel, temperature and time dependent fission product release models for molten fuel, fission product transport and chemistry analysis in the primary coolant system piping, fission product partitioning in the compartmentalized confinement building, and confinement leak rate modeling. The canal accidents occur in an entirely different environment thus the detailed analysis in Section 15.12 is not applicable to the canal area accidents.

Identify the applicable safety basis document(s) (e. g., DSA, SAR, BIO, TSRs, etc.):
SAR-153, Section 15.12

I. PISA ASSESSMENT

a. Is there a potential inadequacy in the analytical methodology and/or tools used in the safety basis?
☒ Yes ☐ No

b. Is there a potential discrepancy between the safety basis assumptions, provisions, or conditions, in the accident analysis and the facility operation or parameters?
☒ Yes ☐ No

c. Is the actual physical condition of the facility different than as described in the safety basis (discrepant as-found condition)?
☐ Yes ☒ No

d. Has an actual or postulated operational event or incident revealed a potential inadequacy in the safety basis?
☐ Yes ☒ No

e. Is this an activity or condition not analyzed in the existing safety basis?
☐ Yes ☒ No

Provide an explanation of the assessment result:
Section 15.12 analysis (i.e., the "maximum hypothetical accident" consequence analysis) is inappropriately used to bound the consequences of crushing ATR fuel elements that are stored in the unirradiated fuel storage canal area.

J. C. Chapman USQ Evaluator Print/Type Name	JC Chapman USQ Evaluator Signature	27 Sept 2006 Date
M. B. McDonough Nuclear Facility Manager Print/Type Name	M. B. McDonough Nuclear Facility Manager Signature	27 SEP 2006 Date

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If the answer to ALL of the assessment questions above is No, file the completed form. Do not complete Section II, III, or IV.
If the answer to any one of the assessment questions is Yes, there is a potentially inadequate safety analysis (PISA):

- Nuclear Facility Manager document actions (Section **II**), including interim operating restrictions, taken to place or maintain the facility in a safe condition.
- Nuclear Facility Manager execute reporting process per MCP-190 or AWP-3.1, for PISA.
- USQ evaluator proceed to Section **III**.

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

No interim restriction are need. TSR-186 AC 5.7.7.2 restricts heavy load handling near fuel storage locations.

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. DETERMINATION

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

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:

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Subject: Section 15.12 Maximum Hypothetical Accident Analysis Used to Bound Canal Accidents

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

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:

IIIc: POTENTIAL FOR REDUCTION IN A MARGIN OF SAFETY

INL USQ PROCESS
POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
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USQ Process No.: RTC-USQ-2006-656

Subject: Section 15.12 Maximum Hypothetical Accident Analysis Used to Bound Canal Accidents

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:

NOTE: If USQ determination result is positive, additional notification for ORPS is required per MCP-190 or AWP-3.1.

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

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POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
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Subject: Section 15.12 Maximum Hypothetical Accident Analysis Used to Bound Canal Accidents

Describe the New Information/Discovery:

The ATR Design Basis Reconstitution Program (DBRP) review of the radiological consequence analysis in Section 15.12, Severe Accident Analyses, of SAR-153 resulted in numerous observations.

The exposures resulting from the radiological consequence analyses in Section 15.12 of SAR-153 are scaled to determine exposures from fuel failure events in the ATR canal area. The analytical basis for the exposures in Section 15.12 is a detailed analysis of molten fuel relocation and quenching in the reactor vessel, temperature and time dependent fission product release models for molten fuel, fission product transport and chemistry analysis in the primary coolant system piping, fission product partitioning in the compartmentalized confinement building, and confinement leak rate modeling. The canal accidents occur in an entirely different environment thus the detailed analysis in Section 15.12 is not applicable to the canal area accidents.

Identify the applicable safety basis document(s) (e. g., DSA, SAR, BIO, TSRs, etc.):
SAR-153, Section 15.12

I. PISA ASSESSMENT

a. Is there a potential inadequacy in the analytical methodology and/or tools used in the safety basis?
☒ Yes ☐ No

b. Is there a potential discrepancy between the safety basis assumptions, provisions, or conditions, in the accident analysis and the facility operation or parameters?
☒ Yes ☐ No

c. Is the actual physical condition of the facility different than as described in the safety basis (discrepant as-found condition)?
☐ Yes ☒ No

d. Has an actual or postulated operational event or incident revealed a potential inadequacy in the safety basis?
☐ Yes ☒ No

e. Is this an activity or condition not analyzed in the existing safety basis?
☐ Yes ☒ No

Provide an explanation of the assessment result:
Section 15.12 analysis (i.e., the "maximum hypothetical accident" consequence analysis) is inappropriately used to bound the consequences of crushing ATR fuel elements that are stored in the unirradiated fuel storage canal area.

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

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If the answer to ALL of the assessment questions above is No, file the completed form. Do not complete Section II, III, or IV.
If the answer to any one of the assessment questions is Yes, there is a potentially inadequate safety analysis (PISA):

- Nuclear Facility Manager document actions (Section II), including interim operating restrictions, taken to place or maintain the facility in a safe condition.
- Nuclear Facility Manager execute reporting process per MCP-190 or AWP-3.1, for PISA.
- USQ evaluator proceed to Section III.

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

No interim restriction are need. TSR-186 AC 5.7.7.2 restricts heavy load handling near fuel storage locations.

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. DETERMINATION

Identify applicable section(s) of the safety basis document(s) (e.g., DSA, SAR, BIO, TSRs, etc.).
SAR-153, Section 15.12.10, "Radiological Analysis," and Section 15.8.7, "Significant Melting of One Entire Element (or Partial Melting in More than One Element) Due to Crushing or Other Accidents"

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 PISA concerns the appropriateness of scaling the Section 15.12.10 maximum hypothetical accident analysis to bound the consequence of melting ATR fuel elements while submerge in the ATR canal. The PISA does not affect the probability of occurrence any accident. Section 15.8.7 hypothesizes melting one entire ATR fuel element, or partially melting eight elements, due to any cause and assumes the event is a Condition 4 fault.

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Subject: Section 15.12 Maximum Hypothetical Accident Analysis Used to Bound Canal Accidents

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

Explain:
The PISA questioned the appropriateness of scaling the Section 15.12.10 maximum hypothetical accident analysis consequence. The Section 15.12.10 analysis is a large loss-of-coolant accident (LOCA) in which the core melts; fission products are released into a mixture of the primary coolant and raw water from emergency firewater injection. Gases and volatiles are then release from the water to the confinement. In the canal, the fuel melts, and fission products are released into the canal water, which has different chemistry, and then into the canal area which is not in the confinement. It is questionable whether the scaled Section 15.12.10 LOCA analysis bounds the release from the Condition 4 canal accident.

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 equipment important to safety is the canal structure, canal liner and equipment whose failure or misuse could damage ATR fuel elements in the un-irradiated fuel storage area. The PISA, scaling the Section 15.12.10 LOCA analysis consequence to bound the canal accidents, does not affect any equipment 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:
The PISA questioned the appropriateness of scaling the Section 15.12.10 analysis consequence. The Section 15.12.10 analysis is a LOCA in which the core melts; fission products from the melt are released into a mixture of the primary coolant and raw water from emergency firewater injection. Gases and volatiles are then release to the confinement. In the canal, the fuel melts and fission products are released into the canal water which has different chemistry and then into the canal area which is not in the confinement. It is questionable whether the scaled Section 15.12.10 LOCA analysis bounds the release from the Condition 4 canal accident. So the consequence of a failure of equipment that could result in crushing ATR fuel elements in the un-irradiated canal storage may not be well defined.

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:
The PISA questioned the appropriateness of scaling the Section 15.12.10 LOCA analysis consequence to bound the Condition 4 canal accident. The PISA does not create an accident of a different type.

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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:
   The PISA questioned the appropriateness of scaling the Section 15.12.10 LOCA analysis consequence to bound the Condition 4 canal accident. The PISA does not create any possibility of a malfunction of equipment important to safety.

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:
   The PISA questioned the appropriateness of scaling the Section 15.12.10 LOCA analysis consequence to bound the Condition 4 canal accident. The consequence of the Condition 4 canal accident in which one ATR fuel element melts or eight fuel elements partially melt is not well defined, and therefore, the margin of safety is not well defined.

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:
   Section 15.12.10 LOCA analysis may have been inappropriately used to bound the consequence of crushing an ATR fuel element or elements in the canal. Therefore, the consequence of the Condition 4 canal accident may not be well defined.

NOTE: If USQ determination result is positive, additional notification for ORPS is required per MCP-190 or AWP-3.1.

IV. APPROVAL/CONCURRENCE SIGNATURES

APPROVAL:

J. C. Chapman USQ Evaluator Print/Type Name	JC Chapman USQ Evaluator Signature	4 Oct 2006 Date
M. B. McDonough Nuclear Facility Manager Print/Type Name	M. B. McDonough Nuclear Facility Manager Signature	4 OCT Date

CONCURRENCE:

A. P. Hoskins Independent Review Committee Chair Print/Type Name	Alan P Hoskins Independent Review Committee Chair Signature	10-5-06 Date