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

Facility or Activity: RTC, TRA-670-Advanced Test Reactor

USQ Process No.: RTC-USQ-2006-577

Subject: Discrepancies in the Analysis of Rupture of a Heat Exchanger Tube and the Bases for the Secondary Coolant System (SCS) Activity Level

Describe the New Information/Discovery:
SAR-153, Chapter 15.6 "Decrease in Primary Coolant Inventory" Section 15.6.3 discusses a rupture of a heat exchanger tube; this Condition 2 event will result in a 200-300 gpm loss of coolant accident. TRA-ATR -905- "Bases for Technical Specification 3.4 Secondary Coolant Radioactivity Control" establishes a SCS activity limit of 0.01μCi/ml for Condition 1 (normal operation and anticipated operational transients). According to the analysis a secondary coolant system (SCS) radioactivity concentration of 0.01 μCi/ml would result in exposures of no more than 2.5 mrem/year EDE to a full time resident at the INL nearest site boundary and no more than 500 mrem/year EDE to the maximally exposed RTC worker. These exposure limits were based on DOE Orders and guidance in effect at the time of the analyses. Discrepancies arise from the use of the results of the condition 1 analysis in ATR-TRA-905 for the analysis of the condition 2 heat exchanger tube rupture in SAR-153 Section 15.6.3. Additionally, there are assumptions in TRA-ATR-905 that cannot be supported. Several discrepancies were noted:

1. The isotopic release rates from the SCS are based on 1900 gpm SCS blowdown (evaporation) and a SCS activity of 0.01μCi/ml. The release rates should have been based on the primary coolant system (PCS) activity limit (20μCi/ml) and a combined release rate of break flow and PCS degassing flow (~300 gpm). Volatile radioactive material (e.g., noble gases) that leaks from the primary coolant system (PCS) would be released from the SCS to the environment at a rate higher than the evaporation rate assumed in the analysis. Since these materials are not retained in the water they would be released when the coolant was exposed to the atmosphere.
2. The PCS normal activity source term assumed in the analysis was obtained from depressurized PCS RML samples, the depressurization of the PCS sample would cause the volatile gaseous isotopes to come out of solution leaving mostly particulates in the sample and therefore the total activity would not be appropriately represented in the RML sample analysis.
3. The site boundary dose calculation only includes the source from the cooling tower and neglects the release from the stack. Both sources would contribute to the site boundary dose.
4. The current method for verifying PCS and SCS activity levels remain below limits may not be appropriate. The current depressurized PCS activity sample (RML and Deepwell) measures mostly particulates and would not be a representative sample of actual water activity. The SCS sample would be degassed by the action of water flow over the cooling tower leaving mostly particulates in the in the water sample, this too would be not be a representative sample.
5. The X/Q used in the determination of the limit for normal operation is a long term average value that is appropriate for a long term exposure calculation. The accident analysis should be based on a worst-case (i.e., 95%) X/Q to be consistent with the accident analysis methodology described in SAR-153.
6. The time to reach the secondary coolant system (SCS) activity limit in SAR-153 chapter 15.6 is miscalculated. It appears the time is calculated for a SCS activity of 1 μCi/ml rather than the 0.01 μCi/ml SCS activity limit.

Identify the applicable safety basis document(s) (e. g., DSA, SAR, BIO, TSRs, etc.):
SAR-153, chapter 15.6-Decrease in Primary Coolant Inventory
EDF TRA-ATR-905-Bases For Technical Specification 3.4 Secondary Coolant Radioactivity Control

I. PISA ASSESSMENT

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

Facility or Activity: RTC, TRA-670-Advanced Test Reactor

USQ Process No.: RTC-USQ-2006-577

Subject: Discrepancies in the Analysis of Rupture of a Heat Exchanger Tube and the Bases for the Secondary Coolant System (SCS) Activity Level

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:
The analysis for the SCS activity limit incorrectly assumes that volatile constituents will be released to the environment based on the evaporation rate of the SCS cooling tower, likewise the PCS and SCS activity surveillances incorrectly assume that all activity constituents will be measured. Based on this, the answer to questions a and b are yes.

LEWIS KIRKPATRICK		8/22/06
USQ Evaluator Print/Type Name	USQ Evaluator Signature	Date
MARTIN B. McDONOUGH	M. B. McDonough	8/22/06
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

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

Establish an interim control for the SCS activity of no more than 100 cpm above background. With the radioactivity greater than 100 cpm above background. Perform a 10 minute background per DOP-6.1.1 (ATR Canberra Well Counting System), take a second, and if necessary a third sample, within 30 minute intervals. If two samples show radioactivity greater than 100 cpm above background, boundary fault leakage is possible. Enter T~~SR-186 section 3.3.6 - Primary Coolant Leakage, an~~d AOP 2.4 - Primary To Secondary Leak.

M 8/22/06

Steve Wagner	Steve Wagner	8/22/06
Safety Analyst Print/Type Name	Safety Analyst Signature	Date

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

Facility or Activity: RTC, TRA-670-Advanced Test Reactor

USQ Process No.: RTC-USQ-2006-577

Subject: Discrepancies in the Analysis of Rupture of a Heat Exchanger Tube and the Bases for the Secondary Coolant System (SCS) Activity Level

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:

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:

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POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
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USQ Process No.: RTC-USQ-2006-577

Subject: Discrepancies in the Analysis of Rupture of a Heat Exchanger Tube and the Bases for the Secondary Coolant System (SCS) Activity Level

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

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

   Explain:

IIId: USQ DETERMINATION CONCLUSION

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

Facility or Activity: RTC, TRA-670-Advanced Test Reactor

USQ Process No.: RTC-USQ-2006-577

Subject: Discrepancies in the Analysis of Rupture of a Heat Exchanger Tube and the Bases for the Secondary Coolant System (SCS) Activity Level

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

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

Facility or Activity: RTC, TRA-670-Advanced Test Reactor

USQ Process No.: RTC-USQ-2006-577

Subject: Discrepancies in the Analysis of Rupture of a Heat Exchanger Tube and the Bases for the Secondary Coolant System (SCS) Activity Level

Describe the New Information/Discovery:
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1. The isotopic release rates from the SCS are based on 1900 gpm SCS blowdown (evaporation) and a SCS activity of 0.01μCi/ml. The release rates should have been based on the primary coolant system (PCS) activity limit (20μCi/ml) and a combined release rate of break flow and PCS degassing flow (~300 gpm). Volatile radioactive material (e.g., noble gases) that leaks from the primary coolant system (PCS) would be released from the SCS to the environment at a rate higher than the evaporation rate assumed in the analysis. Since these materials are not retained in the water they would be released when the coolant was exposed to the atmosphere.
2. The PCS normal activity source term assumed in the analysis was obtained from depressurized PCS RML samples, the depressurization of the PCS sample would cause the volatile gaseous isotopes to come out of solution leaving mostly particulates in the sample and therefore the total activity would not be appropriately represented in the RML sample analysis.
3. The site boundary dose calculation only includes the source from the cooling tower and neglects the release from the stack. Both sources would contribute to the site boundary dose.
4. The current method for verifying PCS and SCS activity levels remain below limits may not be appropriate. The current depressurized PCS activity sample (RML and Deepwell) measures mostly particulates and would not be a representative sample of actual water activity. The SCS sample would be degassed by the action of water flow over the cooling tower leaving mostly particulates in the ~~in the~~ water sample, this too would be not be a representative sample. JCC 8/24/06
5. The X/Q used in the determination of the limit for normal operation is a long term average value that is appropriate for a long term exposure calculation. The accident analysis should be based on a worst-case (i.e., 95%) X/Q to be consistent with the accident analysis methodology described in SAR-153.
6. The time to reach the secondary coolant system (SCS) activity limit in SAR-153 chapter 15.6 is miscalculated. It appears the time is calculated for a SCS activity of 1 μCi/ml rather than the 0.01 μCi/ml SCS activity limit.

Identify the applicable safety basis document(s) (e. g., DSA, SAR, BIO, TSRs, etc.):
SAR-153, chapter 15.6-Decrease in Primary Coolant Inventory
EDF TRA-ATR-905-Bases For Technical Specification 3.4 Secondary Coolant Radioactivity Control

I. PISA ASSESSMENT

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USQ Process No.: RTC-USQ-2006-577

Subject: Discrepancies in the Analysis of Rupture of a Heat Exchanger Tube and the Bases for the Secondary Coolant System (SCS) Activity Level

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:
The analysis for the SCS activity limit incorrectly assumes that volatile constituents will be released to the environment based on the evaporation rate of the SCS cooling tower, likewise the PCS and SCS activity surveillances incorrectly assume that all activity constituents will be measured. Based on this, the answer to questions a and b are yes.

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

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

Establish an interim control for the SCS activity of no more than 100 cpm above background. With the radioactivity greater than 100 cpm above background. Perform a 10 minute background per DOP-6.1.1 (ATR Canberra Well Counting System), take a second, and if necessary a third sample, within 30 minute intervals. If two samples show radioactivity greater than 100 cpm above background, boundary fault leakage is possible. Enter AOP 2.4 - Primary To Secondary Leak.

Safety Analyst Print/Type Name	Safety Analyst Signature	Date

INL USQ PROCESS
POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
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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:
   None of the discussion presented in the PISA evaluation addressed the probability of occurrence of accidents evaluated in the safety basis. Therefore, the PISA could not increase 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:
   Several of the issues raised by the PISA such as the manner and timing of gaseous fission product release and the offsite concentration of the radioactive plume would increase the consequences presented in the safety basis. Therefore, this PISA could increase 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:
   The event scenario remains the same as presented in the safety basis. Therefore, this PISA did not increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the safety basis.

INL USQ PROCESS
POTENTIAL INADEQUACY IN THE SAFETY ANALYSIS (PISA) FORM
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Facility or Activity: RTC, TRA-670-Advanced Test Reactor

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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 PISA identified the possibility of reaching the maximum analyzed concentration of fission products in the secondary much quicker then thought following a failure of a heat exchanger tube. This could result in higher exposure both onsite and offsite than presented in the safety basis. Therefore, this PISA does increase 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:
   None of the discussion presented in the PISA evaluation addressed the possibility of an accident of a different type than previously evaluated in the safety basis. The accident scenarios would be the same. Therefore, the PISA did 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:
   None of the discussion presented in the PISA evaluation addressed the possibility of a malfunction of equipment important to safety of a different type than previously evaluated in the safety basis. The malfunction of equipment would be the same. Therefore, the PISA did 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:
   The issues raised in the PISA could result in more signif cant consequences than those presented in the safety basis. Therefore, this PISA could reduce a margin of safety as defined in the safety basis.

IIId: USQ DETERMINATION CONCLUSION

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

Explain:
Part IIIa shows that there is a potential for an increase in the probability or consequence of an accident evaluated in the safety basis. Part IIIb shows that there is no potential for the creation of an unanalyzed accident or malfunction of a different type, and Part IIIc shows that there is a reduction in the margin of safety established in the safety basis. Therefore, this PISA finding does constitute a USQ.

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:

Steve Wagoner	Steve Wagoner	8/24/06
USQ Evaluator Print/Type Name	USQ Evaluator Signature	Date
MARTIN B. McDONOUGH	Martin B. McDonough	8/24/06
Nuclear Facility Manager Print/Type Name	Nuclear Facility Manager Signature	Date

CONCURRENCE:

Alan P Hoskins	Alan P Hoskins	8-29-06
Independent Review Committee Chair Print/Type Name	Independent Review Committee Chair Signature	Date