RAS M-307

VERMONT YANKEE NUCLEAR POWER STATION

OFF-NORMAL PROCEDURE

ON 3178

ORIGINAL

INCREASED MOISTURE CARRYOVER

USE CLASSIFICATION: **REFERENCE**

RESPONSIBLE PROCEDURE OWNER: **Manager, Operations**

REQUIRED REVIEWS		Yes/No
E-Plan	10CFR50.54(q)	
Security	10CFR50.54(p)	
Probable Risk Analysis (PRA)		
Reactivity Management		

LPC No.	Effective Date	Affected Pages
1	02/16/06	Pg 1 of 6
2	02/16/06	Pgs 2-5 of 6
3	05/02/06	Pgs 2, 3, 4, 5, & 6 of 6

Implementation Statement: N/A

Effective Date: 01/19/2006

Template Secy-028

DS-03

SYMPTOMS

1. Any of the following may be indications of vessel internals damage and potential debris generation (loose parts). (SIL 644 Revision 1)

   - Sudden drop (≤1 minute) in Main Steam Line steam flow of >5%. (B064, B065, B066, B067)
   - RPV water level difference >3 inches step change between level instruments from different reference legs. (B040, B041, B047 versus B021, B042, B043)
   - Sudden drop (≤1 minute) in steam dome pressure of >2 psig. (B048, B049)
   - Unexpected trends in parameters (listed in Appendix A) that may be indicative of loss of steam dryer integrity, particularly unexplained changes in trends.

2. Moisture carryover >0.16%.

AUTOMATIC ACTIONS

1. None

OPERATOR ACTIONS

1. Request Chemistry to perform moisture carryover sampling and analysis per OP 0631, Radiochemistry, Appendix F.

   a. For moisture carryover values ≤0.16%, no action is required, exit this procedure.

   b. For moisture carryover values >0.16% and <0.35%, GOTO Step 2.

   c. For moisture carryover values ≥0.35%, GOTO Step 3.

2. IF moisture carryover is >0.16% and <0.35%, THEN perform the following:

   a. Submit a Condition Report.

   b. Notify:

      - General Manager
      - Operations Management
      - System Engineering
      - Reactor Engineering
      - Design Engineering Mechanical

NOTE

The occurrence of steam dryer damage due to a rod adjustment would be highly unlikely. However, moisture carryover is sensitive to rod patterns and power levels.

c. IF >25% increase in moisture carryover value occurs following a rod adjustment, THEN request Chemistry to perform another moisture carryover sample after 4 hours and within 12 hours of completion of the rod adjustment.

d. IF the moisture carryover increase can not be attributed to a rod adjustment, THEN promptly suspend any power increases until an evaluation concludes that further power ascension is permitted. The steam dryer performance data shall be reviewed as part of an engineering evaluation to assess whether further power ascension can be made without exceeding 0.35% moisture carryover.

e. Review Tech. Spec. license conditions for the steam dryer.

f. If not attributed to rod adjustment, suspend any power increases until an evaluation concludes that further power ascension is permitted.

g. Request Engineering to perform an Operability Evaluation per EN-OP-104, Operability Determinations.

h. Evaluate the moisture carryover data and pressure data (Appendix A) to determine if there is a significant increasing trend or step change that cannot be explained by changes in plant operational parameters.

i. Request Chemistry to perform moisture carryover sample analysis per OP 0631, Appendix F, and continue sampling every 12 hours nominal until otherwise directed by plant management.

j. IF the engineering evaluation of plant data confirms that steam dryer damage may have occurred, THEN:

- Initiate a plant shutdown per OP 0105.
- Place the plant in a cold shutdown condition within 24 hours.
- Evaluate Reportability per AP 0156.

k. IF the results of the evaluation does not support continued plant operation, THEN commence a power reduction and achieve hot shutdown condition within the following 24 hours.

l. IF the results of the engineering evaluation cannot conclude the current power level is justified, THEN reduce power in accordance with OP 0105 as required by the engineering evaluation.

3. IF moisture carryover ≥0.35% THEN:

a. Submit a Condition Report

b. Notify:

- General Manager
- Operations Management
- System Engineering
- Reactor Engineering
- Design Engineering Mechanical

c. Promptly initiate a reactor power reduction of 10% within 2 hours IAW OP 0105, and have Chemistry resample. If greater than 0.35%, repeat until moisture carryover <0.16%, unless an engineering evaluation concludes that continued power operation or power ascension is acceptable.

d. Review Tech. Spec. license conditions for the steam dryer.

e. Suspend any power increases until the engineering evaluation concludes that further power ascension is justified. The steam dryer performance shall be reviewed as part of an engineering evaluation to assess steam dryer integrity.

f. Request Engineering to perform an Operability Evaluation per EN-OP-104, Operability Determinations.

g. Within 24 hours, re-measure moisture carryover and perform an engineering evaluation of the steam dryer integrity.

1) IF the engineering evaluation of plant data confirms that steam dryer damage may have occurred, THEN:

- Initiate a plant shutdown per OP 0105.
- Place the plant in a cold shutdown condition within 24 hours.
- Evaluate Reportability per AP 0156.

2) IF the results of the evaluation does not support continued plant operation, THEN the reactor shall be placed in a hot shutdown condition within the following 24 hours.

3) IF the results of the engineering evaluation cannot conclude the current power level is justified, THEN reduce power in accordance with OP 0105 to a previously acceptable power level as determined by Engineering and Operations management

ATTACHMENTS

1. Appendix A, GE SIL 644 Rev 1 Moisture Carryover Parameter Monitoring and Affects

REFERENCES

1. Technical Specifications and Site Documents

   a. Proposed Tech. Spec. Change 263, Supplement 33, Revised Steam Dryer Monitoring Plan, Attachment 6 to BVY 05-084
   b. Proposed Tech. Spec. Change 263, Supplement 21
   c. Proposed Tech. Spec. Change 263, Supplement 36

2. Codes, Standards, and Regulations

   a. None

3. Commitments

   a. CR-VTY-2005-00778 CA-00002, Issue Off-Normal Procedure for Increased Moisture Carryover

4. Supplemental References

   a. GE SIL 0639 Steam Moisture Content
   b. GE SIL 0644 Rev. 1, BWR Steam Dryer Integrity
   c. EN-OP-104, Operability Determinations
   d. OP 0631, Radiochemistry (Appendix F)
   e. CR-VTY-2006-1260 CA-1, Operability Evaluation

DISCUSSION

Steam dryer cracking has been observed throughout the BWR fleet operating history. The operating environment has a significant influence on the susceptibility of the dryer to cracking. Most of the steam dryer is located in the steam space with the lower half of the skirt immersed in reactor water at saturation temperature. These environments are highly oxidizing and increase the susceptibility to IGSCC cracking. Thus, there is concern for fatigue cracking resulting from flow-induced vibration and fluctuating pressure loads acting on the dryer.

Per GE SIL 644 Revision 1, parameter monitoring programs had been recommended with the intent of detecting structural degradation of the steam dryer during plant operation.

The November, 2003 BWR/3 hood failure demonstrated that monitoring steam moisture content and other reactor parameters does not consistently predict imminent dryer failure nor will it preclude the generation of loose parts. Monitoring is still useful in that it does allow identification of a degraded dryer allowing appropriate action to be taken to minimize the damage to the dryer and the potential for loose parts generation.

I LPC 3 A moisture carryover greater than 0.16% at the licensed power level is an indication of potential steam dryer damage, unless a higher threshold is established.

Moisture carryover is very sensitive to power level. Moisture carryover has increased in cases when steam flow is increased towards the center of the core, when inlet sub-cooling is decreased (i.e., final Feedwater temperature is increased) and when reactor water level is increased (due to degraded separator performance). If significant steam dryer damage occurs, steam line flow distribution changes may result.

Note that the standard deviation of moisture carryover measurements is not expected to change significantly following power distribution changes. However, if a significant condenser tube leak occurs, then the standard deviation of moisture carryover measurements may change significantly due to the resulting increased Na-24 concentrations.

An increased feed-to-steam mismatch (i.e., total Feedwater flow plus CRD flow minus total steam flow, with reactor water level constant) may validate an increase in moisture carryover. Plant application has confirmed this correlation exists when the initial moisture carryover value is low (~0.01%); however the correlation showed significant scatter at higher initial moisture carryover values (0.04% to 0.10%).

If significant steam dryer damage occurs, steam line flow distribution changes may or may not result.

APPENDIX A

GE SIL 644 REV 1 MOISTURE CARRYOVER PARAMETER MONITORING AND AFFECTS

A Look for an explanation of the increased moisture carryover and confirmation of dryer failure by evaluating:

1. Differences (5% or more) in the steam flow distribution between the steam lines

   - B064 Main Steam Line Flow A
   - B065 Main Steam Line Flow B
   - B066 Main Steam Line Flow C
   - B067 Main Steam Line Flow D

2. Changes in or differences among MSL venturi pressures

   - DPT 2-116A/B/C/D Master (M) Units (MSL "A"),
   - DPT 2-117A/B/C/D Master (M) Units (MSL "B"),
   - DPT 2-118A/B/C/D Master (M) Units (MSL "C"),
   - DPT 2-119A/B/C/D Master (M) Units (MSL "D")

3. Differences in feedwater flow versus total steam flow

   - B015 Feedwater Inlet Flow A
   - B016 Feedwater Inlet Flow B
   - C001 Total Feedwater Flow
   - B022 Total steam flow

4. Changes in reactor water level (3 inches) at each reference leg

   - B040 Reactor water level 72B
   - B041 Reactor water level 57A
   - B047 Reactor water level 68B

   - B021 Reactor water level 72A
   - B042 Reactor water level 58B
   - B043 Reactor water level 68A

5. Changes in feedwater temperature and subcooling

   - B030 Reactor feedwater inlet temp A1
   - B032 Reactor feedwater inlet temp B1
   - C110 Core inlet subcooling

6. Changes in rod patterns