

**Constellation Energy**

Nine Mile Point Nuclear Station

P.O. Box 63  
Lycoming, NY 13093

July 25, 2006

U. S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**ATTENTION:** Document Control Desk

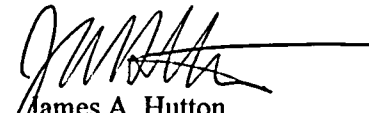
**SUBJECT:** Nine Mile Point Nuclear Station  
Unit No. 2; Docket No. 50-410

Licensee Event Report 06-002, "RCIC Exhaust Piping Vacuum Breakers  
Isolated Resulting in an Unanalyzed Condition"

In accordance with 10 CFR 50.73(a)(2)(ii)(B), we are submitting Licensee Event Report 06-002, "RCIC Exhaust Piping Vacuum Breakers Isolated Resulting in an Unanalyzed Condition."

Should you have questions regarding the information in this submittal, please contact M. H. Miller, Licensing Director, at (315) 349-1510.

Very truly yours,



James A. Hutton  
Plant General Manager

JAH/KSE/sac  
Attachment

cc: S. J. Collins, NRC Regional Administrator, Region I  
L. M. Cline, NRC Senior Resident Inspector

IE22

<b>1. FACILITY NAME</b> Nine Mile Point Unit 2	<b>2. DOCKET NUMBER</b> 05000410	<b>3. PAGE</b> 1 OF 5
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**4. TITLE**

RCIC Exhaust Piping Vacuum Breakers Isolated Resulting in an Unanalyzed Condition

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
05	26	2006	2006	- 002 -	00	07	25	2006	FACILITY NAME	DOCKET NUMBER

<b>9. OPERATING MODE</b> 1	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§:</b> (Check all that apply)									
<b>10. POWER LEVEL</b> 100	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)						
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)						
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)						
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)						
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)						
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)						
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)							
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER							
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A							

**12. LICENSEE CONTACT FOR THIS LER**

NAME Mary H. Miller, Licensing Director	TELEPHONE NUMBER (Include Area Code) (315) 349-1510
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

<b>14. SUPPLEMENTAL REPORT EXPECTED</b>	<b>15. EXPECTED SUBMISSION DATE</b>	MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO			

**ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)**

On May 26, 2006, Nine Mile Point Nuclear Station (NMPNS) determined that an unanalyzed condition had existed on February 8, 2006, due to potential water hammer impacts in the Nine Mile Point Unit 2 (NMP2) Reactor Core Isolation Cooling (RCIC) system. During planned maintenance, the RCIC system was declared inoperable but available for automatic and manual start with the RCIC turbine steam exhaust piping vacuum breakers isolated.

Under worst case conditions, if RCIC was manually or automatically started with the exhaust piping vacuum breakers isolated, the configuration may result in water hammer related stresses significantly above allowables. Under such conditions, there is an increased likelihood that primary containment boundary piping could be breached and other systems affected.

The root cause of this condition has been attributed to the failure of original design change process to provide cautions in procedures and adequate training regarding the RCIC vacuum breaker function when the vacuum breakers were installed prior to NMP2 initial start-up.

To prevent recurrence, key plant procedures have been revised to ensure the RCIC system will not be placed in the same or similar configurations as described in this report. Additional actions to prevent recurrence include implementing staff training with regard to potential water hammer events and improvements in evaluating and applying industry operating experience.

**LICENSEE EVENT REPORT (LER)**

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Nine Mile Point Unit 2	05000410	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 5
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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

**I. Description of Event**

On February 8, 2006, the Nine Mile Point Unit 2 (NMP2) Reactor Core Isolation Cooling (RCIC) system was declared inoperable but available during planned maintenance activities during which a RCIC turbine steam exhaust line vacuum breaker isolation valve, 2ICS\*MOV148, was de-energized shut. The NRC resident inspector questioned if considering RCIC available was appropriate with the vacuum breakers isolated. With the vacuum breakers isolated, vacuum relief is not available post-RCIC initiation to prevent water from the suppression pool from being rapidly drawn back into the RCIC turbine exhaust line. This alignment results in the potential for steam-condensation induced water hammer. Additionally, before NMPNS determined that the RCIC configuration represented an unanalyzed condition, similar but separate events occurred on February 10, 2006 and May 11, 2006 where RCIC vacuum breakers were isolated and RCIC remained available for automatic initiation. These additional conditions were present consistent with procedural requirements during performance of Technical Specification required surveillance N2-OSP-ICS-Q003, (RCIC vacuum breaker testing). This procedure was performed each quarter since NMP2 initial plant start-up. On May 26, 2006, NMPNS determined that an unanalyzed condition existed and was reportable per 10 CFR 73(a)(2)(ii)(B).

During normal RCIC system operation, steam would exit the RCIC turbine and be exhausted through horizontal and vertical 12" piping, a check valve (2ICS\*V29), a Group 12 primary containment isolation valve (2ICS\*MOV122), a containment penetration (203' elevation) and horizontal and vertical piping in primary containment to a sparger at elevation 189' in the suppression pool, approximately 11' below normal suppression pool level. With the RCIC vacuum breaker function unavailable, when steam flow to the RCIC turbine is stopped via manual or automatic action, steam in the exhaust piping would condense (due to piping cooling and steam/water interface in the steam exhaust piping in the suppression pool) and a vacuum would be drawn in the exhaust piping. The differential pressure could rapidly accelerate a water slug from the suppression pool into the exhaust piping. The subcooled water would facilitate the condensation process and increase the acceleration of the water slug. The momentum of the water slug would create large stresses on RCIC system exhaust line valves, piping and pipe supports, of which portions also serve as the primary containment pressure boundary.

In the early and mid-1970's the industry learned of the importance of vacuum breakers on HPCI and RCIC exhaust lines in preventing water hammer events through actual water hammer operating experience. EPRI reported (TR-106438) several RCIC and HPCI events from 1971 to 1977 where system damage occurred due to water hammer events caused by steam condensing in the exhaust piping (before nuclear stations added vacuum breaker lines). As a result of these events, facilities modified their systems by installing vacuum breakers, as recommended by GE Service Information Letter No. 30. More recent industry operating experience from 1998 (Vermont Yankee) and 2004 (Riverbend) provided information that, if critically reviewed, could have led NMP2 to a better understanding of the potential water hammer impacts with RCIC exhaust line vacuum breakers isolated, resulting in actions and staff understanding that may have prevented placing NMP2 in the unanalyzed condition described in this report.

**II. Cause of Event**

The root cause of this condition has been attributed to the failure of original design change process to provide cautions in procedures and adequate training regarding the RCIC vacuum breaker function when the vacuum breakers were installed prior to NMP2 initial start-up.

Contributing causes to this event were determined to be:

- Industry Operating Experience related to water hammer in RCIC and HPCI systems did not receive an adequate review and response. This manifested itself in weaknesses in training and procedures which led to operations and engineering knowledge gaps, resulting in failure to recognize the impact of actions/decisions with regard to maintaining RCIC available without the vacuum breaker function.

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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

**II. Cause of Event (Continued)**

- Inadequate procedures and training created a station knowledge gap regarding the safety function of the RCIC vacuum breakers and did not provide adequate barriers to prevent placing the station in a condition where RCIC remained available for automatic and manual start with the turbine steam line exhaust piping vacuum breakers isolated.
- Non-conservative decision making led to less than adequate immediate compensatory actions in response to NRC resident questions raised about RCIC vacuum breakers being isolated with RCIC line-up for automatic injection on February 8, 2006. This led to repeat occurrence of the unanalyzed condition while performing scheduled Technical Specification surveillance testing on the RCIC vacuum breakers.

**III. Analysis of Event**

This event is reportable in accordance with 10 CFR 50.73(a)(2)(ii)(B), "Any event or condition of the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety."

No actual water hammer occurred, therefore, there were no actual safety consequences associated with this condition.

There were no structures, systems or components that were inoperable during the time this condition existed that contributed to this event.

An engineering analysis determined that under non-loss of coolant accident (LOCA) conditions the forces on the piping would not likely breach the piping, but could result in damage to pipe hangers when containment pressure is normal. This analysis is consistent with operating experience in the 1970's (before vacuum breakers were installed as standard components in RCIC systems) that demonstrated water hammer events did not damage piping, but, in some cases, damaged piping components, valves and piping supports when HPCI/RCIC was shutdown with no vacuum breaker function and where no additional pressure was present in the containment.

Engineering judgment and preliminary analysis indicated that, under worst case conditions, the configuration may result in forces significantly above allowables for RCIC piping and piping components. Under design basis LOCA conditions, with the containment pressurized, operation of RCIC without the vacuum breaker function represents an unanalyzed condition. In this condition, there is an increased likelihood that piping can be breached. In this postulated scenario, the worst case could result in draining the suppression pool below the downcomers, into the lower level of the reactor building. In this case, emergency core cooling systems net positive suction head would be insufficient, reactor vessel and containment flooding post LOCA would not be possible, and there would be direct communication of the wetwell atmosphere to the reactor building.

Due to the small amount of time in this configuration (approximately 8 hours over the past year), the cumulative risk was below the threshold for the significance determination process risk significance (i.e., Green results).

Based on the above, the event did not pose a significant threat to the health and safety of the public or plant personnel.

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**IV. Corrective Actions**

**A. Action Taken to Return Affected Systems to Pre-Event Normal Status**

- When the condition was identified on February 8, 2006, the RCIC steam admission valve was closed and automatic initiation was defeated to prevent automatic start and considered unavailable until the vacuum breaker function was restored.

**B. Action Taken or Planned to Prevent Recurrence**

NOTE: There are no NRC regulatory commitments in this Licensee Event Report.

- Revisions to operating procedures, surveillance procedures, and maintenance work order files have been implemented so that these documents provide guidance to defeat the automatic initiation of RCIC if the RCIC vacuum breaker function is unavailable and to provide cautions, as applicable, about water hammer concerns.
- Operations and appropriate Engineering personnel will be briefed on water cannon/hammer mechanism and the RCIC vacuum breaker function. The brief will include discussion of the need to prevent RCIC initiation if the vacuum breaker function is lost and the potential consequences on RCIC and primary containment if a water cannon were to occur. The briefing to plant operators will describe the importance of adequate and timely response to questions in maintaining a conservative approach to issues that could impact nuclear safety.
- Operator and engineering training programs will be improved with regard to potential RCIC water hammer events and water hammer mechanisms by revising lesson plans for initial and continuing training for the RCIC system to describe water cannon initiation mechanisms. This training material will clearly describe the vacuum breaker function and the potential consequences of operating RCIC while the vacuum breaker function is unavailable.
- A list of standard questions will be developed to assist industry operating experience (OE) reviewers in maintaining a broad view when reviewing OE. The list will include questions regarding enhancing procedures to assure appropriate cautions are given to operating and surveillance procedures and questions regarding enhancing operations and engineering training.
- External OE that is screened as applicable or potentially applicable will be entered into the corrective action program or, when implemented, into a new database, as individual records and assigned a single individual for review and response.

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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

**V. Additional Information**

A. Failed Components:

None

B. Previous similar events:

None

C. Identification of components referred to in this Licensee Event Report:

<u>Components</u>	<u>IEEE 805 System ID</u>	<u>IEEE 803A Function</u>
Reactor Core Isolation Cooling System (BWR)	BN	--
High Pressure Coolant Injection System (BWR)	BJ	--
Containment Leakage Control System	BD	--
Vacuum Breaker Valves	--	CKV
Isolation Valves	--	ISV
RCIC Turbine	--	TRB