

# NINE MILE POINT UNIT 1

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*Lycoming, NY*

**Owner:** Niagara Mohawk Power Corporation

**Outage dates (duration):** December 19, 1987 to August 12, 1990 (2.6 years)

**Reactor type:** Boiling water reactor

**Reactor age when outage began:** 18.0 years

**Commercial operations began:** December 1, 1969

**Fleet status:** Oldest of two reactors owned by the company

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## Synopsis

This outage began in December 1987 when Nine Mile Point Unit 1 operators manually scrambled the reactor in response to feedwater flow fluctuations caused by vibrating piping. By the following spring, the plant's owner, Niagara Mohawk, had drawn additional NRC attention by failing to renew the licenses of reactor operators and senior reactor operators. By summer 1988, the NRC had seen enough to place Unit 1 on its Watch List. By the fall, the NRC team sent in to evaluate one fairly small but important system (core spray) had documented enough problems to keep Unit 1 shut down for months.

In summer 1989, the NRC found that Niagara Mohawk had dumped excess water into the basement of the radwaste building back in 1978, causing dozens of metal drums to spill their highly radioactive contents. It took another year for the company to resolve enough of these many issues to obtain the NRC's authorization to restart Unit 1.

## Process Changes

No discernible changes were identified.

## Commentary

In the late 1980s, the NRC handled Nine Mile Point like Dr. Jekyll and Mr. Hyde. The agency found little right with the way Niagara Mohawk operated and maintained Unit 1, but little wrong with the way it operated and maintained Unit 2.

Could two nuclear reactors sitting side by side and operated by the same management team truly perform so differently? Not likely—and not as was ultimately proven at Nine Mile Point. On August 13, 1991, Niagara Mohawk reported one of the very few Site Area Emergencies ever declared in the United States due to a design error and maintenance breakdown at Unit 2.<sup>1</sup>

### NRC Systematic Assessment of Licensee Performance (SALP) History

Date	Operations	Radiological Controls	Maintenance	Surveillance Testing	Emergency Preparedness	Fire Protection	Security	Outage Management	Quality Assurance	Licensing	Training
5/1/1981	2	3	2	2	3	2	2	2	2	n/a	n/a
9/1/1982	2	3	2	2	2	2	1	1	n/a	1	n/a
8/1/1983	2	2	2	n/a	n/a	1	1	1	n/a	1	n/a
9/1/1984	3	2	2	2	1	1	1	1	n/a	2	n/a
8/1/1985	1	1	2	1	1	1	1	n/a	n/a	1	n/a
7/1/1987	2	2	3	2	1	n/a	1	2	3	1	2
7/1/1988	2	2	2	2	1	n/a	1	n/a	3	2	2
	Operations	Radiological Controls	Maintenance/Surveillance Testing	Emergency Preparedness		Security	Engineering and Technology		Safety Assessment and Quality Verification		
7/1/1987	3	2	3	1		1	3		3		
7/1/1988	3	2	3	1		1	2		3		
	Operations		Maintenance	Engineering			Plant Support				
8/1/1991	2		2	2			2/1/1				
10/1/1992	2		2	2			2/1/1				
9/1/1993	2		2	1			2				
3/1/1995	1		2	2			2				
7/1/1996	1		2	2			2				

NOTE: A rating of 1 designated a superior level of performance where NRC attention may be reduced. A 2 rating designated a good level of performance with NRC attention at normal levels. A rating of 3 designated an acceptable level of performance where increased NRC attention may be appropriate.

#### Details

*December 19, 1987:* Operators manually scrammed Unit 1 after observing excessive vibration of the feedwater system piping. The reactor had been operating at approximately 98 percent power when fire alarms went off in the turbine building. The control room operator noticed that feedwater flow was fluctuating and dispatched an equipment operator to examine the feedwater flow control valves (FCVs). The equipment operator reported back that he “could not view the stem motion on the FCVs because both the valves and the feedwater piping were shaking violently.” Moments later, the operators in the control room could feel the floor shaking and manually scrammed the reactor. Subsequent investigation concluded that the initial fire alarms had been caused by dust shaking off the vibrating pipes, which tripped the photoelectric fire sensors.<sup>2</sup>

*March 28, 1988:* The NRC issued a Confirmatory Action Letter to Niagara Mohawk regarding problems stemming from its failure to renew licenses for reactor operators and senior reactor operators.<sup>3</sup>

*July 13, 1988:* NRC staff briefed commissioners on problem plants and added Nine Mile Point Unit 1 to its Watch List.<sup>4</sup>

*July 24, 1988:* The NRC issued a Confirmatory Action Letter to Niagara Mohawk requiring Unit 1 to remain shut down until:

1. The root causes underlying why line management had not been effective in recognizing and remedying problems were determined.
2. A restart action plan specifying measures needed to correct the root causes identified in item 1 was developed and submitted to the NRC.
3. A written report was submitted to the NRC detailing the rationale for concluding that the measures specified in item 2 had been successfully completed.<sup>5</sup>

*August 11, 1988:* *Nucleonics Week* reported that Nine Mile Point Unit 1 was the lowest-cost producer of nuclear electricity from 1985 to 1987.<sup>6</sup>

*October 14, 1988:* NRC Information Notice 88-82 alerted owners of boiling water reactors to the fact that independent measurements by NRC inspectors of torus shell thicknesses on Unit 1 fell below the minimum specified wall thickness due to corrosion.<sup>7</sup>

*October 26, 1988:* An NRC safety system functional inspection team examined the Unit 1 core spray system in preparation for restart. The team's findings included:

- The technical specifications allowed one core spray sparger to be inoperable for up to seven days, but the plant's safety analyses assumed that both core spray spargers were always available.
- Core spray system flow resistance curves non-conservatively excluded some components.
- Vortexing analyses for the core spray pumps failed to account for the close proximity of the two pump suction.
- Core spray pump curves were not controlled and were not validated by testing over the full range of expected flows.
- Potential flow diversion through the core spray pump discharge relief valve was not considered by any analysis.
- The core spray pump low-suction and discharge pressure alarms were established at values expected to be present under accident conditions, and plant procedures directed operators to stop the pumps if the alarms were present even though the system was operable.
- The core spray pump strainer high-differential pressure alarms were established at a value expected to be present under accident conditions, and plant procedures directed operators to stop the applicable pump upon receipt of the alarm.
- The emergency operating procedure for filling the torus using the core spray system would not work under the conditions expected following an accident.
- The design of the core spray piping keep-fill system did not appear to prevent water hammer during testing and post-accident conditions.
- The range of instrumentation in the control room for the core spray system was not adequate to monitor the full range of system flows expected following an accident.<sup>8</sup>

*December 21, 1988:* Niagara Mohawk submitted its Restart Action Plan for Unit 1 in response to the NRC's July 24 Confirmatory Action Letter.<sup>9</sup> The company identified five primary root causes for its problems:

1. Insufficient planning and goal setting
2. Inadequate problem identification and resolution
3. Improper management technical focus
4. Insufficient standards of performance and self-assessment
5. Lack of teamwork<sup>10</sup>

The company additionally described its plans to resolve 18 specific problems:

1. Outage management oversight
2. Maintenance of operator licenses
3. Emergency operating procedures
4. In-service inspection
5. Control of commercial-grade items
6. Fire barrier penetrations
7. Torus wall thinning
8. Scram discharge volume
9. Appendix J testing of emergency condenser and shutdown cooling valves
10. Reactor pressure vessel temperature/pressure curves
11. Erosion/corrosion program
12. Motor generator set battery chargers
13. Implementation of long-term programs related to instrumentation & control technician allegations
14. Safety system functional inspection
15. Cracks in walls and floors
16. Feedwater nozzles
17. In-service testing
18. 125 vdc system concerns<sup>11</sup>

May 10, 1989: An NRC special inspection team reported to Niagara Mohawk:

*“Several concerns warrant your prompt attention. Specifically, deficiencies noted in your corrective action programs, procedural controls, relations between Unit 1 operators and the training department personnel, and your management oversight of plant activities require immediate attention.”*<sup>12</sup>

May 24, 1989: The NRC issued its Systematic Assessment of Licensee Performance report for Nine Mile Point, commenting:

*“Poor performance by licensed operators as reflected in their understanding and ability to implement the new emergency operating procedures indicated poor training and a complacency with respect to the adequacy of the training received.”*<sup>13</sup>

August 23, 1989: NRC staff informed their managers that Niagara Mohawk, lacking sufficient tanks at Nine Mile Point to store overflow water from the reactor recirculation loops, had apparently dumped the water into the Unit 1 radwaste building's basement. At the time, the basement stored 55-gallon drums of demineralizer filter sludge and resins that were “unusually radioactive” due to prior operation with fuel cladding damage. The water level in the basement caused some of the drums to float off their pallets, and some of these drums and/or their retaining rings subsequently corroded, spilling their contents onto the water-covered basement floor.<sup>14</sup>

August 23, 1989: The NRC dispatched an Augmented Inspection Team (AIT) to the site following media reports that the Institute of Nuclear Power Operations (INPO) had criticized the company for a longstanding radiological problem in the Unit 1 radwaste building.<sup>15</sup>

August 27, 1989: The *New York Times* reported that 150 drums of radioactive sludge were in the basement because a conveyor belt used to transport the drums had jammed.<sup>16</sup>

*September 1, 1989:* The NRC's AIT reported its preliminary findings that Niagara Mohawk deliberately used the basement of the Unit 1 radwaste building to hold radioactively contaminated water in 1978. The water level caused about 150 barrels of radioactive sludge to float off their pallets and spill. In July 1981, the company pumped about 50,000 gallons of contaminated basement water (containing approximately 5.3 curies of radioactivity) into Lake Ontario. Because of the high radiation levels and the company's desire to prevent airborne contamination, it left about 12 inches of water in the basement. The company reported the release to the NRC that October, although the source of the water was not specified. In 1986, radiation levels in the Unit 1 radwaste building ranged up to 400 rem/hr.<sup>17</sup>

*September 29, 1989:* The NRC approved the Restart Action Plan submitted by the company in December 1988.<sup>18</sup>

*October 30, 1989:* The NRC conducted an enforcement conference with Niagara Mohawk regarding apparent violations stemming from the flooded radwaste basement. According to the NRC:

*"The licensee began their presentation by stating that, except for the apparent violations, the findings noted in NRC Inspection Report 50-220/89-80 were essentially correct."*<sup>19</sup>

*November 8, 1989:* The NRC's Integrated Assessment Team reported on Niagara Mohawk's progress toward completion of the tasks in the Restart Action Plan.<sup>20</sup>

*February 23, 1990:* The NRC issued a violation to Niagara Mohawk for using the radwaste building basement "as a liquid waste retention facility" but opted not to fine the company "because of the age of the violation (violation occurred in 1981) and major management changes have been made during the extended shutdown because of your past inability to identify and correct problems."<sup>21</sup>

*May 14, 1990:* NRC staff and Niagara Mohawk officials briefed NRC commissioners on the restart readiness of Unit 1.<sup>22</sup>

*July 27, 1990:* The NRC authorized Niagara Mohawk to restart Unit 1.<sup>23</sup>

*July 29, 1990:* Operators withdrew control rods to bring the reactor to criticality.<sup>24</sup>

*July 30, 1990:* Operators inserted control rods, bringing the reactor sub-critical after a leak developed inside the containment building.<sup>25</sup>

*August 2, 1990:* Operators withdrew control rods to bring the reactor to criticality.<sup>26</sup>

*August 6, 1990:* Operators inserted control rods, bringing the reactor sub-critical after a bad bearing caused the main turbine shaft to vibrate excessively as it neared the rated speed of 1,800 revolutions per minute.<sup>27</sup>

*August 11, 1990:* Operators withdrew control rods to bring the reactor to criticality.<sup>28</sup>

*August 12, 1990:* Unit 1 was connected to the electrical grid, ending the extended outage.<sup>29</sup>

*October 11, 1990:* Niagara Mohawk announced that a malfunctioning valve caused approximately 3,000 gallons of radiologically contaminated water to overflow a waste storage tank and flow into the Unit 1 radwaste building basement. This flood added about three inches of water to the two inches still remaining in the basement from the 1978 incident.<sup>30</sup>

*October 18, 1990: Nucleonics Week* reported that an INPO evaluation team at Unit 1 the previous week found that Niagara Mohawk was behind schedule on nearly 300 preventative maintenance tasks for safety-related components, that procedures were not being following by plant workers, that Niagara Mohawk was not enforcing standards of performance, that operator log books did not reflect shift events, that control room operators sat with their backs to the control panels, that auxiliary operator log sheets were not routinely reviewed, that notable differences existed between the control room simulator and the plant's control room, and that drawings of the plant differed from the actual plant layout to a sufficient degree that operators were not sure what was in the plant.<sup>31</sup>

## Notes

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- <sup>1</sup> Nuclear Regulatory Commission (NRC). 1991. Site area emergency resulting from a loss of non-class 1E uninterruptible power supplies. Information Notice No. 91-64, October 9.
- <sup>2</sup> Niagara Mohawk Power Corporation. 1988. Manual reactor scram initiated due to feedwater piping vibration. Letter to Nuclear Regulatory Commission, licensee event report no. 50-222/87-028-00, January 18.
- <sup>3</sup> Johnston, W.V. 1988. Confirmatory action letter 88-13. Letter C.V. Mangan, senior vice president, Niagara Mohawk Power Corporation, March 28. W.V. Johnston was a staffer at the Nuclear Regulatory Commission.
- <sup>4</sup> Jordan, B., and M. Sperber. 1988. Nine Mile Point-1, Fort Calhoun added to problem plant list. *Inside NRC*, July 18.
- <sup>5</sup> Russell, W.T. 1988. Confirmatory action letter 88-17. Letter to John M. Endries, president, Niagara Mohawk Power Corporation, July 24. William T. Russell was a regional administrator at the Nuclear Regulatory Commission.
- <sup>6</sup> *Nucleonics Week*. 1988. NRC problem plant is lowest-cost U.S. producer for 1985–1987, August 11.
- <sup>7</sup> NRC. 1988. Torus shells with corrosion and degraded coatings in BWR containments. Information Notice No. 88-82, October 14.
- <sup>8</sup> Varga, S.A. 1988. Safety system functional inspection (SSFI) restart findings. Letter to C.V. Mangan, senior vice president, Niagara Mohawk Power Corporation, October 26. Steven A. Varga was director of reactor projects I/II at the Nuclear Regulatory Commission.
- <sup>9</sup> Donlon, W.J. 1988. Letter to Nuclear Regulatory Commission, December 21. William J. Donlon was chairman and chief executive officer of Niagara Mohawk Power Corporation.
- <sup>10</sup> Niagara Mohawk Power Corporation. 1990. Nine Mile Point Unit 1 restart. Presentation to the Nuclear Regulatory Commission, May 14.
- <sup>11</sup> Ibid.
- <sup>12</sup> Berman, D. 1989. NiMo gets worst-ever NRC grade. *The Post Standard*, May 25.
- <sup>13</sup> Ibid.
- <sup>14</sup> Haughney, C.J. 1989. The operating reactors events meeting, August 23, 1989: Meeting 89-30. Memorandum to Charles E. Rossi, director, division of operational events assessment, Nuclear Regulatory Commission, August 24. Charles J. Haughney was chief of the events assessment branch at the Nuclear Regulatory Commission.
- <sup>15</sup> Lindeman, E. 1989. NRC's AIT finds Niagara Mohawk may have violations at Nine Mile Point. *Inside NRC*, September 11.
- <sup>16</sup> Gutis, P.S. 1989. Tainted spill at nuclear plant is investigated. *New York Times*, August 27.
- <sup>17</sup> Lindeman, 1989.
- <sup>18</sup> Niagara Mohawk Power Corporation, 1990.
- <sup>19</sup> Bellamy, R.R. 1990. Enforcement conference report no. 50-220/89-80. Letter to Lawrence Burkhardt III, executive vice president, nuclear operations, Niagara Mohawk Power Corporation, January 2. Ronald R. Bellamy was chief of facilities radiological safety and safeguards branch at the Nuclear Regulatory Commission.

- <sup>20</sup> Carr, K.C. 1990. Letter to Rosemary S. Pooler, vice president for legal affairs, Atlantic States Legal Foundation, Inc., June 21. Kenneth M. Carr was chairman of the Nuclear Regulatory Commission.
- <sup>21</sup> Russell, W.T. 1990. Notice of violation (NRC inspection report no. 50-220/89-80). Letter to Lawrence Burkhardt III, executive vice president, nuclear operations, Niagara Mohawk Power Corporation, February 23. William T. Russell was a regional administrator at the Nuclear Regulatory Commission.
- <sup>22</sup> Niagara Mohawk Power Corporation, 1990.
- <sup>23</sup> *Energy Report*. 1990. Niagara Mohawk restarts Nine Mile Point, August 6.
- <sup>24</sup> Bianchetti, A., and T. Kinne. 1990. Nine Mile 1 reactor nudged into gear. *The Post-Standard*, July 30.
- <sup>25</sup> Mulder, J.T. 1990. Leak takes Nine Mile Point 1 back down. *The Post-Standard*, July 31.
- <sup>26</sup> *The Post-Standard*. 1990. NiMo's nuke plant is running again, August 3.
- <sup>27</sup> Bianchetti, A. 1990. Bad bearing forces shutdown of Nine Mile 1. *The Post-Standard*, August 7.
- <sup>28</sup> Eimas, L. 1990. Nine Mile 1 nuclear plant makes electricity. *The Post-Standard*, August 13.
- <sup>29</sup> Ibid.
- <sup>30</sup> Burtch, Jr., R.B. 1990. Valve malfunction at Nine Mile One causes holding tank to overflow: No effect on plant safety, operation. Niagara Mohawk Power Corporation press release, October 11.
- <sup>31</sup> Lindeman, E. 1990. Nine Mile gets more bad marks as INPO says problems continue. *Nucleonics Week*, October 18.