

# CLINTON

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*Illinois, IL*

**Owner:** Illinois Power Company

**Outage dates (duration):** September 5, 1996 to May 27, 1999 (2.7 years)

**Reactor type:** Boiling water reactor

**Reactor age when outage began:** 8.8 years

**Commercial operations began:** November 24, 1987

**Fleet status:** Only reactor owned by the company

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## Synopsis

The management and operational mishandling of a fairly routine equipment problem—the degradation of a seal in one of the reactor recirculation pumps—caused the reactor to be shut down. It also caused the NRC to send in teams of inspectors who identified a long list of other problems. The company had nearly convinced the NRC it was ready to restart Clinton in August 1997. The NRC closed out the Confirmatory Action Letter it issued to track resolution of restart items in preparation for authorizing restart. But on the very next day, an electrical breaker failed at Clinton. The NRC, having just fined the company \$110,000 the previous day for not having adequately prevented recurring electrical breaker failures, was not amused. It took the company nearly two more years to re-convince the NRC that Clinton was ready to restart.

## Process Changes

Clinton was but one of seven reactors that were shut down throughout the entire year of 1997. These extended outages were reaction to the industry and NRC problems featured in *Time* magazine's cover story from March 1996 about the NRC's regulatory meltdown at the Millstone nuclear plant. Collectively, these seven reactors prompted the NRC to abandon its systematic assessment of licensee performance (SALP) process and introducing its reactor oversight process (ROP) in April 2000.

## Commentary

It doesn't take 2.7 years to repair a seal in a recirculation pump. It does, however, take a long time to repair all the problems caused by years of bad management. Clinton demonstrated an important part of the nuclear safety equation. The recirculation pump seal event that initiated the extended outage reflected an improper safety focus. Fixing the broken pump seal is a given. Fixing the improper safety focus is a given. Finding and fixing all the other safety compromises produced by years of improper safety focus is also a given. In this case, the NRC was preparing to allow Illinois Power Company to restart Clinton in August 1997 after having only addressed the broken pump seal and the improper safety focus. Fortunately, another manifestation of the many undetected—and uncorrected—safety problems caused by improper safety focus in the past revealed itself and forced the NRC to defer restart.

## 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
11/1986	2	2	3	n/a	2	2	2	n/a	3	2	n/a
01/1988	2	2	2	2	2	2	2	n/a	2	1	2
	Operations	Radiological Controls	Maintenance/Surveillance Testing		Emergency Preparedness	Security	Engineering and Technology		Safety Assessment and Quality Verification		
01/1989	2	2	2		2	1	2		2		
03/1990	2	2	2		1	2	3		2		
	Operations		Maintenance		Engineering		Plant Support				
06/1991	2		2		2		2/2/1				
08/1992	1		2		2		1/2/1				
01/1994	1		1		2		2				
08/1995	2		1		2		1				

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

*April 9, 1996:* After the failure of an electrical transformer triggered an automatic shutdown of the reactor, plant management opted to keep the unit in hot standby condition to minimize the duration of the outage. As a result, the safety relief valves were degraded from having cycled open/closed 85 times.<sup>1,2</sup>

*June 1996:* Management again elected to maintain the unit in a hot standby condition following an automatic reactor shutdown. After the event that occurred later that year, on September 5, the NRC cited this June shutdown as a missed opportunity for finding the recirculation pump seal problem and fixing it before it failed.<sup>3</sup>

*September 5, 1996:* Responding to an increasing leak from the B recirculation pump seal, operators attempted to place the reactor into single loop operation so as to be able to isolate the B pump. Those efforts were not occurring fast enough, so shift supervisors directed the operators to take steps inconsistent with both approved procedures and vendor recommendations. Those steps failed to prevent the leak rate from exceeding the five gallon per minute (gpm) Technical Specification limit. A Notice of Unusual Event was declared based on the leak and the reactor entered a four-hour Limiting Condition for Operation. Shift supervisors directed additional “shortcuts” from approved procedures in an attempt to reduce the leak rate back below the five gallon-per-minute limit. Those steps caused the seal to fail. The leak rate exceeded the range of the instrument monitoring leakage.

When the next shift arrived and used other means to determine the actual leak rate, an alert was not declared despite the criteria for this emergency classification being met. Six hours into the four-hour Limiting Condition for Operation, the shift supervisors finally gave up trying to reduce the leak rate and ordered the reactor shut down. Problems persisted after the reactor was shut down. When the feedwater system was placed in cleanup mode, equipment was operated in violation of approved procedures resulting in lubricating oil not being supplied to the bearings of the feedwater pump.<sup>4</sup>

*September 11, 1996:* The NRC issued Confirmatory Action Letter RIII-96-013 detailing tasks related to the recirculation pump seal leakage event that had to be completed prior to the reactor's restart.<sup>5</sup>

*September 12, 1996:* The NRC announced it was dispatching a special team to Clinton to investigate the shutdown necessitated by excessive recirculation pump seal leakage.<sup>6</sup>

*October 14, 1996:* The company transitioned the maintenance outage into a scheduled refueling outage.<sup>7</sup>

*November 11, 1996:* To resolve a maintenance work request initiated on April 20, 1995, about leakage from the manual isolation valves on the B reactor recirculation loop drain line, workers applied a freeze seal blanket around the piping upstream of the valves. The high temperature water in the piping prevented the blanket from completely freezing the water in the piping to form a secure "plug" for the work on the valves. So workers applied a second freeze seal blanket upstream of the first freeze seal blanket. A solid "plug" was formed and the maintenance work completed. An NRC inspection later determined the use of the second freeze seal blanket violated plant procedures and federal regulations because the engineering analysis had been for only one freeze seal and applying the second freeze seal put the piping at risk of brittle fracture.<sup>8</sup>

*November 19, 1996:* The NRC notified the company of the results from two separate but related inspections conducted by the NRC following the September 5 event. The NRC conducted a special inspection into the recirculation pump seal failure and an Operational Safety Team Inspection into operator performance issues identified during the special inspection. The NRC reported, "It appears that plant management and staff made decisions which placed plant production ahead of plant operational safety."<sup>9</sup>

*January 8, 1997:* The company estimated that the reactor would be ready to restart on January 10th and would be producing electricity again sometime between January 13 and January 31.<sup>10</sup>

*January 9, 1997:* The NRC issued Confirmatory Action Letter RIII-97-001 detailing tasks related to the recirculation pump seal leakage event that had to be completed prior to the reactor's restart.<sup>11</sup>

*January 24, 1997:* The company announced that unforeseen maintenance work had delayed restart of the reactor and did not provide a new projected restart date.<sup>12</sup>

*January 27, 1997:* Following the senior management meeting early in the month, the NRC notified Illinois Power Company by letter that safety performance at Clinton was in an adverse trend.<sup>13</sup>

*March 13, 1997:* The NRC issued a Restart Action Plan for Clinton under Manual Chapter 0350.<sup>14</sup>

*June 9, 1997:* The NRC issued Confirmatory Action Letter RIII-97-006 detailing tasks related to degraded coatings inside reactor containment that had to be resolved prior to the reactor's restart.<sup>15</sup>

*June 10, 1997:* The NRC announced it was proposing a \$450,000 fine on Illinois Power Company for a long list of violations identified by the NRC in inspections conducted after the September 5 event: two violations for inadequate performance during the September 5 event (\$200,000), 17 violations of operating and radiation protection procedures (\$100,000), two violations where design requirements for the emergency diesel generators were not properly incorporated into the calibration of time delay relays (\$50,000), seven violations involving inadequate safety evaluations for proposed changes to the facility (\$50,000), and two violations for inadequate corrective actions following determination that the feedwater system containment isolation valves would not close properly to prevent the flow of contaminated water or steam (\$50,000). The NRC reported the company's actions demonstrated a "careless disregard" for procedural requirements.<sup>16</sup>

*June 23, 1997:* The NRC stated in its SALP report:

*“Illinois Power’s management had not provided sufficient oversight to ensure the program for problem identification and corrective action was effective and that management often did not understand the significance of hardware issues and did not ensure that effective measures were taken to address the issues.”*<sup>17</sup>

*July 15, 1997:* The NRC closed its Restart Action Plan for Clinton in preparation for restart of the reactor.<sup>18</sup>

*August 4, 1997:* The NRC proposed a \$110,000 fine on Illinois Power Company for failure to take adequate corrective action to ensure electrical circuit breakers were properly maintained and to prevent the use of incorrect lubricants and cleaning fluids. An NRC inspection found that workers had been using the wrong lubricants and improper cleaning materials for the circuit breakers, resulting in hardened grease that prevented the circuit breakers from functioning properly.<sup>19</sup>

*August 4, 1997:* The NRC closed Confirmatory Action Letters RIII-96-013, RIII-97-001, and RIII-97-006 via a letter from Regional Administrator A. Bill Beach to Senior Vice President John G. Cook.<sup>20</sup>

*August 5, 1997:* The NRC dispatched an Augmented Inspection Team to Clinton to investigate the failure of a safety-related circuit breaker to open when operators attempted to open it. With the plant shut down, operators were re-aligning pumps used to cool the reactor core. They started a second pump, verified it was running properly, and attempted to shut down the first pump. But the circuit breaker failed to open when signaled to do so by the operators. A similar circuit breaker had also malfunctioned on July 22.<sup>21</sup>

*August 6, 1997:* The NRC issued Confirmatory Action Letter RIII-97-009 detailing tasks to be completed related to the electrical circuit breaker problems.<sup>22</sup>

*August 26, 1997:* Illinois Power Company announced it had retained an independent group of 20 experts to conduct an integrated safety assessment (ISA) at Clinton. An NRC spokesperson stated that the company “volunteered” to conduct the ISA rather than have the NRC perform a diagnostic evaluation at Clinton.<sup>23</sup>

*August 27, 1997:* The NRC announced it had chartered a special evaluation team to assess the performance of Illinois Power Company in operating the Clinton nuclear plant. The 10-person team was tasked with examining operations, training, maintenance, engineering design, technical support, radiation protection, and management at the site.<sup>24</sup>

*September 26, 1997:* The NRC issued a Demand For Information to Illinois Power Company requesting a description of the root case for past problems with the corrective action and preventative maintenance programs at Clinton along with planned program improvements. The demand resulted from the NRC’s Augmented Inspection Team evaluation of circuit breaker malfunctions occurring on July 22 and August 5.<sup>25</sup>

*November 24, 1997:* The NRC issued the report by its Augmented Inspection Team on the circuit breaker events that occurred on July 22 and August 5.<sup>26</sup>

*January 2, 1998:* The NRC issued the report from its Special Evaluation Team. The report concluded that the independent safety assessment conducted at Clinton in fall 1997 had been effective. The four root causes of problems at Clinton were determined to be:

1. Management generally did not establish and implement effective performance standards.
2. Programs, processes, and procedures failed to consistently provide defense-in-depth to assure plant activities were conducted in a safe manner.

3. Problem identification was inconsistent and corrective actions were generally ineffective.
4. Management did not provide an infrastructure suitable to support major changes.<sup>27</sup>

*January 5, 1998:* Illinois Power Company announced that PECO Energy Company had been retained to provide management services at Clinton.<sup>28</sup>

*January 15, 1998:* NRC informed Illinois Power Company that Clinton had been placed on the watch list.<sup>29</sup>

*February 3, 1998:* Illinois Power Company announced several management changes at Clinton.<sup>30</sup>

*February 13, 1998:* Illinois Power Company declared an alert following a loss of shutdown cooling at Clinton. A power supply system failure de-energized the pump in the cooling water system. After power was recovered, the cooling water system was vented of air and refilled with water prior to re-establishing cooling of the reactor core.<sup>31</sup>

*February 19, 1998:* Illinois Power Company submitted a Plan For Excellence to the NRC describing actions for providing effective management oversight, improved communications, proper safety culture, better training, safe conduct of operations, effective corrective actions, better work management, effective preventative maintenance, reduced backlogs of maintenance and testing, and organizational effectiveness.<sup>32</sup>

*July 14, 1998:* The NRC re-opened and reissued its Restart Action Plan for Clinton and developed a Case Specific Checklist to track items that had to be completed by Illinois Power Company and verified by the NRC prior to restart.<sup>33</sup>

*Fall 1998:* A significant number of the NRC-licensed control room operators failed their re-qualification examinations.<sup>34</sup>

*April 20, 1999:* The NRC completed its verification that all items on the Case Specific Checklist had been closed.<sup>35</sup>

*April 20-21, 1999:* The NRC regional administrator briefed the executive director for operations during the senior management meeting about authorizing restart of the reactor.<sup>36</sup>

*April 27, 1999:* The NRC's status of tasks completed and verified prior to restart reported that NRC inspector intervention was required for the company to assess a large backlog of procedure changes. Approximately 3,000 changes to procedures had been identified but not yet implemented due to resource limitations. When the company assessed the backlog in response to the NRC inspector's questions, approximately 170 procedure changes were identified as needing to be incorporated prior to restart.<sup>37</sup>

*April 27, 1999:* The NRC issued three letters to Illinois Power Company. One letter closed Confirmatory Action Letter RIII-97-009 on the malfunctioning electrical circuit breakers. One letter closed out the Demand For Information on the corrective action and preventative maintenance programs. And the third letter authorized the reactor's restart.<sup>38</sup>

*May 14, 1999:* Operators manually shut down the reactor from four percent power when a feedwater regulating valve malfunctioned causing a water level transient inside the reactor vessel that automatically tripped the feedwater pump on high water level.<sup>39</sup>

*May 27, 1999:* The unit was connected to the electrical grid to end its extended outage.<sup>40</sup>

## Notes

- <sup>1</sup> Nuclear Regulatory Commission (NRC). 1996. Daily Event Report No. 30253. April 9.
- <sup>2</sup> Beach, A.B. 1996. Letter to John G. Cook, senior vice president, Illinois Power Company, November 19. A. Bill Beach was regional administrator at the NRC.
- <sup>3</sup> Beach, 1996.
- <sup>4</sup> Ibid.
- <sup>5</sup> Ibid.
- <sup>6</sup> NRC. 1996. NRC staff to conduct special team inspection of Sept. 6 shutdown at Clinton Power Station. Press Release No. RIII-96-53. Lisle, IL. September 12.
- <sup>7</sup> Swiech, P. 1997. Clinton plant restart delayed. *The Pantagraph*, January 25.
- <sup>8</sup> Romberg, W.D. 1997. Revision to Reply to a Notice of Violation Contained in Inspection Report 50-461/97006 (DRP). Letter to the NRC, September 30. Wayne D. Romberg was assistant vice president of Illinois Power Company.
- <sup>9</sup> Beach, 1996.
- <sup>10</sup> Swiech, 1997.
- <sup>11</sup> NRC. 1997a. NRC manual chapter 0350 restart action plan for Clinton Power Station. Lisle, IL. April 27.
- <sup>12</sup> Swiech, 1997.
- <sup>13</sup> NRC, 1997a.
- <sup>14</sup> Ibid.
- <sup>15</sup> Ibid.
- <sup>16</sup> NRC. 1997b. NRC staff proposes \$450,000 fine against Illinois Power Co. for violations at Clinton Nuclear Power Station. Press Release No. RIII-97-55. Lisle, IL. June 10.
- <sup>17</sup> NRC, 1997a.
- <sup>18</sup> Ibid.
- <sup>19</sup> NRC. 1997c. NRC Staff Proposes \$110,000 Fine Against Illinois Power Co. for Circuit Breaker Maintenance at Clinton Nuclear Plant. Press Release No. RIII-97-71. Lisle, IL. August 4.
- <sup>20</sup> NRC, 1997a.
- <sup>21</sup> NRC. 1997d. NRC Augmented inspection team to review circuit breaker failure at Clinton nuclear plant. Press Release No. RIII-97-72. Lisle, IL. August 5.
- <sup>22</sup> NRC, 1997a.
- <sup>23</sup> Weil, Jenny. 1997. NRC special team to monitor Clinton's performance evaluation. *Inside NRC*, September 1.
- <sup>24</sup> NRC. 1997e. Special NRC team to evaluate performance at Clinton nuclear power plant. Press Release No. RIII-97-78. Lisle, IL. August 27.
- <sup>25</sup> *Inside NRC*. 1997. IP asked to demonstrate corrective action program improvements. October 13.
- <sup>26</sup> NRC, 1997a.
- <sup>27</sup> Ibid.

<sup>28</sup> Ibid.

<sup>29</sup> Ibid.

<sup>30</sup> Ibid.

<sup>31</sup> NRC. 1998. Daily Event Report No. 33710, February 13.

<sup>32</sup> NRC, 1997a.

<sup>33</sup> Ibid.

<sup>34</sup> Ibid.

<sup>35</sup> Ibid.

<sup>36</sup> Ibid.

<sup>37</sup> Ibid.

<sup>38</sup> NRC. 1999. NRC staff finds improvements at Clinton nuclear power plant sufficient for resumption of operation. Press Release No. RIII-99-29, April 27.

<sup>39</sup> NRC. 1999. Daily Event Report No. 35715, May 14.

<sup>40</sup> Burghart, T. 1999. Clinton nuclear plant producing power again. Associated Press, May 28.