

# PEACH BOTTOM UNIT 2

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## *Delta, PA*

**Owner:** Philadelphia Electric Company

**Outage dates (duration):** March 31, 1987 to May 22, 1989 (2.1 years)

**Reactor type:** Boiling water reactor

**Reactor age when outage began:** 12.7 years

**Commercial operations began:** July 5, 1974

**Fleet status:** Second oldest of four reactors owned by the company

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## Synopsis

Peach Bottom Unit 2 had been shut down for 14.5 months between April 1984 and July 1985 for replacement of recirculation system piping. Operation following restart from this extended outage was marked by frequent forced outages to repair equipment problems. The frequency of these forced outages and the theme of recurring equipment problems garnered the attention of both the NRC and the Institute of Nuclear Power Operations (INPO).

In August 1986, after getting a bad Systematic Assessment of Licensee Performance (SALP) report on Peach Bottom from the NRC, Philadelphia Electric Company (PECo) committed itself to bringing in experienced General Electric (GE) engineers to mentor control room crews until sufficient personnel could be trained and qualified to ease staffing problems at the plant. In March 1987, one or more of the GE mentors informed the NRC that control room operators, sometimes the entire complement, routinely slept on the job. After the NRC substantiated the claims, it ordered PECo to shut down both reactors in March 1987.

Concerned that PECo's efforts were treating the symptoms of Peach Bottom's problems and not their causes, INPO's president argued before PECo's board of directors in August that, without fundamental changes at the corporate level, recent positive changes at Peach Bottom would likely not be sustained. PECo's senior management fought back, contending in September that, based on another recent appraisal by an independent company, INPO was wrong. INPO contacted that independent company and learned that PECo's senior management had misrepresented its findings.

INPO kept up the pressure, and in February 1988, PECo's president and chief operating officer announced his early retirement. The following month, PECo's chairman and chief executive officer followed suit. It took the new management team another year to correct the programmatic problems at Peach Bottom and obtain the NRC's permission to restart both reactors.

## Process Changes

The Commonwealth of Pennsylvania formally intervened in the Peach Bottom restart proceedings and the governor frequently decried the NRC's lack of criteria for determining when a troubled plant can be safely restarted. Following this extended outage, the NRC formalized its process for overseeing activities during

such outages. That process, called the Manual Chapter 0350 process for its location within the agency's Inspection Manual, was subsequently applied by the agency during extended outages at Donald C. Cook (Michigan), Salem (New Jersey), and Davis-Besse (Ohio).

## Commentary

Personal experience tells us that the lessons of Peach Bottom were not shared within the nuclear industry. Prior to joining the Union of Concerned Scientists in 1996, the author worked for many years as a consultant in the nuclear industry. In April 1988, he reported to the Hope Creek nuclear plant in New Jersey to fill in for an engineer who had been loaned to PECO to assist with the Peach Bottom restart. Here and at numerous other plants in which the author worked in subsequent years, Peach Bottom's problems were perceived not as the result of ineffective leadership that INPO and the NRC were right to confront, but as the NRC's overreaction to atypical but not unprecedented control room antics.

This misperception prevented operators at the Salem facility from learning to identify and fix root causes and thus avoid repetitive failures. It prevented senior management at Millstone in Connecticut from learning not to delude itself about warnings by INPO and the NRC. And it prevented senior management at Davis-Besse from learning not to reject clear evidence of problems and resist change. It's too late to learn the lessons that could have prevented these extended outages, but it's never too late to learn the lessons that can prevent future outages.

## 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	
07/1980	2	n/a	3	2	2	2	3	2	3	n/a	n/a	
09/1981	2	2	2	1	2	3	2	1	2	n/a	n/a	
10/1982	2	3	2	2	2	3	2	2	n/a	1	n/a	
09/1983	2	3	2	3	1	3	1	2	n/a	2	n/a	
05/1984	2	2	2	2	2	2	1	2	n/a	1	n/a	
06/1985	2	3	1	2	2	2	3	1	n/a	1	n/a	
06/1986	2	2	2	2	2	2	3	1	3	2	2	
12/1987	n/a	2	2	2	2	3	2	n/a	n/a	2	n/a	
	Operations	Radiological Controls	Maintenance/Surveillance Testing	Emergency Preparedness	Security	Engineering and Technology	Safety Assessment and Quality Verification					
12/1988	2	2	2	2	3	1	2					
02/1990	2	2	2	1	2	2	2					
10/1990	2	2	2	1	1	2	2					
	Operations		Maintenance	Engineering			Plant Support					
12/1991	2		2	2			2/1/1					
03/1993	2		2	2			2/1/1					
06/1994	1		2	2			2					
12/1995	1		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

*December 1984:* INPO found clear evidence of declining performance at Peach Bottom and expressed concerns about corporate support, supervision, standards, and “culture” to PECO’s chief executive officer and chief operating officer.<sup>1</sup>

*July 6, 1985:* Following a year-plus outage to replace recirculation system piping, operators withdrew control rods and achieved reactor criticality. Shortly thereafter, two intermediate range monitors (IRMs) were found to be inoperable and operators shut down the reactor.<sup>2</sup>

*July 7, 1985:* Operators restarted the reactor and conducted startup testing.<sup>3</sup>

*July 13, 1985:* Unit 2 was connected to the electrical grid, ending the year-plus outage.<sup>4</sup>

*July 18, 1985:* Operators shut down the reactor due to high vibration of the main turbine. During this maintenance outage, workers also repaired the B reactor feedwater pump.<sup>5</sup>

*July 19, 1985:* Operators restarted the reactor.<sup>6</sup>

*July 22, 1985:* Operators shut down the reactor after identifying a leak from an instrument line on the C reactor feedwater pump.<sup>7</sup>

*July 24, 1985:* Operators restarted the reactor.<sup>8</sup>

*July 30, 1985:* Operators reduced the power level of the reactor after main steam line radiation levels increased following an injection of condensate system resin into the reactor vessel.<sup>9</sup>

*July 31, 1985:* Operators reduced the power level of the reactor so the A reactor feedwater pump could be removed from service for repairs to its turbine exhaust rupture disc.<sup>10</sup>

*August 2, 1985:* The reactor achieved 100 percent power for the first time since the year-plus outage for recirculation system piping replacement.<sup>11</sup>

*August 5, 1985:* The reactor automatically scrammed during turbine control valve testing.<sup>12</sup>

*August 7, 1985:* Operators restarted the reactor, which automatically scrammed on an IRM reading of high flux.<sup>13</sup>

*August 8, 1985:* Operators restarted the reactor.<sup>14</sup>

*August 12, 1985:* Operators shut down the reactor when one emergency diesel generator and one loop of the residual heat removal system were determined to be inoperable at the same time.<sup>15</sup>

*August 13-18, 1985:* Operators restarted the reactor.<sup>16</sup>

*August 19, 1985:* Operators shut down the reactor when one emergency diesel generator and one loop of the residual heat removal system were again determined to be inoperable at the same time.<sup>17</sup>

*August 20-25, 1985:* Operators restarted the reactor.<sup>18</sup>

*August 26, 1985:* The reactor automatically scrammed when a worker returned a reactor pressure transmitter to service, generating a false high-pressure signal.<sup>19</sup>

*August 26-29, 1985:* Operators restarted the reactor.<sup>20</sup>

*September 19, 1985:* Operators shut down the reactor when one emergency diesel generator and one loop of the residual heat removal system were again determined to be inoperable at the same time.<sup>21</sup>

*September 23, 1985:* A chemistry technician drowned while obtaining a water sample in the plant's discharge canal. Pennsylvania State Police divers recovered his body two days later.<sup>22</sup>

*September 24, 1985:* With the reactor shut down, an operator error resulted in an automatic reactor scram signal on low water level in the reactor vessel.<sup>23</sup>

*October 4, 1985:* Operators restarted the reactor.<sup>24</sup>

*October 17, 1985:* The reactor automatically scrammed on low reactor vessel water level caused by a feedwater system problem.<sup>25</sup>

*October 18, 1985:* Operators restarted the reactor.<sup>26</sup>

*November 29, 1985:* During a planned maintenance shutdown, the reactor automatically scrammed during troubleshooting of the turbine stop valves.<sup>27</sup>

*December 24, 1985:* Operators restarted the reactor following an approximately month-long maintenance outage in which workers replaced the impellers and wear rings on the residual heat removal pumps, replaced mechanical snubbers on piping, modified equipment for environmental qualification purposes, and conducted preventative maintenance.<sup>28</sup>

*December 26, 1985:* The reactor automatically scrammed from 44 percent power during troubleshooting of the reactor feedwater level control system. A waterhammer caused a leak in the reactor feedwater pump suction piping.<sup>29</sup>

*December 29, 1985:* Operators restarted the reactor.<sup>30</sup>

*January 1, 1986:* The reactor automatically scrammed from 90 percent power when a high water level in the moisture separator resulting from a personnel error tripped the main turbine.<sup>31</sup>

*January 2, 1986:* Operators restarted the reactor.<sup>32</sup>

*January 3, 1986:* INPO's president sent a letter to PECO's chief executive officer stating that "standards of performance at the station are unacceptably low" and provided examples of attitude and management problems.<sup>33</sup>

*January 14, 1986:* Operators shut down the reactor for maintenance. During the ensuing outage, workers repaired leaking tubes in the main condenser, two IRMs, the reactor feedwater pump minimum flow valves, and the C1 condenser water box inlet valve.<sup>34</sup>

*January 18, 1986:* Operators restarted the reactor, but shut it back down when three control rods drifted in the core.<sup>35</sup>

*January 19, 1986:* Operators restarted the reactor.<sup>36</sup>

*January 24, 1986:* The reactor automatically scrammed from 95 percent power after an emergency diesel generator tripped (due to an electrical transient that closed the main steam isolation valves).<sup>37</sup>

*April 14, 1986:* INPO's president met privately with PECO's chief executive officer and chief operating officer to express concern over a March 18 event at Peach Bottom caused in part by a lack of training on similar events at other facilities.<sup>38</sup>

May 7, 1986: After a small INPO team conducted a “progress check” visit to Peach Bottom as a follow-up to a December 1985 report, INPO’s president conveyed the team’s concerns in writing to PECO’s chief executive officer.<sup>39</sup>

May 20, 1986: The NRC formally notified plant owners of the significant degradation of impeller wear rings for the residual heat removal pumps at Peach Bottom Units 2 and 3.<sup>40</sup>

June 6, 1986: The NRC issued its SALP report for Peach Bottom, which concluded:

*“During this assessment period performance problems continued to manifest themselves at Peach Bottom. Management involvement and effectiveness toward improving operating activities have not been evident. Indications of the lack of adequate management involvement and effectiveness include: poor dissemination of management goals and policies; poor communication between the different departments and divisions; and a focus on compliance rather than acknowledgement and correction of the root causes of problems.”<sup>41</sup>*

June 12, 1986: The NRC’s executive director for operations wrote to PECO’s chief executive officer concerning the Peach Bottom SALP report and asked that the CEO and senior corporate officials meet with NRC senior management to discuss it.<sup>42</sup>

August 1, 1986: NRC senior management met with PECO senior management to discuss plans to improve performance at Peach Bottom. Dr. Thomas Murley, NRC regional administrator, said of this meeting:

*“We wanted to make sure that they understood crystally clear that we had concerns on Peach Bottom. At that meeting, we got assurances from the chairman of the board on down that they were going to improve the operation.”<sup>43</sup>*

August 12, 1986: PECO responded in writing to the NRC’s SALP report and committed itself to undertaking measures to address the identified shortcomings, such as:

*“Shift professional personnel will be supplemented with certified BWR engineers provided by the Nuclear Steam System Supplier [General Electric]. These engineers will assist shift supervision during the coming period of training and qualification of personnel directed towards meeting quota.”<sup>44</sup>*

September 2, 1986: The NRC sent PECO the report from the agency’s Diagnostic Team Inspection of Peach Bottom (conducted by 10 NRC staffers from June 18 to July 3). The NRC concluded:

*“We continue to believe that the programs at Peach Bottom are fundamentally sound and basically acceptable. However, an assessment of our inspection findings indicates that there are certain underlying factors that inhibit improvements in the overall performance of Peach Bottom. One such factor is your dependence on third parties to identify problems rather than implementing proactive internal methods to assess site program effectiveness, self-identify weaknesses and implement effective long-range actions. Another factor is an apparent attitude that identified weaknesses will somehow be resolved by corrective action plans without aggressive followup and oversight by managers.”<sup>45</sup>*

October 20, 1986: PECO responded in writing to the NRC’s Diagnostic Team Inspection report, stating:

*“We believe that the plant is being operated safely. We can understand your perception relating to our dependence on third parties to identify problems because of findings made by your inspectors as well as comments made by INPO. We do believe, however, that if it were not for the current heavy workload which*

*is directed towards correcting deficiencies stemming from plant staff involvement in pipe replacement and repair, that the staff would be in a more proactive mode relating to the identification of problems.... Also, we believe some of our perceived weaknesses in aggressively following up corrective action plans stem from these same causes.”<sup>46</sup>*

*November 1986:* The NRC’s chairman and executive director for operations met privately with PECO’s chief executive officer regarding concerns about performance at Peach Bottom.<sup>47</sup>

*November 12, 1986:* An INPO evaluation concluded that improvement had been observed in some areas but noted a large number of events caused by “inadequate management guidance and supervisory oversight of plant operators.”<sup>48</sup>

*March 24, 1987:* The NRC received information from someone working at Peach Bottom that control room operators had been sleeping while on duty in the control room. The NRC launched a special safety inspection of Peach Bottom including 24-hour coverage of the control room.<sup>49</sup>

*March 31, 1987:* The NRC ordered PECO to shut down Unit 3 immediately and keep it shut down until the agency was satisfied that measures had been taken to improve conditions. A special NRC inspection determined that one or more control room operators had been sleeping on the job and that plant management either knew about it or should have known about it. Victor Stello, the NRC’s executive director for operations, wrote in the order:

*“I have determined that continued operations of the facility is an immediate threat to the public health and safety.”<sup>50</sup>*

*April 2, 1987:* An editorial in the *Washington Post* concluded:

*“It’s deeply heartening to see the Nuclear Regulatory Commission throw its large and heavy rule book at a utility whose reactor operators, it charges, were asleep on the job—literally.... The NRC’s shutdown of the Peach Bottom machine is reassuring.”<sup>51</sup>*

*April 10, 1987:* PECO’s CEO, saying his job was on the line, replaced the big reclining chairs in Peach Bottom’s control room with less comfortable low-back chairs.<sup>52</sup>

*May 11, 1987:* The NRC notified all plant owners that it had ordered PECO to shut down both reactors at Peach Bottom because licensed operators were sleeping while on duty.<sup>53</sup>

*August 7, 1987:* PECO submitted its “Peach Bottom Commitment to Excellence Action Plan” to the NRC, identifying the root causes of the problems as:

- “Poor leadership by plant management
- Failure to initiate timely licensed operator replacement training programs
- A station culture, which had its roots in fossil and pre-TMI operations, that had not adapted to changing nuclear requirements
- Slowness on the part of corporate management to recognize the developing severity of these problems and take sufficient corrective action”<sup>54</sup>

August 28, 1987: INPO's president made a presentation to the Special (Nuclear Oversight) Committee of PECO's board of directors, commenting:

*"The fundamental approach to nuclear operational management at Philadelphia Electric Company has not changed, and is unlikely to change noticeably in the foreseeable future. The underlying problems at Peach Bottom will be slow to change because of the absence of fundamental changes at corporate. Changes that do occur as a result of the Action Plan are not likely to be sustained."*<sup>55</sup>

September 10, 1987: PECO's chief operating officer met with INPO's president to rebut the points made at the August 28 board meeting. The COO stated that INPO's concern about corporate management problems was unfounded based on an evaluation performed by an outside consultant, Management Analysis Company.<sup>56</sup>

September 11, 1987: The president of Management Analysis Company (MAC) spoke with INPO's president by phone, expressing his concerns about PECO's corporate management and the narrowly targeted corrective actions. MAC's president said he had communicated these concerns to PECO's chief executive officer and chief operating officer weeks ago.<sup>57</sup>

September 11, 1987: An unnamed senior NRC official contacted a member of the Industry Panel created by PECO in April to convey the agency's concern that PECO's plan attempted to blame all of the performance problems on the Peach Bottom operators without any acceptance of responsibility by corporate management.<sup>58</sup>

September 14, 1987: NRC staff and PECO officials briefed commissioners on the status of Peach Bottom recovery efforts. PECO sought the agency's approval to restart Peach Bottom Unit 2 by late October since the root cause of the problems had been identified. NRC Chairman Lando W. Zech, Jr. disagreed, stating:

*"I would submit that your corporate-management problems are just as serious. I need personally to hear from you more than I've heard today... I need results. Part of the problem, as I can see, is leadership, right from the top down."*<sup>59</sup>

October 8, 1987: The NRC responded to PECO's "Commitment to Excellence" plan, concluding that the plan failed to address "a fundamental concern regarding the past inability of Philadelphia Electric Company (PECO) to self-identify problems, and implement timely and effective corrective actions."<sup>60</sup>

November 10, 1987: A federal grand jury indicted several Peach Bottom employees for allegedly distributing illegal drugs to other employees.<sup>61</sup>

November 19, 1987: PECO submitted a license amendment request to the NRC for a reorganization of Peach Bottom and its corporate management structure.<sup>62</sup>

November 25, 1987: PECO submitted Revision 1 of its "Peach Bottom Commitment to Excellence Action Plan" to the NRC.<sup>63</sup>

December 2, 1987: The Commonwealth of Pennsylvania petitioned the NRC under Title 10 of the Code of Federal Regulations (CFR) Part 2.206 for a hearing to consider the proposed reorganization at PECO and Peach Bottom.<sup>64</sup>

December 4, 1987: Responding to reports that improper actions by operators and others at Peach Bottom were more widespread and serious than presented, a member of PECO's Industry Panel called the chief operating officer and requested that INPO be given access to the company's internal investigation materials. The request was denied.<sup>65</sup>

*December 7, 1987:* INPO's president asked PECO's chief operating officer for access to the company's internal investigation materials. The request was "met with strong resistance." INPO's president insisted that his organization had an inherent right to know the relevant facts in order to appraise safety performance. PECO's COO agreed to permit INPO's corporate team manager to review the materials at PECO headquarters.<sup>66</sup>

*December 10, 1987:* INPO's corporate team manager reviewed PECO's internal investigation materials and learned that the problems at Peach Bottom had been more widespread and serious than previously reported. Some of the unreported problems included:

- Occasions when the control room was not manned as required by technical specifications
- One occasion when only one person was in the control room with both reactors at power
- Another occasion when all personnel in the control room were asleep
- One instance where a General Electric engineer assigned to a shift with an operator was not permitted in the control room area
- One instance where a PECO quality assurance inspector assigned to monitor shift turnover was "kicked out" of the control room prior to shift turnover
- Reading of non-technical material was pervasive and not confined to control room operators
- Operators displayed a hostile attitude toward management
- A radwaste shift operator slept on a table in the radwaste control room covered by a coat
- Non-licensed operators locked themselves in their "shack" in the turbine building so they could sleep without being observed<sup>67</sup>

*December 23, 1987:* The NRC issued a temporary waiver of compliance authorizing PECO to implement its corporate and station reorganization immediately without formal approval by NRC commissioners.<sup>68</sup>

*December 23, 1987:* The NRC issued a proposed finding of "no significant hazard" regarding the proposed management changes at PECO and Peach Bottom, and gave the interested parties until January 22, 1988, to file for intervention.<sup>69</sup>

*January 11, 1988:* INPO's president wrote to the chairman of the Special (Nuclear Oversight) Committee of PECO's board of directors:

*"It is ironic to note that the company's current dilemma stems directly from an effort to improve professionalism in the control room by measures outside the line organization. Specifically, the six General Electric engineers that were hired under contract in late 1986 were assigned to each shift by PECO management to assist in upgrading operator professionalism. The operators strongly resented these 'outsiders,' and their resentment probably exacerbated their unprofessional behavior. (Ultimately the GE engineers 'blew the whistle' by reporting operator conduct to the NRC, after attempts to improve the situation by informing PECO management were unsuccessful.)"*<sup>70</sup>

*January 15, 1988:* The NRC denied the Commonwealth of Pennsylvania's December 2, 1987, petition, stating that the petition was untimely. The NRC urged the Commonwealth to submit a petition pursuant to 10 CFR 2.206.<sup>71</sup>

*January 22, 1988:* The Commonwealth of Pennsylvania responded to the NRC's denial of its petition by pointing out that it was not contesting the NRC's shutdown order but rather its finding of "no significant hazards" for the PECO and Peach Bottom reorganization. The Commonwealth based its contention on provisions in the technical specifications for management structure and responsibilities at Pennsylvania's Susquehanna and Three Mile Island facilities that were absent in Peach Bottom's specifications.<sup>72</sup>



*January 29, 1988:* PECO forwarded an extremely critical report by INPO to the NRC. The INPO report blamed corporate management for the depth and breadth of problems at Peach Bottom and concluded that nothing had really changed at Peach Bottom since the NRC-ordered shutdowns.<sup>73</sup>

*February 1, 1988:* At a special meeting, PECO's board of directors accepted the early retirement of President and Chief Operating Officer John H. Austin, Jr.<sup>74</sup>

*March 7, 1988:* PECO Chairman and Chief Executive Officer J. Lee Everett announced his early retirement and the company hired Joseph F. Paquette, Jr. to replace him. PECO also hired Corbin A. McNeill, Jr. to be its executive vice president for nuclear operations.<sup>75</sup>

*May 26, 1988:* Maryland Governor William Donald Shafer provided written comments on the Peach Bottom restart plan to the NRC's regional administrator, stating, "I have repeatedly asked the NRC to establish restart criteria against which to judge PECO's efforts," and then asked once more for these criteria.<sup>76</sup>

*June 16, 1988:* The Commonwealth of Pennsylvania's General Counsel Morey M. Myers provided written comments on the Peach Bottom restart plan to the NRC's regional administrator, noting, "[t]he Plan is lacking because of its failure to reduce its proposals to specific verifiable commitments and to specify an adequate system for tracking those commitments."<sup>77</sup>

*June 22, 1988:* The NRC approved an amendment to the Peach Bottom operating license for the site and corporate reorganization requested on November 19, 1987.<sup>78</sup>

*July 1988:* Public Service Electric & Gas (which owned 42.49 percent of Peach Bottom), Atlantic Electric (which owned 7.51 percent), and Delmarva Power & Light (which owned 7.51 percent) filed a lawsuit against PECO for unspecified damages allegedly arising from management negligence resulting in the extended outages of the Peach Bottom reactors.<sup>79</sup>

*August 9, 1988:* The NRC proposed a record \$1.25 million fine against PECO and sanctions against all 36 licensed operators at Peach Bottom for violations such as reading non-technical materials, being inattentive to instrumentation, being observed sleeping while on duty, and inattentive behavior while on duty. In three cases, the NRC waived fines but warned that recurrence could lead to revocation of the operators' licenses. In the 33 other cases, the NRC proposed fines ranging from \$500 to \$1,000.<sup>80</sup>

*September 13, 1988:* A member of the Pennsylvania Public Utility Commission wrote to NRC Chairman Zech protesting secret meetings between the NRC and PECO regarding the restart of Peach Bottom. The commissioner had previously written letters dated August 16 to the NRC chairman and PECO's chairman seeking full disclosure of all meetings and phone conversations about Peach Bottom, and received a reply dated September 2 from PECO Chairman Paquette (but nothing from the NRC). The commissioner now wrote:

*"According to Mr. Paquette's response to my letter, secret discussions were held among PECO executives and NRC officials apparently regarding whether Peach Bottom operators should be fired or wrist slapped with fines.... Had the reactor operators been fired, restart would have been delayed, costing PECO more millions. Shortly after one round of secret talks, the NRC agreed to only fine these operators—operators who had either fallen asleep on duty, left the plant controls unmanned, or otherwise risked another Three Mile Island."*

*“I favor the public’s right to know. You apparently favor a ‘behind closed doors’ approach with the elite ‘admirals club’ making safety decisions for the average citizen who is kept in the dark about what is happening. Clearly we disagree. It is time our disagreement became public even if your process stays secret.”*<sup>81</sup>

*October 5, 1988:* NRC staff and PECO officials briefed the NRC’s commissioners on the Peach Bottom restart activities.<sup>82</sup>

*November 1988:* PECO’s executive vice president for nuclear operations, upon hearing during a staff meeting about a problem that would further delay restart, hurled a chair across the room, breaking one of its legs.<sup>83</sup>

*February 8, 1989:* PECO Chairman Paquette estimated the two-year-plus outage had cost the company \$250 million (\$400 million in 2006 dollars<sup>84</sup>). During that period, approximately 13,000 maintenance tasks involving 178 physical modifications to the plant had occurred.<sup>85</sup>

*March 22, 1989:* The NRC approved an amendment to Peach Bottom’s operating license that imposed working-hour limits on control room operators. Insufficient staffing had been cited as a contributing factor to the events leading up to the March 31, 1987, shutdown order, and the working-hour limits provided protection against insufficient staffing. PECO had originally requested the amendment by a written request dated February 11, 1982, which was then revised on an approximately annual basis: August 24, 1983; November 1, 1985; September 30, 1986; September 8, 1987; and September 7, 1988.<sup>86</sup>

*April 14, 1989:* NRC commissioners voted 3-0 to lift the Peach Bottom shutdown order.<sup>87</sup>

*April 26, 1989:* Operators withdrew control rods to restart Unit 2.<sup>88</sup>

*May 19, 1989:* The reactor automatically scrammed due to a malfunction of the feedwater control system.<sup>89</sup>

*May 22, 1989:* Unit 2 was connected to the electrical grid, ending the extended outage.<sup>90</sup>

## Notes

- <sup>1</sup> Pate, Z.T. 1988. Letter to Robert D. Harrison, chairman, special committee, Philadelphia Electric Company, January 11. Zack T. Pate was president of the Institute of Nuclear Power Operations. [Note: INPO reports are typically unavailable to the public, but PECO publicly submitted this report to the NRC by letter dated January 29, 1988, from John H. Austin to William T. Russell.]
- <sup>2</sup> Murley, T.E. 1986. Systematic assessment of licensee performance (SALP). Letter to S.L. Daltroff, vice president, electric production, Philadelphia Electric Company, June 6. Thomas E. Murley was a regional administrator at the Nuclear Regulatory Commission.
- <sup>3</sup> Ibid.
- <sup>4</sup> Ibid.
- <sup>5</sup> Ibid.
- <sup>6</sup> Ibid.
- <sup>7</sup> Ibid.
- <sup>8</sup> Ibid.
- <sup>9</sup> Ibid.
- <sup>10</sup> Ibid.
- <sup>11</sup> Ibid.
- <sup>12</sup> Ibid.
- <sup>13</sup> Ibid.
- <sup>14</sup> Ibid.
- <sup>15</sup> Ibid.
- <sup>16</sup> Ibid.
- <sup>17</sup> Ibid.
- <sup>18</sup> Ibid.
- <sup>19</sup> Ibid.
- <sup>20</sup> Ibid.
- <sup>21</sup> Ibid.
- <sup>22</sup> Ibid.
- <sup>23</sup> Kane, W.F. 1987. Combined inspection 50-277/87-10; 50-278-87-10. Letter to J.W. Gallagher, vice president, nuclear operations, Philadelphia Electric Company, May 12. William F. Kane was director of reactor projects at the Nuclear Regulatory Commission.
- <sup>24</sup> Murley, 1986.
- <sup>25</sup> Ibid.
- <sup>26</sup> Ibid.
- <sup>27</sup> Ibid.
- <sup>28</sup> Ibid.
- <sup>29</sup> Ibid.
- <sup>30</sup> Ibid.
- <sup>31</sup> Ibid.
- <sup>32</sup> Ibid.

- <sup>33</sup> Pate, 1988.
- <sup>34</sup> Murley, 1986.
- <sup>35</sup> Ibid.
- <sup>36</sup> Ibid.
- <sup>37</sup> Ibid.
- <sup>38</sup> Pate, 1988.
- <sup>39</sup> Ibid.
- <sup>40</sup> Nuclear Regulatory Commission (NRC). 1986. Failures of RHR pump motors and pump internals. Information Notice No. 86-39, May 20.
- <sup>41</sup> Murley, 1986.
- <sup>42</sup> Pate, 1988.
- <sup>43</sup> States, D. 1987. Complacent attitude at plant cited. *Philadelphia Inquirer*, April 2.
- <sup>44</sup> Daltroff, S.L. 1986. Systematic assessment of licensee performance (SALP) for Peach Bottom Atomic Power Station assessment period: April 1, 1985 to January 31, 1986. Letter to Dr. Thomas E. Murley, regional administrator, Nuclear Regulatory Commission, August 12. Shields L. Daltroff was vice president, electric production, at Philadelphia Electric Company.
- <sup>45</sup> Kane, W.F. 1986. Diagnostic team inspection: Combined inspection report nos. 50-277/86-12 and 50-278/86-13. Letter to S.L. Daltroff, vice president, electric production, Philadelphia Electric Company, September 2. William F. Kane was director of reactor projects at the Nuclear Regulatory Commission.
- <sup>46</sup> Daltroff, S.L. 1986. Letter to William F. Kane, director, reactor projects, Nuclear Regulatory Commission, October 20. Shields L. Daltroff was vice president, electric production, at Philadelphia Electric Company.
- <sup>47</sup> Pate, 1988.
- <sup>48</sup> Ibid.
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