

Release All

**From:** "Dave Lochbaum" <dlochbaum@ucsusa.org>  
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**Date:** 6/14/04 8:21AM  
**Subject:** Salem deja vu

Hello Randy:

Attached is an electronic copy of a appendix in a May 1997 General Accounting Office report. This appendix examined how the NRC handled problems at Salem.

Among other things, GAO noted:

"Salem's main problems include long-standing problems in performance and equipment failures, units that are operated outside of their design bases, and weak management by the licensee."

"NRC's lack of more aggressive action on these problems where they were first reported, compounded the worsening condition of the Salem units."

"NRC's records cite a long history of the licensee not addressing recurring reliability and operability issues at Salem."

"In February 1996, NRC developed a RAP [Restart Action Plan] citing numerous problems that NRC would require to be fixed before it would approve a restart of the units. Those items included weak management oversight, ineffective corrective actions, and numerous technical specification related items."

"The performance report was particularly critical of the utility's maintenance programs and activities. According to the report, the utility's management oversight of corrective action program activities had been weak, as evidenced by the high number of recurrent equipment failure rates."

Sound familiar?

I'll be pulling a copy of the NRC's Restart Action Plan from the Public Document Room to see just how many of the "numerous problems that NRC would require to be fixed" before restart are problems today. There were, you may recall, 43 items on that Restart Action Plan. If even one of those 43 items is present today, the obvious question is HOW CAN A PROBLEM BE SO IMPORTANT IN 1997 THAT SALEM COULD NOT RESTART WITHOUT FIXING IT YET SO UNIMPORTANT IN 2004 THAT SALEM CAN OPERATE WITHOUT FIXING IT?

PSEG is repeating its mistakes. NRC must not repeat its mistakes.

Thanks,  
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GAO

Report to Congressional Requesters

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May 1997

# NUCLEAR REGULATION

## Preventing Problem Plants Requires More Effective NRC Action



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GAO/RCED-97-145

# Salem Nuclear Generating Station, Units 1 and 2

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The Salem nuclear power Units 1 and 2 are located on the Salem Generating Station, 18 miles south of Wilmington, Delaware, in Salem, New Jersey. The Public Service Electric and Gas Company (PSE&G) is the owner and licensed operator of the plant. Each unit is a four-loop pressurized light-water reactor that can produce 1,115 megawatts of electricity. The units were designed by Westinghouse and were built by the United Engineers & Constructors, Inc. NRC approved operating licenses for Salem's Units 1 and 2 on December 1, 1976, and May 20, 1981, respectively. Units 1 and 2 began operating on June 30, 1977, and October 13, 1981, respectively.

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## Summary

NRC has been concerned with Salem's regulatory performance since January 1990 when Salem was first discussed at its Senior Management Meeting. NRC discussed the plant seven additional times before it listed Salem on its Watch List in January 1997. NRC's records document numerous conditions that demonstrated poor management of the plant, including the operation of the plant outside of its design bases for extended periods of time. The units are currently under an NRC Restart Action Plan (RAP) that requires the licensee to correct a long list of technical and programmatic issues to bring about long-term performance improvement prior to receiving NRC's approval to restart. The plan was developed after PSE&G shut down the units in mid-1995. Salem's main problems include long-standing problems in performance and equipment failures, units that are operated outside of their design bases, and weak management by the licensee. NRC's lack of more aggressive action on these problems when they were first reported, compounded the worsening condition of the Salem units.

Salem's performance history compares unfavorably to the industry's average. For example, NRC heavily fined Salem on seven occasions; the fines ranged from none for several years to a high of \$680,000. The industry average annual fines assessed each plant during this period ranged from \$17,000 to \$37,000. As the number of NRC's hours of inspection of the Salem plant increased—an indication of NRC's growing concern—Salem's Systematic Assessment of Licensee Performance (SALP) scores worsened in 1993. Salem's performance indicators also worsened during this period, and NRC discussed Salem's performance every year except 1992 and 1993 at its SMMS. In addition, from 1989 through 1996 Salem units reported an average of about five safety system failures per year compared to an industry average of about three per year. Since 1989, SALP scores, performance indicators, and the number of safety system

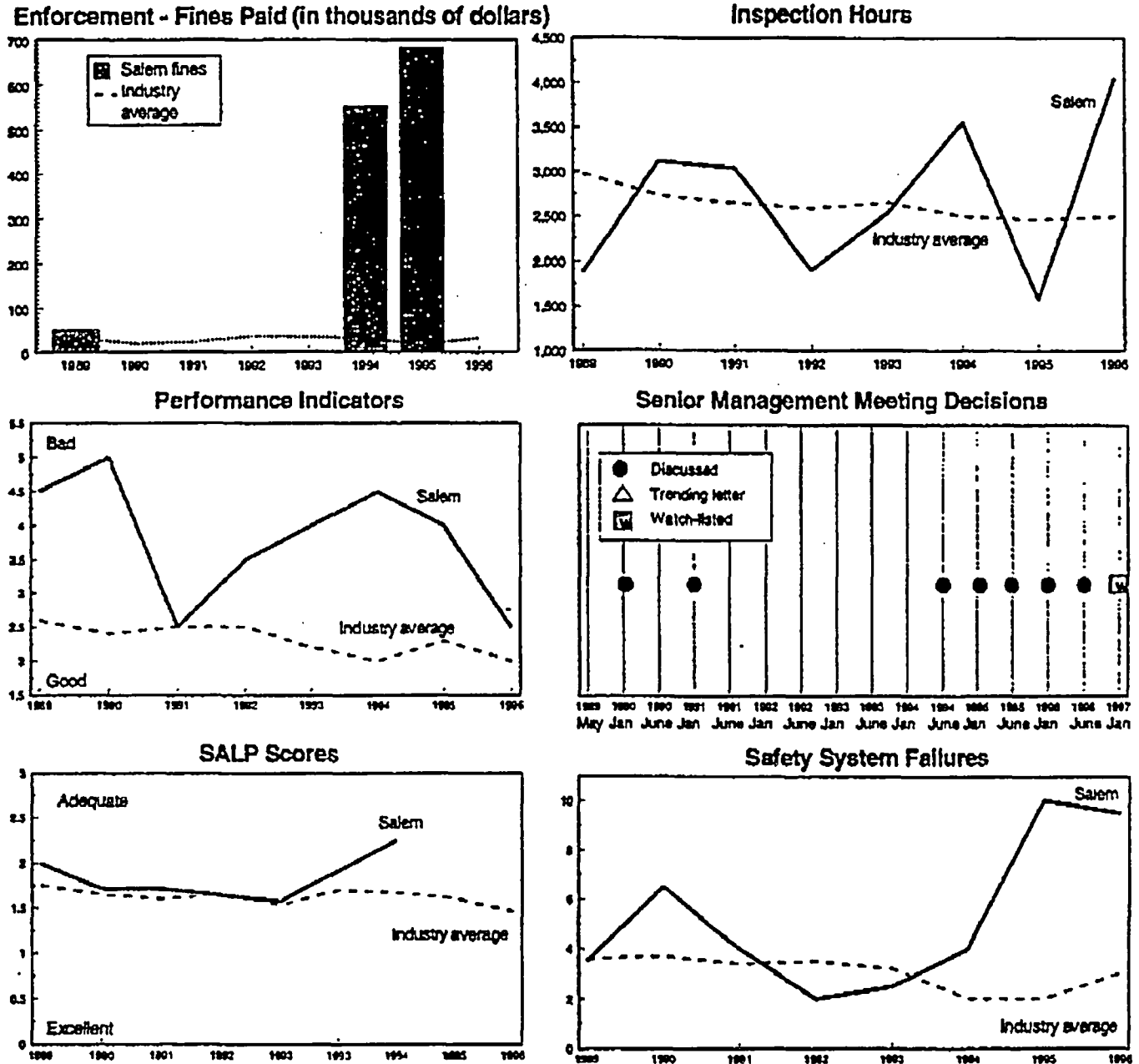
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failures, on average for the industry, have shown overall improvement, while the number of inspection hours devoted to a plant have decreased. Figure II.1 compares the performance of the Salem plant with the nuclear industry as a whole.

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Figure II.1: Salem's Performance History Against the Industry Average



Source: GAO's analysis of NRC's data.

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## Performance History

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### Design Basis Issues

The licensee operated the Salem units outside of their design bases and, in some instances, NRC was not aware of the degraded conditions until months later when the licensee reported the conditions.

- On April 7, 1994, the licensee experienced a significant condition adverse to quality<sup>4</sup> when an equipment failure occurred during a reactor trip. (A reactor trip is an action in which a reactor automatically shuts down because it has been programmed to do so under certain conditions that could challenge the reactor's safety if the unit continued to operate). Prior to this event, the licensee did not promptly identify and correct the cause of previous similar equipment failures during prior reactor trips in June 1989, July 11, 1993, and February 10, 1994. This was a recurring problem that the licensee and NRC failed to ensure was corrected. NRC fined the licensee \$150,000 for this incident.
- On December 12, 1994, a ventilation fan failed, creating a significant condition adverse to quality at the Salem Unit 1. Unit 1's design basis requires that the facility have two fans capable of operating automatically and one other fan in a standby condition. The utility did not report this incident to NRC at the time nor did it determine the cause of the problem as required by NRC's regulations. On May 12, 1995, another supply fan became inoperable before the first fan that had failed was fixed. These fans are crucial to keep important safety equipment from overheating. The licensee's records show that there had been two prior similar occurrences, in April 1990 at Unit 2 and in December 1994 at Unit 1. NRC fined the licensee \$100,000 for these numerous fan violations.
- On January 26, 1995, workers at Unit 2 discovered that a flow valve would not open automatically as required, thus requiring a shutdown within 12 hours by its technical specifications. According to the technical specifications, the unit's problems should have been fixed within 3 days or the unit should have been shut down within 12 hours. However, the licensee did not correct the problem and did not shut down the Unit 2 reactor until June 7, 1995—128 days later. The licensee's staff incorrectly determined that the valve was operating as required because they could manually operate it. This situation also should have been reported to the

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<sup>4</sup>This is important terminology used by NRC in its regulations and its inspection program. NRC defines the term by example. It lists failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances as examples of conditions adverse to quality. NRC requires that as part of ensuring adequate protection of the public's health and safety, these conditions be promptly identified and corrected.

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NRC within 1 hour because the plant violated its technical specifications. However, it was not reported.

- On February 9, 1995, another valve failed to open automatically as required. As in the previous case, this valve did not operate as required but could be manually operated. At this point, two valves were not operating as required. The plant's technical specifications require at least one of the valves to be operating as required within 1 hour or the plant must be shut down. Eventually, the plant was forced to shut down in June 1995 because of these and other events. NRC fined the licensee \$100,000 for failing to handle the valve situations properly.

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## Corrective Action Issues

NRC's records cite a long history of the licensee not addressing recurring reliability and operability issues at Salem. On June 9, 1995, after the two units shut down, NRC sent the utility a Confirmatory Action Letter citing the need to organize a special team to review the problem of long-standing equipment and operability issues. The utility identified approximately 31,000 work items that it felt it should complete before restarting the units. In February 1996, NRC developed a RAP citing numerous problems that NRC would require to be fixed before it would approve a restart of the units. Those items included weak management oversight, ineffective corrective actions, and numerous technical-specification-related items. The RAP cited examples of the long-standing decline of Salem's plant performance in justifying the need for the units to remain in a shutdown status until NRC would approve start-up. For example:

- NRC's SALP report for Salem for the period from June 20, 1993, through November 5, 1994, which preceded the mid-1995 shutdown, was particularly critical of the licensee's performance. The report stated that overall performance had declined and that NRC was particularly concerned with the challenges to the plants' systems and operators caused by repetitive equipment problems and personnel errors that had the potential to, or actually did, adversely affect the safety of the plant or its personnel. The report recognized that the licensee had, within the last year, initiated several comprehensive actions that had the potential to improve the plant's overall performance but that the efforts had not resulted in any noticeable change in overall performance.
- The NRC's report said that in arriving at its assessment, NRC determined that the following factors contributed to Salem's condition: (1) the tendency of the licensee's operations staff to accept and accommodate system performance that was not in accordance with design; (2) the tendency of the licensee to not aggressively question the validity of assumed causes of



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degraded conditions or unexpected system performance and dismiss or not adequately consider other possible contributors or factors without a substantial technical basis or rationale; (3) the general reticence of the licensee's maintenance and operations organizations to solicit technical support from the engineering organization to resolve system or equipment issues at the plant, and the engineering organization's apparent reservation to engage in the diagnosis or resolution of the plant's technical problems without requirement or request; (4) the lack of value attributed to, or expected from, nuclear safety review and quality assurance activities and the consequent ineffectiveness of these functions; (5) insufficient critical self-assessment initiatives to evaluate the adequacy and performance of personnel, procedures, and hardware; and (6) insufficient supervisory oversight and poor communication of senior plant management's expectations relative to the performance of activities.

The performance report was particularly critical of the utility's maintenance programs and activities. According to the report, the utility's management oversight of corrective action program activities had been weak, as evidenced by the high number of recurrent equipment failure rates. Inconsistencies in troubleshooting activities and a breakdown in the licensee's analysis of root causes also contributed to the delay in correcting recurring problems. Other examples of the utility's ineffective correction of long-standing problems include the following:

- Salem's units were heavily fined during 1994 and 1995. Annual fines assessed on the Salem plant ranged from none for the earlier years to \$680,000 at the same time the industry average for fines was about \$30,000. One enforcement action in October 1994 involved six violations that NRC identified during several inspections conducted at the facility. Five of the violations were associated with the utility's failure to promptly respond to and correct conditions involving numerous systems over extended periods of time. In one case, the utility failed to take action for 5 years.
- NRC's RAP for Salem contained 43 technical restart issues (issues having to do primarily with equipment and procedures as compared to management and human resource issues), of which all but 5 were known by NRC before the units shut down. According to Salem's current NRC Senior Resident Inspector, recurring problems had been prevalent at Salem for years. Two of the issues had been continuing problems for 6 to 7 years—the control air system and the circulating water traveling screen motor. One of the issues had been on NRC's information followup system since 1989 and was addressed in three separate inspection reports.

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- An NRC report entitled Engineering Evaluation Report Analysis of Allegation Data, dated June 1996, showed that Salem experienced a disproportionate number of employee allegations in 1995 about the licensee's potential failure to follow safety procedures and potential violations of the employees' rights. The report concluded that the utility was a potential organization for further NRC evaluation because it was in the top 10 percent of NRC's groups with respect to increases in the number of total allegations, including harassment and intimidation allegations from 1994 to 1995.

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## Management Weaknesses Issues

NRC records show numerous examples of management weaknesses:

- In NRC's October 1995 Notice of Violation and Proposed Imposition of Civil Penalties to Salem, NRC noted that Salem's management appeared to have tolerated an atmosphere that accepted degraded conditions rather than establish the atmosphere of a high-quality operating environment. NRC also recognized that even after it became more imperative to address these component issues, Salem's management delayed making decisions on whether or not equipment was operating as required until it was apparent that a rationale could not be established to justify the continued operation of the equipment in its existing condition.
- The licensee's Licensee Event Reports cited management as the cause of the adverse quality events. According to the reports, the apparent cause of the valve incident discussed earlier was attributed to inadequate management oversight. The inadequate management oversight led to operators and engineers not having sufficient knowledge of the design basis of structures, systems, and components to recognize problems and take timely corrective actions. NRC cited these and numerous other examples, including failures to perform adequate testing of modifications and evaluation of changes as indicative of an attitude on the part of both management and staff that was not conducive to the safe operation of a nuclear power plant.
- The utility industry's Institute of Nuclear Power Operations also faulted management for the April 7, 1994, situation when marsh grass clogged water intake screens, resulting in automatic trips of circulating water pumps. These pumps are used to circulate water to portions of the reactor's operations. The pumps' failures caused significant safety concerns and ultimately resulted in the shutdown of the reactor.
- NRC's recent inspection reports were critical of the utility's lack of effective management to correct the various long-standing problems at Salem. NRC's

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first inspection report (July 14, 1995), issued right after the two plants shut down, contained the following:

"During this period (May 7-June 23, 1995) Salem management and staff continued to demonstrate significant weakness in performing operability determinations ... [making a determination as to whether a component of the plant is operating as required to operate according to NRC's rules and regulations] for degraded safety-related equipment, and implementing prompt and effective corrective actions .... In these cases, your organization accommodated the conditions without effective root cause assessment or understanding of the nature of the problems since 1992."

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## Watch List Issues

The Salem plant—Units 1 & 2—were first placed on NRC's Watch List in January 1997. There is substantial evidence, however, that the Salem plant should have been placed on the Watch List before the utility shut down the units on May 16 and June 7, 1995. NRC's SMs show that NRC knew about the ineffectiveness of the licensee's Quality Assurance program, which is designed to provide reasonable assurance that the risk to the public from the utility's operation is acceptably low.

In placing the Salem plant on the Watch List in January 1997, NRC recognized that it had erred in not putting the plant on the Watch List sooner. The SM stated that NRC put the plant on the Watch List for its past performance history and that it should have put the plant on the Watch List much earlier. In January 1990, for example, materials prepared for the SM revealed NRC staff's concerns about the plant's management and operational performance. Staff noted the declining performance of Salem as demonstrated by an increasing number of personnel errors, inadequate management oversight and involvement, inadequate procedures, and weak root cause analyses. They also noted that Salem's corrective action programs had frequently been ineffective. Salem's problems continued to reflect declining performance. In briefing materials prepared for senior managers in 1994, NRC noted:

"stagnant, and sometimes declining performance relative to the licensee's ... initiative and ability to successfully perform comprehensive and thorough root cause analysis of abnormal conditions or situations affecting the operation of the facility, or to recognize trends indicative of programmatic weaknesses."

NRC concluded that corrective actions had not always been effective, as evidenced by recurring deficiencies of a similar nature or continuing performance weaknesses. NRC noted that while the licensee stated that

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corrective actions appeared to have addressed the causal factors, given past performance, there was no assurance that a similar event would not recur. Also noted was that Salem continued to experience recurring operational, design, and maintenance-related problems with no indication that previously applied corrective measures had been effective in resolving or causing a reduction in the frequency or severity of the apparent problems.

Even after the Salem licensees shut down the units for violating technical specifications and after NRC had placed the units under a Confirmatory Action Letter (that documented the licensee's agreement not to restart the units without NRC's concurrence) NRC did not list Salem on its Watch List until January 1997, when NRC officials acknowledged that they had made a mistake and that the plant should have been listed on the Watch List sooner because of poor performance.

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## Chronology

### 1989

NRC's inspection reports cited the poor material condition of the Salem plant.

### 1990

Salem was first discussed in the SMM.

### 1991

NRC initiated an Augmented Inspection Team (AIT) review on Salem. An AIT is an intensive special investigation of an event that NRC requires, in addition to routine audit activities, when it determines it needs more information to evaluate a situation.

NRC issued a violation as a result of the licensee's failure to follow procedures and for insufficient preventative maintenance.

### 1992

A second AIT was performed that found that the licensee failed to follow procedures.

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1993

A third AIT was performed at Salem after the licensee aborted several start-up attempts.

SALP ratings started to decline for the first time.

NRC met with PSE&C's management to discuss the licensee's weak root cause analysis and ineffective corrective action history.

1994

PSE&C concurred that it had significant deficiencies in root cause determination and established a Strategic Improvement Plan.

Marsh grass clogged the water intake screens and blocked the flow of cooling water to part of the plant, leading to a shutdown of Unit 1. In response to this event, NRC ordered a fourth AIT review at Salem, in just four years, an unprecedented action. NRC fined Salem \$500,000 for its handling of the incident.

An NRC special performance assessment found weaknesses in maintenance and management oversight activities.

1995

On January 3, 1995, Salem was notified that its SALP rating for the period from June 20, 1993, through November 5, 1994, declined and dropped to its lowest level. NRC senior officials met with PSE&C's management to discuss the low SALP ratings and questioned management's overall direction and performance.

NRC senior management met with the licensee's Board of Directors to discuss serious concerns with lingering performance problems.

The licensee shut down Unit 1 because of technical specification violations.

An NRC special inspection team concluded that the licensee's management had been deficient in several key areas and should have taken strong action sooner.

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The licensee shut down Unit 2 because of technical specification violations.

NRC issued a Confirmatory Action Letter requiring its authorization prior to restarting either unit.

1996

NRC issued its Restart Action Plan for both units citing 43 technical and 21 programmatic items that had to be corrected before the units could restart.

NRC cited fundamental design problems at Salem.

1997

After years of declining performance, NRC placed the Salem units on the Watch List and acknowledged that Salem should have been on the Watch List much sooner.