

April 17, 2000

Mr. Norm Cohen  
Coordinator, UNPLUG Salem Campaign  
Coalition for Peace and Justice  
321 Barr Avenue  
Linwood, NJ 08221

Dear Mr. Cohen:

I am responding to a letter you submitted on behalf of the UNPLUG Salem Campaign dated February 22, 2000. In the letter, you requested that the Nuclear Regulatory Commission (NRC) take action, in light of the Indian Point Nuclear Generating, Unit No. 2 (Indian Point 2), steam generator tube failure, and order the Salem Nuclear Generating Station, Unit Nos. 1 and 2 (Salem), to be immediately shut down so that the steam generator systems can be completely checked out by both NRC inspectors and by independent scientists. The purpose of the requested inspections was to further assure the people of southern New Jersey and Delaware that the Salem steam generators are safe to operate. Your letter also stated that, because the Indian Point 2 event was actually a loss-of-coolant accident, the NRC needs to take every step possible to assure the public that plants similar to Indian Point 2, such as Salem, do not carry the same risk. You compared the two sites based upon the following stated factors:

- Salem uses steam generators that are exactly the same as installed at Indian Point 2;
- Given the recent steam generator tube rupture incident involving Indian Point 2 on February 15, 2000, the age and "history of defective steam generators" at Salem make it "prudent" to shut the plants down.

In a March 14, 2000, telephone conference call with the Office of Nuclear Reactor Regulation (NRR) Petition Review Board (PRB) and other members of the NRC staff, you were given an opportunity to provide additional or clarifying information relevant to your February 22, 2000, letter. The PRB met subsequent to this telephone call to discuss the information you provided in your letter and telephone call to determine if your request warranted further consideration by the NRC as a petition pursuant to Title 10 of the *Code of Federal Regulations*, Section 2.206 (10 CFR 2.206). The PRB conference call was recorded and transcribed. A copy of the conference call transcript was recently provided in our March 24, 2000, letter to you.

During the telephone conference, representatives of the UNPLUG Salem Campaign reiterated the call for additional steam generator inspections and raised several other concerns. In summary, the staff understood the following additional points:

- The UNPLUG Salem Campaign is frustrated by the lack of information found in the NRC's Public Document Room (PDR), or in its Agencywide Documents Access and Management System (ADAMS), specific to the material condition of Salem's steam generators. The UNPLUG Salem Campaign considers that the lack of access to this information inhibits its ability to identify facts to support safety concerns.

- There are members of the public who are concerned that either one of the Salem plants could experience a steam generator tube rupture, and that the “public lacks the confidence in the NRC” to ensure the safe operation of Salem, given the recent event at Indian Point 2.

The NRC staff has reviewed the information provided in your letter and the subsequent phone call. Although your letter did not specifically request that your concerns be addressed as a petition in accordance with 10 CFR 2.206, the NRC, nevertheless, reviewed your request to determine if it met the Commission’s guidelines outlined in Management Directive (MD) 8.11. The staff has carefully considered the issues that you raised and has determined that your letter does not meet the criteria for a 10 CFR 2.206 petition. The staff concluded that you did not present sufficient plant-specific information, nor any substantial or new facts concerning steam generator issues, to justify the requested actions. MD 8.11 guidelines state that petitioners should provide some element of support beyond the bare allegation, and that these facts must be credible and sufficient to warrant further inquiry. Although your letter will not be treated as a 10 CFR 2.206 petition, the NRC staff has reviewed the specific concerns that you raised, and provides the following response.

During the telephone call, you cited examples of similarities between the steam generators used at Indian Point 2, operated by Consolidated Edison Company, and at Salem, which is operated by Public Service Electric and Gas Company (PSE&G). These factors focused on the “age of the two Salem plants” and the use of Alloy 600 for the steam generator tubing with the same heat treatment process (mill-annealed). The NRC staff understands that it is your view that the similarity in plant age and materials between Salem and Indian Point 2 is sufficient cause for the NRC to order additional steam generator inspections.

In order to put the similarities and differences between the Salem and Indian Point 2 steam generators in proper perspective, it is helpful to compare some of their more significant design characteristics. The table below outlines some of these important design features:

Characteristic	Indian Point, Unit 2	Salem, Unit 1	Salem, Unit 2
S/G Model	Westinghouse Model 44	Westinghouse Model F	Westinghouse Model 51
Began Operation	August 1974	1995* (*Replaced)	October 1981
Tubing Material/ Heat Treatment	Alloy 600 Mill-Annealed	Alloy 600 Thermally-Treated	Alloy 600 Mill-Annealed
Tubing Size Wall Thickness	7/8-inch O.D. 0.050-inch wall thickness	11/16-inch O.D. 0.043-inch wall thickness	7/8-inch O.D. 0.050-inch wall thickness
S/G Tubing to Tube Sheet Fabrication	Tubes are mechanically hard-rolled into the tube sheets.	Tubes are hydraulically expanded into the tube sheets.	Tubes are explosive expanded into the tube sheets.
S/G Support Structure	Tube support plates are made of carbon steel with drilled holes	Tube support plates are made of stainless steel with broached holes to reduce corrosion and denting.	Tube support plates are made of carbon steel with drilled holes.

As shown in the table, the original Westinghouse Model 51 steam generators at Salem Unit 1 were replaced in 1995. In addition, it should be noted that Inconel Alloy 600 is a commonly used material for steam generator tubing. Furthermore, the first row of tubes in the Salem Unit 2 and Indian Point 2 steam generators have been plugged as a preventive measure, and Salem Unit 2 has received a U-bend region heat treatment (stress relief) in the Row No. 2 tubes. The newer Salem Unit 1 tubing was thermally treated, and the U-bends in the first 10 rows were also stress relieved after bending. Moreover, the tube support plates are made of stainless steel with broached holes at Salem Unit 1 to reduce corrosion and denting while the tube support plates at Salem Unit 2 and Indian Point 2 are made of carbon steel with drilled holes.

The degradation of Alloy 600 tubing has received significant attention by the NRC. Industry experience has shown that there are many factors, beyond age and component materials, that impact the effective life of steam generators. Some of these factors include: (1) design considerations such as the number, design, materials, and placement of tube supports; (2) techniques used to expand the tubes to lock them into the tubesheet; (3) operating history specific to each plant in controlling primary and secondary water chemistry during normal operation and lay-up conditions; (4) maintenance history (e.g., certain actions taken by individual licensees during refueling outages, such as cleaning the secondary side sludge, can greatly affect plant chemistry and thus, impact steam generator life); and (5) normal plant operating temperature.

The degradation detected in the original Salem Unit 1 steam generators was, in part, due to early problems with secondary water chemistry control that ultimately led to significant tube denting from corrosion at the tube support plates and stress corrosion cracking of the tubes in these locations. The main feedwater (secondary water that is heated in the steam generator to make steam) was not treated using condensate polishers during the first two cycles of operation. Condensate polishing systems are designed to remove assorted impurities, and provide the plant with a feedwater system cleanup capability. This system helps to maintain the secondary water chemistry to within guidelines provided by the Electric Power Research Institute. Because of the pervasive denting and cracking that had been observed in the original Salem Unit 1 steam generators, the licensee performed an augmented inspection at every tube to tube support plate intersection in each steam generator prior to their replacement. Based on the number of indications found and repairs needed, the licensee elected to replace the Salem Unit 1 steam generators rather than request a change to either increase the tube plugging limit or to implement alternate repair criteria.

At Salem Unit 2, the condensate polishers were used from the start of initial plant operation. In addition to the polishers and the use of an all-volatile chemistry control to reduce corrosion, Salem Unit 2 has had less operating time than either Salem Unit 1 prior to its steam generator replacement or Indian Point 2. The Indian Point 2 steam generator tubing also has experienced pitting that was accelerated by copper deposits coming from the secondary side components. This has not occurred at Salem due to the minimal use of copper-based components. Further, the licensee at Salem has been using a chemical addition to control and minimize iron transport from the secondary system. Iron deposits in the steam generators act as a type of bonding agent for other impurities that can contribute to the potential for stress corrosion cracking. PSE&G also has implemented a program of sludge lancing each refueling outage to remove deposits that may form in the area above the tubesheet to minimize the occurrence of pitting and cracking. During the 1999 outage at Salem Unit 2, the licensee chemically cleaned the secondary side of the steam generators prior to conducting the inservice inspection of the

tubes. It should be noted that the Consolidated Edison Company has also implemented a similar program to perform sludge lancing on its steam generator tubing during refueling outages at Indian Point 2. In addition, they have been developing plans to remove and replace copper-based components within its feedwater heating system in order to improve secondary water chemistry.

Each licensee is required to inspect and repair or remove from use all tubes found to contain flaws exceeding certain limits. The plant's technical specifications describe the frequency and scope of these inspections and tube repair limits. There are also operational leakage limits to ensure that if any of the tubes leak beyond these limits, the plant will be shut down quickly. The NRC has maintained a strong oversight of steam generator performance in commercial nuclear power plants. This has been accomplished, in part, through routine field observation of the licensee's steam generator inspection program and audit reviews of examination results by NRC inspectors, and special NRC staff evaluations of individual plants experiencing significant amounts of tube degradation. In some instances, tube inspections at mid-operating cycle have been performed at plants experiencing significant amounts of tube degradation. On the basis of its assessment of recent inspections, as documented in the licensee's letter dated February 28, 2000, the licensee concluded that the Salem steam generators will meet the structural integrity and leakage limits during the cycle.

For the reasons previously discussed, individual steam generator operating and maintenance histories cannot be directly compared. Therefore, the experience at Indian Point 2 would not necessarily signify an identical concern at Salem. Rather, it highlights the importance that individual licensees implement an effective steam generator inservice inspection program.

During the most recent Salem outages, NRC inspectors monitored PSE&G's steam generator inservice inspection program. The inspector's review consisted of observing PSE&G's training regarding the robotic eddy current testing (ET) equipment in the steam generator primary (bottom) head mock-up, ET procedure reviews, examination of test equipment, and observation of operator actions, equipment function, data collection, data evaluation and resolution. As a result of this routine audit of the licensee's inspection program, there were no documented findings nor any unresolved issues.

As stated earlier, PSE&G performed a chemical cleaning of the Salem Unit 2 steam generators prior to performing the inspection of the tubes. The results of that inspection were documented in an annual report to the NRC dated February 28, 2000, as required by the Salem Technical Specifications. Of note, the licensee found and plugged four row 2 tubes with indications in the U-bend region. Unlike at Indian Point Unit 2, however, the indications were not in the higher stress apex region of the U-bend. The first inservice inspection of the replacement Salem Unit 1 steam generators was performed during the fall 1999 outage. The results of that inspection are also documented in the February 28, 2000, report.

In response to the NRC staff's ongoing regulatory development effort, the industry has focused its efforts on improving existing steam generator inspection guidance and developing additional guidelines on other programmatic elements related to steam generator tube integrity. The industry's efforts to improve industry guidance culminated in an initiative developed through the Nuclear Energy Institute (NEI) Nuclear Strategic Issues Advisory Committee. The NEI 97-06 initiative commits pressurized-water reactor (PWR) licensees to a programmatic approach for structuring and strengthening existing steam generator programs. The fundamental elements include a balance of prevention, inspection, evaluation, repair and leakage monitoring measures. The licensee has committed to follow these guidelines.

Finally, the NRC will be performing an in-depth evaluation of lessons learned as a result of the February 15, 2000, Indian Point 2 event. This evaluation will include the insights gained through the NRC's onsite inspection, the licensee's steam generator tube examinations and root cause failure analyses, and will consider these issues from both a technical and regulatory perspective. In addition, NRC headquarters technical staff is reassessing the industry's steam generator tube inspection efforts and acceptance criteria to determine if any further improvements or changes should be incorporated into the new regulatory framework proposed by the industry. Likewise, any additional generic issues uncovered during the course of these efforts will be thoroughly reviewed by the staff and managed as a separate action. PSE&G would, in turn, be expected to address any generic concerns stemming from the Indian Point 2 experience that would apply to Salem.

The NRC staff has forwarded your comments relating to your difficulties in obtaining publicly available documents through the PDR and ADAMS computer system to the Office of the Chief Information Officer (OCIO). The NRC recognizes that members of the public may be experiencing some difficulty accessing documents through ADAMS during the current transition period. OCIO is, therefore, looking at a number of opportunities to improve document accessibility through ADAMS.

Furthermore, the staff notes that the information that pertains to steam generators on each plant's docket, and available to the public through these sources, is limited to the information required by regulations or by the plant's license, or is submitted by a licensee as part of a license amendment request. For example, Salem Technical Specifications Section 6.9.1.5.b requires the licensee to submit a summary of the results of steam generator tube inservice inspections performed during a particular reporting period. All the information that the NRC does have in its possession is made publicly available as soon as the current information systems allow. A copy of Salem's latest report was recently sent to you in our March 24, 2000, letter. More detailed information is maintained by the licensee and is subject to NRC audit.

I hope that you will find this information useful in addressing the concerns that you raised. Although we are not processing your request as a petition pursuant to 10 CFR 2.206, we appreciate your concern for nuclear safety and your willingness to bring these matters to the attention of the NRC. Public health and safety are better served whenever concerned citizens and organizations speak out.

Sincerely,

*/RA/*

John A. Zwolinski, Director  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket Nos. 50-272 and 50-311

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/RA/

John A. Zwolinski, Director  
Division of Licensing Project Management  
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