November 17, 2000

Mr. Marvin I. Lewis
3133 Fairfield Street
Philadelphia, PA 19136

Dear Mr. Lewis:

I am responding to a letter that you emailed to the Nuclear Regulatory Commission (NRC) on October 15, 2000, followed by a corrected version emailed on October 21, 2000. In your letter, you provided comments and asked specific questions related to "NRC Special Inspection Report - Indian Point Unit 2 [IP2] Steam Generator Tube Failure - Report No. 05000247/2000-010," dated August 31, 2000. Based on your comments and questions, you requested that the NRC cease all operations of all nuclear power plants (NPPs) using steam generator (SG) tubing until your questions are answered for all plants involved. Additionally, in an October 28, 2000, email, you forwarded a news article related to corrosion problems on a United Kingdom (UK) nuclear submarine. You stated that the problems you discussed in your previous e-mails related to IP2 may also extend to submarines.

Although your letter did not specifically request that your concerns be addressed as a petition pursuant to Title 10 of the *Code of Federal Regulations*, Section 2.206 (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. In an October 23, 2000, telephone message and an October 24, 2000, telephone conversation, you were offered an opportunity to address the NRC's Petition Review Board (PRB) and provide additional or clarifying information relevant to your letter. You declined the offer to address the PRB as discussed in your follow-up letter dated October 23, 2000.

The NRC 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 SG 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.

Your letter concluded, in part, that the "engineering design at IP2 rests on an engineering assessment that is 8000% overoptimistic, which reflects a tube failure rate of 80 times more than the engineering assessment of one tube failure in the lifetime of IP2." You also state that the NRC Special Inspection Report "admits that tube cracking is 80 times more likely than used in design documents" and that "tube cracking has occurred at IP2 at a rate 80 times greater than used in design documents." You based this conclusion on a statement from the NRC's Special Inspection Report that "the performance issues identified in this inspection report, changed the SGTR [steam generator tube rupture] frequency to 1 failure per year of operation, above the Indian Point 2 individual plant examination (IPE) assumed frequency of 1 SGTR per approximately 80 years of operation."

The statement from the NRC Special Inspection Report does not support your conclusion that the “tube cracking is 80 times more likely than used in the design documents.” The statement from the report projected the change in the frequency of SGTR (number of tube ruptures per year of operation) at IP2 based on deficiencies in Consolidated Edison Company’s (Con Ed’s) SG program that affected their ability to detect flaws and resulted in significant flaws remaining in service. In contrast to your conclusions, the Special Inspection Report did not conclude that tube cracking was more likely or occurring at an increased rate.

The original SGTR frequency that was determined for IP2 was based on tube ruptures from random events. The NRC staff concluded that the expected frequency had changed for IP2 based on performance issues. Specifically, Con Ed did not recognize and take appropriate corrective actions for significant conditions adverse to quality that affected the SG inspection program. As a result, significant flaws were not detected and left in service subsequent to the SG tube examination in 1997. The performance issues are under the control of the licensee, and are, therefore, not random. Once the performance issues are addressed by the licensee, the probability of SGTR from the original assessment will still be valid.

Your letter states that the Special Inspection Report exposes immediate dangers that extend to all NPPs using SGs based on a tube cracking rate at IP2 that is 80 times greater than used in design documents. The statement from the NRC Special Inspection Report does not support your conclusion that there exists a tube cracking rate at IP2 that is 80 times greater than used in design documents, but instead concluded that in the specific case of IP2, the expected frequency of tube rupture would change due to degraded conditions that existed for the cycle subsequent to the 1997 SG examination. Because the change to the expected frequency of tube rupture was based on performance issues specific to IP2, the staff has concluded that immediate dangers that would extend to all NPPs using SGs do not exist.

Your letter also raised specific concerns related to Inconel 600 SG tubing. Your letter stated that “Inconel 600 has notable resistance to stress corrosion cracking and provides an excellent choice for steam generator service as evidenced by its history in this application for decades.” The NRC staff has observed that, although mill-annealed Inconel 600 is considered a “corrosion-resistant” material, it has not provided “corrosion-free” performance in SG tubes. The SG tubes at IP2 were made from mill-annealed Inconel 600. Industry problems that have been noted concerning the performance of mill-annealed Inconel 600 SG tubing are discussed in NRC Information Notices 92-80 and 96-38, as well as in other NRC generic communications.

In practice, most of the SGs in service with mill-annealed Inconel 600 tubes have experienced some corrosion-induced cracking in the tubes. As a result, many of the licensees have made plans to replace their SGs containing mill-annealed Inconel 600 tubes with later models of SGs that contain either thermally-treated Inconel 600 tubes or Inconel 690 tubes. Thermally-treated Inconel 600 and Inconel 690 tubes have exhibited superior corrosion resistance compared to mill-annealed Inconel 600 in laboratory tests and field experience to date. In addition, later models of SGs have replaced the carbon steel tube support plates with more corrosion-resistant materials such as stainless steel.

IP2 was not unique regarding the extent of degradation found in the mill-annealed Inconel 600 tubes. In fact, IP2 possessed the sole remaining Model 44 SGs in service at the time of the tube failure. Seven other plants had used Model 44 SGs, and all seven had replaced their SGs by 1996 due to degradation of the mill-annealed Inconel 600 SG tubes. The materials and environmental factors that you cite in your letter did not cause the IP2 SGs to exhibit degradation to a larger extent than the other SGs of a similar design. Following the SG tube failure, Con Ed made the decision to replace the current SGs with those that contain thermally treated Inconel 600 tubes.

Your letter stated that the "water chemistry had to be such that the corrosion proceeded to cause enough deposition of magnetite to produce PWSCC [primary water stress corrosion cracking] to give 80 times more tube cracking than used in design documents." As you mentioned in your letter, the magnetite was produced from the corrosion of the carbon steel tube support plates. However, carbon steel is not a corrosion-resistant material, so small amounts of magnetite would be expected to develop over time even if the water chemistry was kept within acceptable limits. An NRC Technical Evaluation Report on the IP2 SG tube failure, forwarded to Con Ed on October 11, 2000, stated that the staff believes that abnormal chemistry was not a significant contributor to the tube failure based on information provided by the licensee. This conclusion was based on Con Ed's adherence to established water quality guidelines issued by the Electric Power Research Institute.

The NRC has examined the extent of tube degradation problems throughout the industry. To put the extent of degradation into context, consider that there are approximately 1.2 million SG tubes in service in 209 SGs at 69 pressurized-water reactors (PWRs) in the US. About 5 percent of the total number of tubes have been repaired (by either plugging or sleeving) through 1998. These tubes are spread throughout 188 SGs in 62 PWRs. This shows that tube degradation is an issue for many licensees. An observation that could be made by comparing this information to the number of tube failures is that, overall, tube integrity programs are effective. Large numbers of tubes are repaired, in the vast majority of cases, before significant failures occur.

Your letter also raised concerns about the adequacy of the SG tube inspections conducted at IP2. Your letter stated that tube cracks were missed because the sensitivity of the probe was reduced, and that this method is used to reduce interference such as "noise," which was present in the data at IP2 from their SG examinations. The staff is not aware of this method being used during the licensee's SG examinations to reduce the level of "noise" observed in the data, and this is probably because the sensitivity to the desired signal would also be reduced. The sensitivity of the probe is typically controlled by the gain setting, which is specified in the Examination Technique Specification Sheet (ETSS) used for the inspection. The ETSS for each technique in the inspection is kept as a permanent record, and can be compared with the actual data analysis. The Special Inspection Team did not note any discrepancies with the gain settings in their inspection report.

Your letter raised concerns about the NRC recognizing and taking appropriate actions. The degradation of mill-annealed Alloy 600 tubing and problems noted in inspecting SG tubes have received significant attention by the NRC. The staff has issued numerous generic letters and information notices, has conducted many studies on generic issues related to SG tube integrity, and has had an active SG research program for many years. In response to the NRC staff's ongoing regulatory development effort, the industry has focused its efforts on improving existing

SG inspection guidance and developing additional guidelines on other programmatic elements related to SG 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 PWR licensees to a programmatic approach for structuring and strengthening existing SG programs. The fundamental elements include a balance of prevention, inspection, evaluation, repair and leakage monitoring measures.

The NRC has also performed an in-depth evaluation of lessons learned as a result of the February 15, 2000, IP2 event. This evaluation includes the insights gained through the NRC's onsite inspection, the licensee's SG tube examinations, and root cause failure analyses, and considers these issues from both a technical and regulatory perspective. In addition, NRC headquarters technical staff is reassessing the industry's SG 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. Information and reports related to IP2 are available on the NRC's website. Go to www.nrc.gov and click on 'Nuclear Reactors' and then 'Indian Point 2 Event.'

Finally, regarding the news article you forwarded related to corrosion problems on a UK nuclear submarine, the NRC has no information on the event described. The NRC is not involved in the inspection or regulation of UK nuclear submarines.

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 by Suzanne C. Black for/
John A. Zwolinski, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

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