

GERRY E. STUDDS
TENTH DISTRICT, MASSACHUSETTS

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Congress of the United States
House of Representatives

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HYANNIS
146 MAIN STREET
HYANNIS, MA 02601

February 9, 1994

Dear Mr. Rathbun:

I am contacting you on behalf of my constituent, Ms. Mary Ott, who would like answers to the questions raised in the enclosed letter from Robert Pollard of the Union of Concerned Scientists.

I would appreciate your attention to Ms. Ott's concerns, and your response to me at: 1212 Hancock St, Quincy, MA 02169, Attn: Mary Lou Butler.

Very respectfully,

Gerry E. Studds
MC, 10th District, MA

Dennis Rathbun
Director, Office of Congressional Affairs
Nuclear Regulatory Commission
Washington
DC 20555

Enclosure

9403040286

FROM : UCS/DC

TO : 9 1 202 225 2212

1994.02-01

03:13PM #570 P.02/06

UNION OF CONCERNED SCIENTISTS

February 1, 1994

The Honorable Gerry E. Studds
United States House of Representatives
Washington, DC 20515-2110

Dear Congressman Studds:

As you know, Boston Edison's Pilgrim nuclear power plant is operating with cracks in the main turbine despite warnings from General Electric, the turbine manufacturer, that the turbine could fail. In your letter of June 29, 1993 to the Chairman of the U.S. Nuclear Regulatory Commission, you and Senator Kennedy and Senator Kerry raised several questions about the risk of continuing to operate the plant with cracks in the main turbine. Recent events caused me to re-examine the NRC's August 4, 1993 response to your inquiry.

I have concluded that the NRC's analysis is inadequate to justify continued operation of the Pilgrim plant. My reasons for writing are to explain the inadequacies of the NRC's analysis and to describe the additional information needed to determine whether the Pilgrim plant should be shut down until the cracked turbine rotor is repaired or replaced.

One deficiency of the NRC's analysis is that it assessed the potential for turbine failure only under the conditions of normal operation of the turbine. It appears that the NRC did not consider the potential for turbine vibrations to increase significantly the force on the cracked rotors. Two recent events show that this is an important omission.

On December 25, 1993, the turbine at the Fermi 2 nuclear plant near Detroit came apart. The damage to the plant is described in the enclosed NRC Preliminary Notification of Occurrence, PNO-III-93-69 and PNO-III-93-69A, dated December 27 and December 30, 1993. Note that, at the time of turbine failure, plant "personnel reported that significant vibration was felt throughout the plant, accompanied by loud noises," and that "the vibrating motion was sufficient to be recorded on the seismic monitor in the reactor building." [PNO-III-93-69A, p. 2.]

Then, on January 7, 1994, the NRC issued Information Notice 94-01, "Turbine Blade Failures Caused by Torsional Excitation [i.e., vibration] From Electrical System Disturbance." A copy is enclosed. The Information Notice describes how routine disturbances in the electrical system can induce vibrations in the turbine that can and have caused blade failures in the low pressure turbines of several nuclear power plants. The NRC notes that "when the frequency of the excitation coincides with the natural

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torsional frequency of the turbine rotor, the rotor and blade responses are highly magnified." [IN 94-01, p. 2, emphasis added.] In other words, routine disturbances in the electrical system can cause vibrations that significantly increase the stresses on the turbine blades and rotor. The Pilgrim plant has an extensive history of the types of electrical disturbances listed in the Information Notice. Nevertheless, the Information Notice states that "no specific action or written response is required."

The NRC's response to you did not consider the effects of vibrations that can increase the stress on the turbine blades and the cracked rotor. Nor did the NRC consider the effects of severe vibrations--large enough to be detected by an earthquake monitor--that the cracked rotor disks can experience following failure of a turbine blade. In fact, the NRC's response to you explicitly states that "no safety concerns exist for normal operation of the [Pilgrim] turbine to the end of the current fuel cycle." [Emphasis added.] Thus, the NRC did not consider the potential for blade failures or electrical disturbances to induce vibrations that could magnify the force on the cracked rotors.

There are several other deficiencies in the NRC analysis:

- o - The size of one of the cracks in the Pilgrim turbine rotor is not known and may be larger than the crack size assumed in the analyses performed by GE, Structural Integrity Associates (SIA) and NRC.

General Electric "could not accurately size" one crack. Instead, GE, SIA and NRC "assumed a crack size of 6.35 mm (0.25 in) based on flaw indications from other plants' inspection data and laboratory data." NRC proffered the view that it "believes" that the assumed crack size is conservative, but can not quantify the uncertainty of the assumed size. [NRC response, encl. 2, p. 1, and encl. 2, attachment 1, emphasis added.]

- o - The cracks in the Pilgrim turbine may be growing at a rate significantly higher than the crack growth rate assumed in the analyses.

"GE used a crack growth rate of 1.52 mm (0.06 inch) each year, which was the median value from a statistical study correlating the average crack growth rate with the wheel operating temperature from turbine inspection data of both BWR [boiling water reactor] and PWR [pressurized water reactor] plants." The maximum crack growth rate used in the SIA and NRC analyses was the same as GE used. However, "GE's data indicate that the upper bound growth rate . . . could be as high as 2.03 mm (0.08 inch) each year," i.e., 33 percent greater than the crack growth rate assumed in the analyses. [NRC response, encl. 2, p. 2, emphasis added.]

FROM : UCS/DC

TO : 9 1 202 225 2212

1994-02-01

03:14PM #570 P.04/06

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- o - The NRC admits that the probability that the Pilgrim turbine rotor will fail is higher than the NRC's criterion.

In its response to you, the NRC states it "desires" that the probability of turbine disk failure be less than 1 in 100,000 per year. [NRC response, encl 2, p. 2.] However, in its internal evaluation, the NRC states that it "requires" that the probability be less than 1 in 100,000 per year. [Memorandum for Walter Butler from Jack Strosnider, "Pilgrim Unit 1: Assessment of Low Pressure Turbine Analysis," June 17, 1993, p. 3.] Whether the NRC "desires" or "requires" that the probability be less than 1 in 100,000 per year, the fact is that the probability is higher than that for the Pilgrim turbine. The NRC "estimated that the turbine disk failure probability for the LPA turbine is between 1E-5 and 1E-4 per year," i.e., between 1 in 100,000 and 1 in 10,000 per year, or up to 10 times higher than the NRC's criterion. [NRC response, encl. 2, p. 2.]

Furthermore, although the NRC states that it will permit the Pilgrim turbine to remain in service until the next scheduled outage in April 1995, the NRC states that, at that time, Boston Edison "should ensure they meet the turbine disk failure probability to the 1E-5 [1 in 100,000] criterion." [NRC response, encl. 2, p. 2.] The NRC makes no attempt to explain why it intends to permit the Pilgrim plant to operate in violation of the probability criterion until April 1995, but not beyond that date.

Before turning to the additional information that the NRC should provide, there is one other aspect of the NRC's conduct in this matter that is cause for concern. Various NRC officials have made statements to the media that create the impression that turbine failures are primarily an economic concern for Boston Edison, but are not a nuclear safety concern. Perhaps the most egregious statements were attributed to Jack Strosnider, who prepared the June 17, 1993 internal NRC memorandum cited above and presumably participated in preparing the NRC's response to you.

The following is from the June 28, 1993 issue of Inside N.R.C., a McGraw-Hill publication:

Strosnider stressed that "there is no regulatory requirement that NRC review" the GE or SIA reports on the Pilgrim turbines. That equipment is considered "balance-of-plant" and "not a nuclear safety sort of thing," he said. "We would not normally perform a review," Strosnider said. "But there were concerns raised by citizens and some congressmen, so Boston Edison gave us the SIA analysis for information and we did do an evaluation."

Strosnider explained that, though some more recently licensed plants do have license conditions or technical specifications that would force them

FROM : UCS/DC

TO : 9 1 202 225 2212

1994-02-01

03:15PM #570 P.05/06

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to take immediate action if the probability of a "turbine missile failure" became too great, there are no such requirements on Pilgrim, even though the turbine deck is "oriented unfavorably with respect to the reactor building."

"There is nothing that would require them" to take immediate action, Strosnider said. "It's their decision. They have a large financial investment (in the turbine equipment). They wouldn't want to fail the thing. It's their responsibility."

It is clear that these statements are, in significant part, incorrect. The NRC has described the risk posed by failure of the turbine rotor in Regulatory Guide 1.115, "Protection Against Low-Trajectory Turbine Missiles." A copy is enclosed. General Design Criterion 4 of Appendix A to 10 CFR Part 50 requires, in part, that structures, systems and components important to safety be appropriately protected against the effects of missiles that may result from equipment failures.

Failure of the turbine rotor has the potential to produce large, high-energy missiles. For example, a 120-degree section of a steel disk in a low pressure turbine weighs a ton or more. Failure of the disk at the normal turbine speed of 1800 rpm would give the disk section an initial velocity of 200 to 300 miles per hour. The kinetic energy of such a "turbine missile" can be sufficient to damage even substantial reinforced concrete walls. Thus turbine missiles have the potential for damaging safety-related equipment in the plant. The potential consequences of turbine missiles include direct effects (e.g., damage to the spent fuel pool) as well as indirect effects (e.g., impairment of vital control room functions).

In sum, turbine failure is not solely an economic concern. It can result in a serious nuclear accident with significant radiological consequences for the public. This matter is clearly within the NRC's scope of responsibility.

I recommend that the NRC be asked to provide the following information:

1. Identify all existing regulations and regulatory guidance (e.g., regulatory guides and policies) that are relevant to ensuring that turbine missiles do not pose an unacceptable risk to public health and safety. If any of these are not applicable to the Pilgrim plant, explain why.
2. Explain the bases for allowing the Pilgrim plant to operate with a probability of turbine disk failure greater than 1 in 100,000 per year until the next scheduled outage, but not after that outage.

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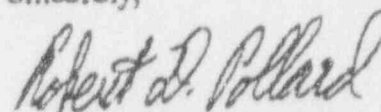
February 1, 1994

3. For each parameter used in the turbine failure analysis described in the NRC's August 4, 1993 response, explain the basis for the value used and state whether that represents the worst case assumption. The parameters to be discussed include turbine speed, disk temperature, crack size, crack growth rate and critical flaw (crack) size.
4. If the analysis described in the August 4, 1993 response did not include consideration of the stresses on the cracked disks that could be caused by the type of vibrations discussed in Information Notice 94-01, perform such an analysis and report the results. Explain the bases for any assumptions used in the analysis.
5. If the analysis described in the August 4, 1993 response did not consider the stresses on the cracked disks that could result from a blade failure, perform such an analysis and report the results. Explain the bases for any assumptions used in the analysis.
6. The NRC stated that it "intends to perform a confirmatory review of the GE analysis and its methodology." [NRC response, encl. 2, p. 3.] Provide the results from that review or explain why it was not performed.

On behalf of the Union of Concerned Scientists and our members who live and work in the vicinity of the Pilgrim plant, I want to thank you for your efforts in this matter. We are reluctant to add to the many important issues requiring your attention, but the NRC has demonstrated that it is, at best, a reluctant regulator. If NRC could be entrusted to do a thorough analysis on its own initiative, we would not need to request your assistance. However, that is not the case.

If you or your staff need additional information or would like to discuss this matter further, please feel free to contact me at the Union of Concerned Scientists' office in Washington, DC at (202) 332-0900.

Sincerely,



Robert D. Pollard
Nuclear Safety Engineer

Enclosures:

NRC Preliminary Notification of Occurrence PNO-III-93-69
NRC Preliminary Notification of Occurrence PNO-III-93-69A
NRC Information Notice 94-01
NRC Regulatory Guide 1.115

WB

ACTION

EDO Principal Correspondence Control

FROM: DUE: 03/25/94

EDO CONTROL: 0009858
DOC DT: 03/01/94
FINAL REPLY:

Rep. Gerry E. Studds

TO:

Dennis Rathbun, OCA

FOR SIGNATURE OF : ** GRN **

CRC NO: 94-0218

Executive Director

DESC:

ROUTING:

ENCLOSES LTR FROM MARY C. OTT & DONALD MUUIRHEAD
CONCERNING PILGRIM NUCLEAR POWER PLANT

Taylor
Milhoan
Thompson
Blaha
TMMartin, RI
Lieberman, OE
Cyr, OGC

DATE: 03/11/94

ASSIGNED TO:

CONTACT:

NRR Russell

SPECIAL INSTRUCTIONS OR REMARKS:

REF. EDO 9775.
REPLY TO QUINCY, MA OFFICE.
MARK ENVELOPE ATTN: MARY LOU BUTLER.

NRR RECEIVED: March 11, 1994
NRR ACTION: DRPE:VARGA

NRR ROUTING: WR/FJM
LR
AT
DC
FG
NRR MAIL ROOM

ACTION
DUE TO NRR DIRECTOR'S OFFICE
BY Gar. 22

OFFICE OF THE SECRETARY
CORRESPONDENCE CONTROL TICKET

PAPER NUMBER: CRC-94-0218 LOGGING DATE: Mar 10 94

ACTION OFFICE: EDO

AUTHOR: REP GERRY STUDDS
AFFILIATION: U.S. HOUSE OF REPRESENTATIVES

ADDRESSEE: RATHBUN

LETTER DATE: Mar 1 94 FILE CODE: IDR-5 PILGRIM

SUBJECT: POTENTIAL DANGERS OF PILGRIM'S CRACKED MAIN TURBINE

ACTION: Signature of EDO

DISTRIBUTION: OCA TO ACK, DSB

SPECIAL HANDLING: NONE

CONSTITUENT: MARY OTT

NOTES:

DATE DUE: Mar 24 94

SIGNATURE: . DATE SIGNED:

AFFILIATION: