DMB 016

September 6, 1984

Docket No. 50-289

Mr. John Kovalic
739 Dietrich Avenue
Middletown, Pennsylvania 17057

Dear Mr. Kovalic:

At the limited appearance session for the Three Mile Island, Unit 1 steam generator repair hearing which was held in Middletown on July 16 and 17, 1984, you raised several questions. Your questions, paraphrased, and the NRC Staff's answers, are attached.

I trust this letter is responsive to your questions.

Sincerely,

"ORIGINAL SIGNED BY:"
Mary E. Wagner
Counsel for NRC Staff

Attachment: As stated

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1. Are the tubesheets of the OTSGs at TMI-1 made of plain steel, iron and plated with Inconel, or solid Inconel?

The tubesheets of the OTSGs at TMI-1 are made of carbon steel. However, the primary side of the tubesheets are protected by a layer of Inconel 600 weld-overlay.

2. Are the circumferential cracks of the TMI-1 OTSG tubes caused by flexing or sulfuric acid? Why is it occurring only at the top of the tubes?

The circumferential cracks of the TMI-1 OTSG tubes were not caused by flexing or sulfuric acid. The causative agent(s) which is responsible for the tube cracking has been determined to be a reduced form of sulfur species as discussed in detail in Section 3.1 of the NUREG-1019 which is in the Local Public Document Room. Since oxygen must be present in order for the sulfur-induced corrosion attack to occur, venting of the OTSGs provided sufficient oxygen to the top of the TMI-1 OTSGs water. This is the reason why cracking occurred preferentially at the top of the OTSG tubes.

3. Are dissimilar metals used in the OTSG construction?

Yes, carbon steel tubesheets and Inconel 600 tubes were used in the construction of OTSGs. However, in the primary side, where tube cracking occurred, the tubesheets were covered by a layer of Inconel 600 weld overlay. Therefore, galvanic corrosion, caused by dissimilar metals, was not a factor in the observed corrosion.

4. Were the tubes restrained with an outside shell or die to prevent the explosion from going beyond a certain limit?

As discussed in NUREG-1019, the kinetic expansion occurred only within the two-foot thick tubesheet, the holes in which provide only a very small radial clearance for the tube. The amount of explosive charge has been optimized through an extensive qualification process to prevent excessive stresses, while ensuring a tight seal.

5. Does the expansion joint rely on corroded sections of the tube which were already affected by embrittlement and corrosion to maintain the seal?

No. The expansion joints rely on six-inch defect-free tube sections to maintain the seal. As indicated in Section 3.4.1 of NUREG-1019, pullout loads for high and low strength tubing with the six-inch expansion on both corroded and uncorroded blocks showed pullout loads significantly in excess of 3140 pounds (the calculated design-basis accident load limit) for all qualification conditions. The Inconel 600 tubes were not embrittled as confirmed by ductility measurements of tubes which were removed from the TMI-1 steam generators.

6. Were the steam generator tubes leaking before 1979? Would the leak have gone on forever if it hadn't been for the TMI-2 accident of 1979?

The tube leakage in question occurred in late November 1981 while performing reactor coolant system hydrostatic testing with the reactor shut down. There is no evidence of prior tube leakage due to sulfur induced corrosion. The failure scenario of the OTSG tubes is discussed in NUREG-1019.

7. Do the kinetically expanded tubesheet-to-tube joints provide a leak-tight seal? Will tube leaks vent pollution and radiation into the atmosphere?

As discussed in NUREG-1019 Section 3.4.1, the kinetically expanded joints are fabricated to be leak-tight. However, during plant operation, some very low-level leakage is expected. The joints have been qualified by drip tests, bubble tests and through operation at full temperature and pressure. The licensee monitors the tubes continuously to detect indications of increased primary-to-secondary leakage. If excessive leakage beyond six gallons per hour (60 gallons per hour is allowed by the Technical Specifications) is detected, the plant will be shut down and repaired as necessary. The Technical Specifications leakage limit will result in very low releases of radioactivity to the environment even with postulated relatively high primary-side radioactivity. Actual primary radioactivity has historically been much lower than allowable limits at TMI-1, and with reduced allowed leakage, any radioactivity releases will be considerably lower.

Mr. R. J. Toole
O&M Director, TMI-1
GPU Nuclear Corporation
P. O. Box 480
Middletown, Pennsylvania 17057

Board of Directors
P. A. N. E.
P. O. Box 268
Middletown, Pennsylvania 17057

Docketing and Service Section
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Chauncey Kepford
Judith H. Johnsrud
Environmental Coalition on Nuclear Power
433 Orlando Avenue
State College, Pennsylvania 16801

Judge Reginald L. Gotchy
Atomic Safety & Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Jordan D. Cunningham, Esq.
Fox, Farr and Cunningham
2320 North 2nd Street
Harrisburg, Pennsylvania 17110

Ms. Louise Bradford
TMIA
1011 Green Street
Harrisburg, Pennsylvania 17102

Ms. Marjorie M. Aamodt
R. D. #5
Coatesville, Pennsylvania 19320

Earl B. Hoffman
Dauphin County Commissioner
Dauphin County Courthouse
Front and Market Streets
Harrisburg, Pennsylvania 17101

Ellyn R. Weiss
Harmon, Weiss & Jordan
20001 S Street
Suite 430
Washington, D.C. 20009

Ivan W. Smith, Esq., Chairman
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. Thomas E. Murley, Regional Administrator
U. S. N. R. C., Region I
631 Park Avenue
King of Prussia, Pennsylvania 19406

Gary J. Edles, Chairman
Atomic Safety & Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

ANGRY/TMI PIRC
1037 Maclay Street
Harrisburg, Pennsylvania 17103

Dr. John H. Buck
Atomic Safety & Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

John Levin, Esq.
Pennsylvania Public Utilities Commission
Box 3265
Harrisburg, Pennsylvania 17120

Mr. Thomas M. Gerusky, Director
Bureau of Radiation Protection
Pennsylvania Department of
Environmental Resources
P. O. Box 2063
Harrisburg, Pennsylvania 17120

Marvin I. Lewis
6504 Bradford Terrace
Philadelphia, Pennsylvania 19149

G. F. Trowbridge, Esq.
Shaw, Pittman, Potts & Trowbridge
1800 M Street, N.W.
Washington, D. C. 20036

J. S. Wetmore
Manager, PWR Licensing
GPU Nuclear Corporation
100 Interpace Parkway
Parsippany, New Jersey 07054

Ms. Virginia Southard, Chairman
Citizens for a Safe Environment
264 Walton Street
Lemoyne, Pennsylvania 17043

Dr. David Hetrick
Professor of Nuclear Energy
University of Arizona
Tucson, Arizona 85721

Mr. David D. Maxwell, Chairman
Board of Supervisors
Londonderry Township
RFD#1 - Geyers Church Road
Middletown, Pennsylvania 17057

Regional Radiation Representative
EPA Region III
Curtis Building (Sixth Floor)
6th and Walnut Streets
Philadelphia, Pennsylvania 19106

Mr. Richard Conte
Senior Resident Inspector (TMI-1)
U.S.N.R.C.
P. O. Box 311
Middletown, Pennsylvania 17057

General Counsel
Federal Emergency Management Agency
ATTN: Docket Clerk
1725 I Street, NW
Washington, DC 20472

Karin W. Carter, Esq.
505 Executive House
P. O. Box 2357
Harrisburg, Pennsylvania 17120

Dr. James Lamb
313 Woodhaven Road
Chapel Hill, North Carolina 27514

Dauphin County Office Emergency
Preparedness
Court House, Room 7
Front & Market Streets
Harrisburg, Pennsylvania 17101

Christine N. Kohl, Esq.
Atomic Safety & Licensing Appeal
Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Ms. Lennie Prough
U. S. N. R. C. - TMI Site
P. O. Box 311
Middletown, Pennsylvania 17057

Mr. Robert B. Borsum
Babcock & Wilcox
Nuclear Power Generation Division
Suite 220, 7910 Woodmont Avenue
Bethesda, Maryland 20814

Mr. Gustave A. Linenberger, Jr.
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. C. W. Smyth
TMI-1 Licensing Manager
GPU Nuclear Corporation
P. O. Box 480
Middletown, Pennsylvania 17057

Governor's Office of State Planning
and Development
ATTN: Coordinator, Pennsylvania
State Clearinghouse
P. O. Box 1323
Harrisburg, Pennsylvania 17120

Sheldon J. Wolfe, Esq., Chairman
Atomic Safety & Licensing Board
Washington, D.C. 20555

Ms. Jane Perkins
City Government Center
10 North Market Square
Harrisburg, Pennsylvania 17101

Jane Lee
183 Valley Road
Etters, Pennsylvania 17319

Bruce Molholt
Haverford College
Haverford, Pennsylvania 19041

Norman Aamodt
R. D. #5, Box 428
Coatesville, Pennsylvania 19320

Michael McBride, Esq.
LeBoeuf, Lamb, Leiby & McRae
Suite 1100
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036