

February 17, 1984

Docket No. 50-320

Mr. B. K. Kanga, Director
Three Mile Island Unit 2
GPU Nuclear Corporation
P.O. Box 480
Middletown, PA 17057

Dear Mr. Kanga: -

Subject: NRC Staff Safety Evaluation of First Pass Stud Detensioning

- References: (a) Letter from B. Kanga (GPU) to B. Snyder (NRC), 4410-83-L-0222,
Head Removal - First Pass Stud Detensioning, dated Sept. 29, 1983.
- (b) Letter from B. Snyder (NRC) to B. Kanga (GPU), First Pass Stud
Detensioning - Request for Additional Information, dated
December 6, 1983.
- (c) Letter from B. Kanga (GPU) to B. Snyder (NRC), 4410-84-L-0009,
Responses to Request for Additional Information - First
Pass Stud Detensioning, dated January 30, 1984.

This letter is in response to your letter, Reference (a), which forwards your safety evaluation and request for our approval of first pass (i.e., partial) detensioning of the 60 reactor pressure vessel (RPV) studs and removal of up to 5 studs. Reference (c) provides further information in support of your safety evaluation and was submitted in response to our request for additional information (Reference b).

Stud detensioning is normally a routine activity during the reactor pressure vessel head removal sequence. However, at TMI-2, the studs and associated nuts which hold the studs in tension have not been detensioned for a period in excess of five years and may well be stuck due to rust and corrosion of the metal surfaces. Inasmuch as stud detensioning is a prerequisite to RPV head removal, it is important to determine as early as possible if the studs can be detensioned without difficulty.

There are 60 studs with associated nuts and washers which bolt the RPV head to the vessel flange. Two concentric, metal "O" ring gaskets provide the seal between the RPV head and vessel mating surfaces. In the present fully tensioned condition, the RPV head exerts approximately 63 million pounds of force on the vessel flange. This force is a result of the tension or elongation applied to the studs during the head bolting sequence. In the fully tensioned condition, the average elongation in each stud is approximately 0.047 inches and the vessel design pressure rating is 2500 psig.

Distribution:

Docket No. 50-320

NRC PDR

Local PDR

DCS

TMI Site R/F

TMI HQ R/F

BSnyder

LBarrett

TPoindexter

MMasnik

RWeller

PGrant

AFasano

JWiebe

LChandler, ELD

I&E (5)

TBarnhart (4)

LSchneider

ACRS (16)

OPA

RDiggs

HRDenton

ARosenthal,

(ASLAB)

RLazo, ASLAP

M-town Off.

OFFICE	TRIPD: NRR	PD: TRIPD: NRR	8402290350 840217		
SURNAME	RAWeller;bg	BSnyder	PDR ADOCK 05000320		
DATE	2/16/84	2/16/84	P PDR		

Stud detensioning is accomplished by relieving the tension or elongation in each stud and is normally a two pass (i.e., two step) process. The detensioning process involves stretching the studs and partially unwinding the nuts, in a patterned sequence, with a hydraulic detensioning machine. During first pass stud detensioning, the elongation in each of the 60 studs will be reduced from approximately 0.047 inches to 0.03 inches. Your proposal also involves the subsequent full detensioning and removal of up to five studs and associated nuts.

The primary purpose of first pass stud detensioning is to check for stuck nuts and studs so that tooling and procedures can be developed to facilitate future head removal. Removal of up to five studs will permit examination of their condition and provide information related to removal of the remaining studs and nuts during the head removal sequence. Following completion of first pass stud detensioning activities, including the removal of up to five studs, the RPV head would be in a condition in which it exerts approximately 39 million pounds of force on the vessel flange mating surface. This force corresponds to a vessel pressure retaining capability of approximately 1600 psig.

The plant Technical Specifications presently limit the allowable pressure in the reactor coolant system to less than 600 psig. In our review, we have considered the capability of the reactor vessel head seal for holding up to 1000 psig (i.e., the GPU design objective to ensure the capability of holding pressures within the limits of the Technical Specifications) following first pass detensioning of all studs and subsequent removal of up to five studs. In this regard, we have examined the temperature history of the metal in the reactor vessel flange and head mating surface to determine if temperature extremes (i.e., temperatures in excess of 960 °C, the melting point of silver) resulting from the accident have affected the silver cladding on the surface of the flange "O" ring seals. We have evaluated the estimates of the occupational exposure likely to be incurred in the conduct of first pass stud detensioning activities. We have reviewed the plant Technical Specifications which were implemented by the Director's Order of February 11, 1980 to see if any changes thereto are necessary or warranted. Lastly, inasmuch as first pass stud detensioning involves a change in the pressure retaining capability of the RPV, we have reviewed the related activities to determine if they represent an "unreviewed safety question" when evaluated against the criteria of 10 CFR Part 50.59 (Changes, tests and experiments).

Our review indicates that the partial unloading (i.e., first pass detensioning) of all studs and subsequent full detensioning and removal of up to five studs would still leave the RPV head with approximately 39 million pounds of bolt force on the vessel flange. This value conservatively neglects the weight of the RPV head. This force corresponds to a vessel pressure retaining capability of approximately 1600 psig which is well in excess of the GPU objective of a pressure retaining capability of 1000 psig. The capability for pressurizing the reactor coolant system (presently limited to 600 psig by the plant Technical Specifications) during the time period prior to future RPV head removal is desirable in that it would facilitate, for example, the processing of reactor coolant.

OFFICE	..... is desirable in that it would facilitate, for example, the processing of reactor coolant.					
SURNAME	.....				
DATE	.....				

As part of our evaluation of the pressure retaining capability of the RPV, we examined the impact that first pass stud detensioning might have on the two metal "O" ring gaskets in the RPV flange. Because of the geometrical configuration of the vessel and head mating surfaces and the location of the studs in the perimeter of the flange (see Figure 1), the fully tensioned condition produces a slight deflection or gap between the mating surfaces at the RPV radial location inside the "O" ring gaskets. When the studs are detensioned, this gap is reduced. Thus, first pass stud detensioning actually increases the compression of the mating surfaces on the flange "O" ring seals, thereby maintaining the full integrity of the flange seals. We also note that the "O" rings are designed as hollow tubes with slotted holes which permit the "O" ring to expand (when subjected to rising vessel pressure) against the flange mating surfaces and ensure a good seal. We have also examined the estimates you provided for the maximum temperatures that the "O" ring gaskets were subjected to during the accident sequence to determine if the silver cladding (0.004 to 0.006 inches thick) on the stainless steel gaskets might have degraded and affected sealing capability. We concur with your analysis which concludes that the temperatures in the vicinity of the "O" rings would be bounded by the estimated maximum temperature (approximately 485 °C) of the inside surface of the vessel in the flange region during the accident sequence. The "O" rings are protected to a degree by virtue of their location in the RPV flange which consists of a massive amount of metal capable of acting as a heat sink during a transient. We conclude that the temperatures occurring in the flange during the accident sequence would not have affected the integrity of the silver cladding (the melting point of silver is approximately 960 °C) on the "O" ring seal. Accordingly, the "O" ring should be capable of performing its intended function with little risk of leakage through the flange seal in the event the vessel is refilled and pressurized at some time in the future.

With regard to the occupational exposure likely to be incurred to complete first pass stud detensioning activities, you estimated a total exposure of 15 man-rem based on 151 man-hours of in-containment work. We believe that the estimate is low in that it does not provide for the contingency of dealing with stuck studs and nuts. More than five years have passed since the previous detensioning of the studs and the studs have surface rust and corrosion. We believe that there is substantial potential for additional work during stud removal and that approximately 75 man-hours of in-containment work would be required to remove up to five studs and nuts that cannot be manipulated using the standard techniques. Accordingly, we estimate that first pass stud detensioning activities could result in as much as approximately 23 man-rem of occupational exposure. This estimate is well within the range of impacts previously assessed in the staff's Programmatic Environmental Impact Statement (PEIS).

With regard to the conduct of first pass stud detensioning activities, we have reviewed the plant Technical Specifications which were implemented by the Director's Order of February 11, 1980 and determined that no changes to the Technical Specifications are necessary or warranted. We have also evaluated

OFFICE	.....	.....	.....	.....	.....	.....
SURNAME	.....	.....	.....	.....	.....	.....
DATE	.....	.....	.....	.....	.....	.....

the activities to determine if they represent an unreviewed safety question when evaluated against the criteria of 10 CFR Part 50.59. The activities would involve an unreviewed safety question (i) if the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report may be increased; or (ii) if a possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report may be created; or (iii) if the margin of safety as defined in the basis for any Technical Specification is reduced.

We have reviewed the sequence of activities involved in first pass stud detensioning and determined that they will not result in an increase in the probability of occurrence or the consequences of an accident or malfunction of equipment. Stud detensioning is a normal activity at any commercial nuclear power plant (e.g., for refueling or maintenance) and the planned effort at TMI-2 will be conducted in the same manner, using standard detensioning equipment and procedures, as for any facility. The planned effort will not perturb reactor coolant water level (currently about one foot below the vessel flange elevation) or affect the conditions inside the RPV. The reactor pressure vessel is currently in the depressurized, vented condition. Should the RCS require repressurization, for whatever reason, the capability for accommodating system pressures up to the technical specification limit of 600 psig is unaffected by first pass stud detensioning as ample margin is provided for pressure retaining capability (i.e., well in excess of 1000 psig). Further, in the unlikely event of system leakage or other upset condition, the consequences would be significantly diminished from those previously evaluated in the Final Safety Analysis Report (FSAR) because of the relatively benign conditions within the RPV. The core decay heat is only 19 Kw (approximately 20 home toasters) and, due to radioactive decay, the core is devoid of the bulk of those radionuclides (i.e., radioiodines and noble gases) which could otherwise form a potential airborne source term for offsite release. Moreover, all safety equipment associated with the control and potential release of radioactive material is fully operational. The operation of these safety systems, considering the 19 Kw of decay heat and the lower radionuclide source term, preclude any credible accident consequence from exceeding those consequences identified in the FSAR.

We have evaluated possible accidents or malfunctions that could be created by stud detensioning activities and determined that none of these events are of a different type than those previously evaluated in the FSAR. The events considered were those that could result in leakage from the reactor coolant system (e.g., from refilling and pressurization) which is evaluated as a loss of coolant accident (LOCA) in the FSAR. For present TMI-2 conditions, with decay heat of approximately 19 Kw and the absence of short-lived radioiodines and noble gases, the TMI-2 situation is well bounded by the FSAR large LOCA analyses.

OFFICE	.....	.....	.....	.....	.....	.....	.....
SURNAME	.....	.....	.....	.....	.....	.....	.....
DATE	.....	.....	.....	.....	.....	.....	.....

We have reviewed the plant Technical Specifications and the bases for the specifications to determine if any margins of safety, as defined in the bases, have been reduced. The Technical Specification limit for reactor coolant system pressure is 600 psig. This limit is based on the need to control system pressure to prevent a nonductile failure of the system while at the same time permitting the system pressure to be maintained at a sufficiently high value to permit operation of the reactor coolant pumps. However, the TH1-2 reactor coolant pumps have not operated since late April 1979 and, given the low level of decay heat, the pumps are not needed for decay heat removal. Moreover, there is little potential for any credible event which could lead to pressurization of the reactor coolant system in excess of the Technical Specification limit. The pressure retaining capability of the RPV following first pass stud detensioning is more than double the pressure limited by the plant Technical Specifications (600 psig). Further, the reactor coolant system is protected from any credible overpressurization event (i.e., operation of the Standby Pressure Control system for processing reactor coolant) by relief valves that would automatically limit system pressure below the Technical Specification limit. This protection from overpressurization is provided both in the Standby Pressure Control System (when in use to maintain system pressure) and in reactor coolant system piping when the system is isolated from the Standby Pressure Control System. Thus, the reduction in pressure retaining capability resulting from first pass stud detensioning will not affect system ductility concerns. We conclude, therefore, that no margin of safety for any Specification has been reduced. Accordingly, we conclude that first pass stud detensioning activities do not represent an unreviewed safety question.

On the basis of our safety review as described above, we conclude that first pass stud detensioning poses insignificant risk to the occupational workforce and offsite public. Additionally, the estimated environmental impacts from first pass stud detensioning fall within the scope of those previously assessed in the staff's PEIS. Accordingly, first pass stud detensioning and the associated activities can be implemented following formal NRC approval of related procedures, in accordance with Section 6.8.2 of the plant Technical Specifications.

Sincerely,

Original signed by

B. J. Snyder

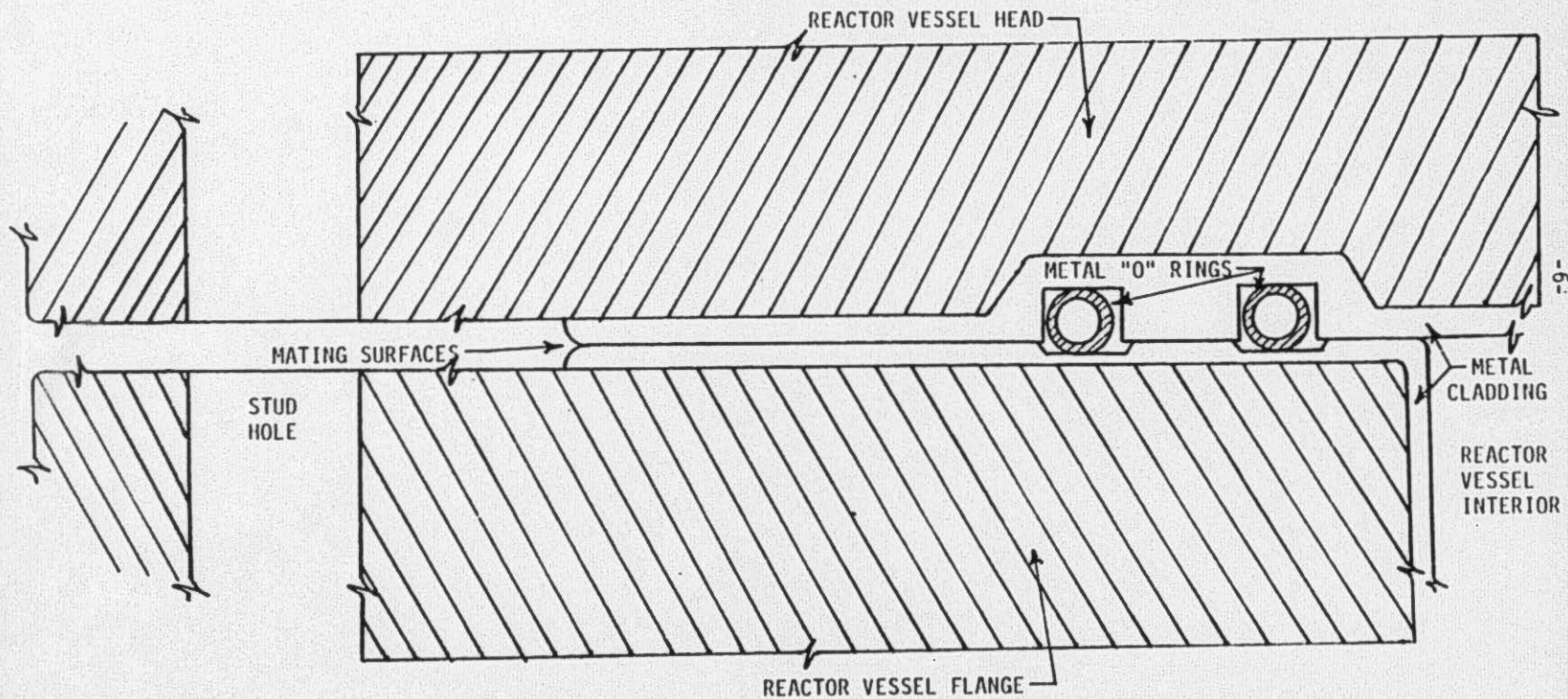
Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation

cc: J. Barton
J. Byrne
J. Larson
Service Distribution List
(see attached)

OFFICE							
SURNAME							
DATE							

FIGURE 1

GENERAL ARRANGEMENT OF REACTOR VESSEL HEAD AND FLANGE,
STUDS, "O" RING SEALS, AND MATING SURFACES
(NOT TO SCALE)



Dr. Thomas Murley
Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

John F. Wolfe, Esq., Chairman,
Administrative Judge
3409 Shepherd St.
Chevy Chase, MD. 20015

Dr. Oscar H. Paris
Administrative Judge
Atomic Safety and Licensing
Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. Frederick H. Shon
Administrative Judge
Atomic Safety and Licensing
Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Karin W. Carter
Assistant Attorney General
505 Executive House
P.O. Box 2357
Harrisburg, PA 17120

Dr. Judith H. Johnsrud
Environmental Coalition on
Nuclear Power
433 Orlando Ave.
State College, PA 16801

George F. Trowbridge, Esq.
Shaw, Pittman, Potts and
Trowbridge
1800 M. St., NW
Washington, D.C. 20036

Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Atomic Safety and Licensing Appeal Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Secretary
U.S. Nuclear Regulatory Commission
ATTN: Chief, Docketing & Service Branch
Washington, D.C. 20555

Mr. Larry Hochendoner
Dauphin County Commissioner
P.O. Box 1295
Harrisburg, PA 17108-1295

John E. Minnich, Chairperson,
Dauphin County Board of Commissioners
Dauphin County Courthouse
Front and Market Streets
Harrisburg, PA 17101

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

U.S. Environmental Protection Agency
Region III Office
ATTN: EIS Coordinator
Curtis Building (Sixth Floor)
6th & Walnut Streets
Philadelphia, PA 19106

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

David Hess
Office of Environmental Planning
Department of Environmental Resources
P.O. Box 2063
Harrisburg, PA 17120

Willis Bixby, Site Manager
U.S. Department of Energy
P.O. Box 38
Middletown, PA 17057-0311

David J. McGoff
Division of Three Mile Island Programs
NE-23
U.S. Department of Energy
Washington, D.C. 20545

William Lochstet
104 Davey Laboratory
Pennsylvania State University
University Park, PA 16802

Randy Myers, Editorial
The Patriot
312 Market St.
Harrisburg, PA 17105

Robert B. Borsum
Babcock & Wilcox
Nuclear Power Generation Division
Suite 220
7910 Woodmont Ave.
Bethesda, MD. 20814

Michael Churchill, Esq.
PILCOP
1315 Walnut St., Suite 1632
Philadelphia, PA 19107

Linda W. Little
5000 Hermitage Dr.
Raleigh, NC 27612

Marvin I. Lewis
5504 Bradford Terrace
Philadelphia, PA 19149

Jane Lee
183 Valley Rd.
Etters, PA 17319

J.B. Liberman, Esquire
Berlack, Israels, Liberman
26 Broadway
New York, NY 10004

Walter W. Cohen, Consumer Advocate
Department of Justice
Strawberry Square, 14th Floor
Harrisburg, PA 17127

Edward J. Swartz
Board of Supervisors
Londonderry Township
RFD #1 Seyers Church Rd.
Middletown, PA 17057

Robert L. Knupp, Esquire
Assistant Solicitor
Knupp and Andrews
P.O. Box P
407 N. Front St.
Harrisburg, PA 17108

John Lewin, Esquire
Pennsylvania Public Utilities Comm.
P.O. Box 3265
Harrisburg, PA 17120

Honorable Mark Cohen
512 E-E Main Capital Building
Harrisburg, PA 17120

Mr. Edwin Kintner
Executive Vice President
General Public Utilities Nuclear Corp.
100 Interpace Parkway
Parsippany, NJ 07054