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October 16, 1986
NRC/TMI 86-101

Docket No. 50-320

Mr. F. R. Standerfer
Vice President/Director, TMI-2
GPU Nuclear Corporation
P. O. Box 480
Middletown, PA 17057

Dear Mr. Standerfer:

Subject: Core Bore Operations

The Nuclear Regulatory Commission (NRC) staff has reviewed your September 19, 1986 submittal regarding core bore operations. As stated in the enclosed safety evaluation issued by the staff, we conclude that the proposed activities can be accomplished without significant risk to the health and safety of the public provided that they are in accordance with the limitations stated in your submittal and supporting information. This activity falls within the scope of activities previously considered in the Programmatic Environmental Impact Statement.

We therefore approve implementation of core bore operations contingent upon submittal of the related procedures subject to Technical Specification 6.8.2. As previously discussed with members of your staff these procedures shall incorporate the following limitations:

1. An alarmed water level instrument for the internals indexing fixture (IIF)/reactor vessel shall be operable during drilling operations.
2. The drill bit will be continuously cooled with flush water during drilling.
3. A combination of administrative and mechanical controls will be used to prevent the bit from traveling below the lower grid.

Sincerely,
ORIGINAL SIGNED BY:
William D. Travers

William D. Travers
Director
TMI-2 Cleanup Project Directorate

cc: T. F. Demmitt
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CORE BORE OPERATIONS

SAFETY EVALUATION

INTRODUCTION

GPUN submitted safety evaluation reports (SERs) to support the planned operation of a drilling rig, utilizing a hollow drill bit, to obtain samples of the TMI-2 reactor core (references 4, 5, 6, 10 and 11). These were reviewed and subsequently approved by the NRC staff (references 7, 8, 9 and 12). GPUN then submitted a proposal to operate the drilling rig as a defueling tool utilizing solid-faced bits (reference 3). The staff reviewed the proposal and approved drilling in core locations which did not contain instrument strings (reference 2). Of 177 total fuel assembly positions in the TMI-2 core 52 have the potential for containing instrument strings. GPUN submitted a letter on September 19, 1986 (reference 1) with information supporting the use of the solid face bit on both instrumented and non-instrumented fuel assembly locations. This would allow expanded use of the drilling rig as a defueling tool.

EVALUATION

Safety issues associated with pyrophoricity, criticality and mechanical forces transmitted to the reactor vessel and internals, as approved in this safety evaluation, are bounded by the previous NRC safety evaluations in references 7 and 2. Additionally, the staff evaluated potential forces which could be applied to incore instrument penetrations as a result of the change in the scope of activities.

Mechanical forces from the solid faced bit could be transmitted through an instrument string to the incore penetration. Although the instrument string itself does not possess strong mechanical properties, it is constrained by an instrument guide tube such that drill forces could be transmitted to the instrument penetration nozzle welded to the lower reactor vessel head. If the strength of the penetration weld is within a factor of two of its "as-built" condition, it can be demonstrated to withstand the maximum forces which could be transmitted via an instrument string and a guide tube. However, there is a potential that the welds at the base of the incore instrument penetrations have been degraded as a result of the March 1979 accident. Staff review confirms the licensee's analysis that an incore instrument penetration nozzle exposed to extreme accident temperature would melt before the weld at its base (references 12 and 13). This results from the fact that during a scenario where hot core material makes contact with a penetration nozzle and its weld, the lower reactor vessel head, protects the integrity of the weld. This protection is provided as the vessel which is directly coupled with the weld, acts as a heat sink. The penetration nozzle, however, is not similarly

protected and melting of the nozzle would occur in advance of weld melting. With a melted penetration nozzle, the nozzle, instrument string and guide tube become uncoupled and significant drilling forces cannot be transmitted to the weld at the base of the penetration. Mechanical and thermal hydraulic analysis indicate that as a minimum a weld with strength equivalent to .034 inch remains. This is more than adequate to withstand any forces transmitted via the uncoupled geometry.

Since the staff does not have sufficient information to evaluate the safety of drilling in all locations below the lower grid, this area is excluded from this evaluation. The staff is imposing a requirement to maintain continuous drill bit cooling; this assures that pyrophoricity issues remain within the bounds previous analyzed (references 7 and 2). The requirement to maintain an operable water level alarm (reference 12) is being retained to assure prompt leak detection if one of the incore instrument nozzle welds is breached.

While the analyses indicate that the core drilling can be accomplished without adverse affect on the reactor coolant system integrity, the staff has also evaluated the licensee's capability to detect and mitigate an RCS leak caused by a total failure of an instrument penetration including discharge of the incore instrument guide tube. The staff has concluded that the licensee has the capability to promptly detect a failed penetration and to maintain RCS level at or above the reactor vessel nozzles by using water from the borated water storage tank and long term recirculation of borated water from the reactor building sump. (reference 12).

CONCLUSION

The staff has examined and evaluated the potential risks associated with the Core Bore Operations Program. Within the limitations stated in this approval, safety issues associated with the pyrophoricity, criticality, and mechanical force considerations regarding the reactor vessel and internals do not differ from those previously reviewed and approved.

The staff has also concluded that the drilling operation will not cause significant risk of a failure of the incore instrument penetrations and that the licensee has the capability to detect and mitigate a failure if it did occur. We therefore conclude that Core Bore Operations activities can be implemented without significant risk to the health and safety of the public.

REFERENCES

1. GPUN letter with attached evaluations from F. R. Standerfer, 4410-86-L-0162, to W. D. Travers, dated September 19, 1986.

2. NRC letter with attached Safety Evaluation NRC/TMI 86-072, W. D. Travers to F. R. Standerfer, dated July 24, 1986.

3. GPUN letter re "Use of Core Stratification Sample Acquisition Tool for Defueling" from F. R. Standerfer to W. D. Travers, dated July 23, 1986.

4. GPUN letter with attached SER from F. R. Standerfer, 4410-85-L-0147, to B. J. Snyder, dated August 30, 1985.

5. GPUN letter with attached SER from F. R. Standerfer, 4410-85-L-0248, to W. D. Travers, dated December 31, 1985.

6. GPUN letter with attached SER from F. R. Standerfer, 4410-86-L-0101, to W. D. Travers, dated June 11, 1986.

7. NRC letter with attached Safety Evaluation, NRC/TMI 86-041, W. D. Travers to F. R. Standerfer, dated May 5, 1986.

8. NRC letter with attached Safety Evaluation, NRC/TMI 86-052, W. D. Travers to F. R. Standerfer, dated May 28, 1986.

9. NRC letter with attached Safety Evaluation, NRC/TMI 86-058, W. D. Travers to F. R. Standerfer, dated June 19, 1986.

10. GPUN letter with attached SER from F. R. Standerfer, 4410-86-L-0091, to W. D. Travers, dated June 23, 1986.

11. GPUN letter from F. R. Standerfer, 4410-86-L-0122, to W. D. Travers, dated July 11, 1986.

12. NRC letter with attached Safety Evaluation, NRC/TMI 86-070, W. D. Travers to F. R. Standerfer, dated July 16, 1986.

13. NRC memorandum, D. M. Crutchfield to W. D. Travers, re "Temperatures Experienced by Instrument Nozzles", dated October 16, 1986.