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March 15, 1983
4410-83-L-0052

TMI Program Office
Attn: Mr. L. H. Barrett, Deputy Program Director
US Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, PA 17057-0191

Dear Sir:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Polar Crane SER - Additional Information

Attached for your information is additional information on the refurbished Polar Crane Safety Evaluation Report. This information is provided as a result of questions by your staff. NRC staff comments are listed by SER section number followed by GPUNC's response.

If you have further questions, please contact Mr. J. J. Byrne of my staff.

Sincerely,

B. K. Kanga

B. K. Kanga
Director, TMI-2

BKK/RBS/jep

Attachment

CC: Dr. B. J. Snyder, Program Director - TMI Program Office

D009

POLAR CRANE LOAD TEST SER

(NRC Comments and Responses Thereto)
(Comments listed by SER section number)

Comment 2.4 Provide stress analysis of the D-ring wall at point of contact with stacked missile shields.

Response 2.4 A stress analysis is not specifically needed since the missile shields have previously been stacked on the D-rings safety using wood blocking to elevate them above interferences. The D-ring walls are designed for this function. The present plan substitutes steel for the wood blocks to avoid bringing combustibles into containment. For further information on design of the D-rings, see Section 3.8.3 of the FSAR.

Comment 3.1 Provide a list of any exception taken to ANSI Standards for the crane and lift rigging.

Response 3.1 Exceptions taken to ANSI standards for the crane are described in the Polar Crane Functional Description, 2-M72-MH02, submitted as Revision 0 to the NRC via 4410-82-L-0021 dated October 8, 1982. Exceptions to ANSI standards for lift rigging were provided via GPUN letter 4410-83-L-0004 dated January 4, 1983.

Comment 3.2 Provide explanation of the statement, "Two individual though not redundant rope systems."

Response 3.2 The main hoist rope system includes two lengths of rope tied to two hoist drums and through a tandem reeved load block. The two ropes acting together are sized for the original 500 ton design rating of the crane.

Comment 3.2 Provide a clarification statement to the effect that the crane was originally designed to 500 tons.

Response 3.2 The original design capacity of the crane is stated in Section 9.1.4.3 of the FSAR.

Comment Figure 3.3-1

Provide an explanation of the load rating on the Dillon load cell, including the factor of safety to ultimate (breaking) strength. Clarify the "pull to 220 tons."

Response Figure 3.3-1

The factor of safety on the Dillon load cell is a 3 to yield and 5 to ultimate based upon a 200 ton load.

The 0-200 ton Dillon load cells have been recalibrated to measure the range 20-220 tons. The wording "pull to 220 tons" refers to the manner in which the calibration laboratory performed this task. Further detail of the calibration sequence would show that routine calibration techniques were used.

Comment Figures 3.3-1 and 3.3-2

Provide an analysis of load-bearing members in the lift rigging to be used. List design ratings and breaking strength.

Response Figures 3.3-1 and 3.3-2

Attachment 1 provides a comparison of design stress versus allowable stress or a factor of safety to yield and to failure of all the load-bearing members, excluding the head lift rig. The head lift rig was designed for a 170 ton load and tested to 255 tons. This lift rig has been used to remove the TMI-2 head twice.

Attachment 2 provides an evaluation of design loads and stresses for the RV head and internals handling equipment.

Comment 4.0 General comment. Do not use the word "probability" without quantification. Either quantify the various probabilities mentioned or provide a clarification to the effect that the term "probability" should be interpreted to mean likelihood.

Response 4.0 The interpretation stated above is correct. The word "probability" is not meant to be interpreted in the mathematical sense but rather is synonomous with "likelihood."

Comment 4.1.3.1 Last paragraph. Quantify any postulated release of radioactivity.

Response 4.1.3.1 An excerpt from the head removal safety evaluation which quantifies the postulated releases of radioactivity is repeated below:

> During head removal activities, there is a remote possibility that the krypton-85 which is assumed to be in the reactor core may be released. This remaining krypton-85 may be securely trapped in the grain boundaries of fuel pellets or in intact fuel rods. An analysis of the potential release was performed, based on the following assumptions.
>
> - Krypton-85 inventory at shutdown (March 28, 1979) is 9.6×10^4 curies.
> - Known releases of krypton-85 inventory are 44,600 curies (reference 2). This is the quantity released during the June-July 1980 reactor building purge. All other releases are negligible.

- The remaining krypton-85 is decayed to January 1, 1983.
- The offsite doses are based on an instantaneous release of the remaining krypton-85.
- An accident X/Q of 6.1×10^{-4} sec/m^3 is used.

These assumptions yield a maximum release of 37,400 curies of krypton-85. Using Regulatory Guide 1.109 methodology and curies to dose conversion tables, the maximum site boundary total body dose is 12 mrem.

These calculations are considered conservative since accident X/Q is used, when in reality, the purge will be isolated. Therefore, release meteorology can be controlled reducing doses by as much as a factor of 100. Also, the assumption of Krypton remaining is conservative since RCS venting activities have not shown significant quantities of Krypton.

Comment 4.2.4 (B) State the quantity of unborated water that could be delivered to the sump as a result of load drops.

Response 4.2.4 (B) Attachment 3 provides the water volume by system of those systems that could be affected by load drop.

Comment (Table 4.2-1): Clarify the intent of using hazard elimination Category E.

Response: Hazard elimination Category E was used with the intent to state that analyses of postulated damage to safety-related equipment have shown that the consequences of this damage are not significant with respect to maintaining required safety functions as stated in the SER.

Comment 5.2 (2) Provide summary of or reference to recent decay heat analyses regarding losses to ambient at reduced RV water level.

Response 5.2 (2) A summary of the referenced analysis is provided on Attachment 4.

Comment 7.0 Include a description of the NDE Program on the main hook.

Response 7.0 The NDE of the main hook will be performed in accordance with GPUNC procedure MTIS-004 Revision 3 and work package M0043. These have been provided to the NRC.

ADDITIONAL COMMENTS:

Comment A Clarify whether or not each indivual set of redundant main hoist brakes is capable of holding the test load.

Response A Each individual set of redundant main hoist brakes is capable of handling the test load.

Comment B	Will the purge be isolated during the actual lifting times of the load test?
Response B	The purge system will be isolated during those times when a missile shield or the test load is actually being lifted by the polar crane.
Comment C	Provide a summary of laboratory test report on wire rope sample.
Response C	A summary of the laboratory test is provided as Attachment 5. The complete laboratory test is available for inspection at your request.
Comment D	Clarify what loads are served by the out-of-containment power supply breaker that would be used to interrupt power to the polar crane.
Response D	MCC-2-32A, the 480V supply breaker in question supplies power only to the polar crane. No other loads are supplied by this breaker.
Comment E	Explain the selection basis for the chosen load path as shown on the figures in Section 2 for movement of the missile shields from the test load frame to their storage location on the "B" D-ring. Refer to figures 2.4-2 and 2.4-3. Specifically, state the reasoning by which clockwise rotation was selected over counter-clockwise rotation.
Response E	Load path selection was based on maximizing the simplicity of movements and minimizing the number of manipulations required to transport the subject loads, as well as considering the load drop analysis as described in the SER.
Comment F:	Provide an analysis of load-bearing members of the load test frame. List design ratings and breaking strengths.
Response F:	Attachment 2 of the first response to verbal comments provides a comparison of computed stress versus allowable stresses for load-bearing members of the test frame.
Comment G:	Verify that rigging components associated with the load test have been certified to appropriate ANSI standards.
Response G:	Newly-designed and/or procured slings associated with the load test have been certified to meet appropriate ANSI standards. Other portions of the lifting assembly will be verified by a combination of testing and inspections as described in Section 3.3 of the SER.

POLAR CRANE LOAD TEST ASSEMBLY
(Shown on Drawing 2-COP-1301)

Component and Drawing Detail	Type of Stess	Computed Stress (KSI) (See Note 1)	Allowable Stress (KSI) (See Note 2)
Extension Bar (1), DET. 6	Tension Shear	7.4 7.4	16.2 14.5
5½" ϕ Pins (3), ELEV. A	Shear Bending	6.8 14.9	14.5 27.0
Lifting Plates (6), DET. 2	Tension Shear	7.3 7.3	16.2 14.5
Base Plates for Lifting Plates (3), DET. 2	Bending Shear	17.6 3.5	27.0 14.5
Lifting Plates (4), DET. 3	Tension Shear	6.4 5.7	16.2 14.5
Base Plates for Lifting Plates (4), DET. 3	Bending Shear	8.2 2.3	27.0 14.5
Load Spreading Frame, Partial Plan B			
- W27 x 146	Bending Shear	11.9 8.9	22.0 14.5
- W27 x 178	Bending Shear	14.0 3.6	22.0 14.5
- W30 x 173 (2)	Bending Shear	14.1 5.5	22.0 14.5
1 3/4" ϕ Wire Ropes (8) and Fittings, ELEV. A	Tension	(See Note 3)	(See Note 3)
Lifting Plates (8), DET. 1	Tension Shear	7.1 7.2	16.2 14.5

Component and Drawing Detail	Type of Stress	Computed Stress (KSI)	Allowable Stress (KSI)
Load Frame, Partial Plan C			
- W24 x 104 (4)	Bending Shear	12.8 4.6	24.0 14.5
- L'S 4 x 4 x ½	Compression	3.4	17.8
<u>Bolted Connections</u> Load Spreading Frame 7/8" ϕ Bolts (20), SECT. L	Shear	12.2	30
Load Spreading Frame 7/8" ϕ Bolts (24), SECT. K	Shear	20.4	30
Base Plate for Lifting Plates 1½" ϕ Bolts (18), DET. 2	Tension	19.9	44
Base Plate for Lifting Plates 1½" ϕ Bolts (16), SECT. H	Tension	22.8	44
Load Frame 3/4" ϕ Bolts (32), SECT. D	Shear	14.8	30
<u>Welded Connections</u> Load Spreading Frame 3/8" Fillet Weld, SECT. L	Shear	10.5	21
Load Spreading Frame 7/16" Fillet Weld, SECT. K	Shear	14.1	21
Lifting Plates 3/4" Parial Pen. Weld, DET. 2	Tension	4.7	21

Component and Drawing Detail	Type of Stress	Computed Stress (KSI)	Allowable Stress (KSI)
Lifting Plates - 3/4" Partial Pen. Weld, DET. 3	Tension	6.5	21

Notes:

1. Computed stresses are based on a vertical design load of 220 tons.

2. Allowable stresses are based on the latest edition of the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings."

3. Wire ropes and fittings have a factor of safety greater than 5 with respect to their ultimate strength.

4. Any load test assembly components not listed in the above table are secondary members provided for lateral support only.

5. The existing head and internals handling fixture assembly and turnbuckle pendant assemblies shown on drawing 2-COP-1301 were furnished by B&W. These components were designed for a lifted load of 170 tons and were load-tested to 255 tons by B&W.

LOAD CELL RIGGING
(Shown on Drawing 2-COP-1302)

Component and Drawing Detail	Yield Safety Factor (Design Load, See Note 1)	Ultimate Safety Factor (Design Load, See Note 1)	Yield Safety Factor (220 Tons)	Ultimate Safety Factor (220 Tons)
10" ϕ Cylinders (2), DET. 1	3.8	5.1	3.5	4.6
Attachment PL (2), DET. 2	4.1	6.6	3.7	6.0
7" ϕ Pin (2), DET. 3	4.0	5.4	3.6	4.9
10½" ϕ Pin (1), B&W Mark 228	7.9	9.9	7.2	9.0
Bore Plates (2), B&W Mark 223	4.1	6.6	3.7	6.0

Notes:

1. The design load for the load cell rigging components listed above is 200 tons.

2. The additional components shown in elevation with the load cell rigging but not listed in the table above are parts of the existing internals handling extension furnished by B&W. These components were designed for a lifted load of 176 tons and were load-tested to 264 tons by B&W.

MISSILE SHIELD RIGGING
(Shown on Drawing 2-COP-1301)

Component and Drawing Detail	Yield Safety Factor (Design Load)	Ultimate Safety Factor (Design Load)
Attachment Plate (1) Shown in DET. 5	6.8	10.9
1¼" ϕ Wire Ropes (4) Shown in Elev.	N/A	5.2
75 Ton "Wide Body" Shackles (2) Shown in Elev.	N/A	15.8
1 3/4" Screw Pin Anchor Shackles (4) Shown in Elev.	N/A	12.7
Missile Shield Lifting Lugs (4/panel) shown on B&R Dwg. 4156	3.0	4.9

Notes:

1. Safety factors are based on a vertical design load of 41 tons.