Nuclear

GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number:

September 2, 1983
4410-83-L-0206

TMI Program Office
Attn: Dr. B. J. Snyder
Program Director
US Nuclear Regulatory Commission
Washington, DC 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Polar Crane Load Test Assembly Evaluation

Attached for your review and approval is the Polar Crane Load Test Assembly Evaluation. This submittal constitutes the response to Question 10 of Dr. B. J. Snyder's letter to Mr. B. K. Kanga dated July 18, 1983. GPUNC's response to the remainder of the questions was provided in GPUNC letter 4410-83-L-0175 from Mr. B. K. Kanga to Dr. B. J. Snyder dated August 16, 1983.

If you have any questions or desire further information, please contact Mr. J. J. Byrne of my staff.

Sincerely,

B. K. Kanga

B. K. Kanga
Director, TMI-2

BKK/RBS/jep

Attachment

CC: Mr. L. H. Barrett, Deputy Program Director - TMI Program Office

A009
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POLAR CRANE LOAD TEST ASSEMBLY EVALUATION

The polar crane load test assembly has been recently re-evaluated for the purpose of confirming the fidelity between the as-designed and as-built conditions.

The governing design documents are drawing 2-UOP-1501 Rev. 2 "Head Lift Load Test Assembly, Plans, Sections & Details" and Specifications 13587-2-C-371 "Furnishing Miscellaneous Metal" and 13587-2-C-372 "Erecting Miscellaneous Metal".

At issue was primarily the welding of the lifting lugs onto the frame members and subsequent inspection of the welds. Accordingly, a thorough and detailed examination was conducted with special emphasis on the physical dimensions and characteristics of the lifting lug welds.

The following paragraphs state specific issues of concern relative to this examination and provide resolutions to the same:

ISSUE 1

The welding procedure and welders were qualified per the ASME Boiler and Pressure Vessel Code, Section IX, in lieu of AWS D1.1 as specified in the design documents.

RESOLUTION 1

Although the welders and welding procedure were qualified to ASME Section IX in lieu of AWS D1.1, paragraph 1.1.1 of AWS D1.1 allows the use of complementary codes or specifications for both design and construction of steel structures. The application of ASME Section IX as invoked by GPUN welding procedure WPS-111 for the load test frame is an acceptable alternate to AWS D1.1.

ISSUE 2

The welding procedure used was qualified for plate thicknesses up to 1.728".

RESOLUTION 2

This issue is being resolved by the implementation of a revised Procedure Qualification Record (PQR) which will extend the qualification range of the appropriate procedure (WPS-111) for groove and butt welds to thicknesses up to and including 8".

ISSUE 3

The welds were inspected to AWS D1.1-79, Article 8.15, instead of the requirements in note 6 on drawing 2-COP-1301.

RESOLUTION 3

Welds inspected to AWS D1.1-79 are acceptable. The 1979 edition is more stringent for undercut limitations than the later 1982 edition.

ISSUE 4

The welders who actually welded the lifting lugs to the main frame members were administratively qualified for welding thicknesses up to and including 0.75".

RESOLUTION 4

The mere fact that the welders were not administratively qualified for the actual plate thickness welded does not mean that they were incapable of producing an acceptable weld. The subject welders were seasoned and experienced craftsman who had previously proven their skills by qualification test of actual weld samples (coupons). Further, these welders are in the process of extending their administrative qualification to an unlimited thickness range in accordance with ASME Section IX.

ISSUE 5

A new stess analysis shoulo be conducted to verify the adequacy of the welds assuming that only 0.75" of the weld metal is effective, ie., taking no credit for weld metal thickness above that for which the welders were administratively qualified.

RESOLUTION 5

A stess analysis has been performed on the lifting lug welds based on only 3/4" of weld being effective. A summary of the design stresses (based on t_{eff} = 3/4") and safety factors for the lifting lug welds is presented below. The stresses of the welds in question are within AISC allowables, even if credit is taken for only the weld thickness up to the qualification limit of the welders. Any additional weld material serves to strengthen the joint and increase the margin to the allowable stresses.

Stress Summary with Factors of Safety for the Polar Crane Load Frame Lug Welds

(1), (2) Lifting Lug Welds	(3) Type of Stress	(6) Actual Stress ksi	(4) Allowable Stress ksi	(5) Yield Stress ksi	F.S. to Yield	(5) Ultimate Stress ksi	F.S. to Ultimate
detail 1	Tension	12.3	21.0	60	4.9	72	5.9
detail 2	Tension	11.8	21.0	60	5.1	72	6.1
detail 3	Tension	11.5	21.0	60	5.2	72	6.3

(1) The polar crane load test assembly lifting lugs and weld details (from drawing 2-WP-1501, Rev. 2).
(2) The welds in this stress summary are based on 3/4" - the maximum weld size considered effective, due to welder qualification.
(3) The lug welds are in tension only.
(4) Based on the AISC Manual of Steel Construction - 8th Edition
(5) Based on "Design of Welded Structures" - Blodgett
(6) Actual stresses are based on the design test load of 220 tons with a 25% increase for impact, and 3/4" of effective weld.

ISSUE 6

The non-destructive examination (NDE) performed on the subject weldment should be reviewed for adequacy and completeness.

RESOLUTION 6

The quality control plant inspection report for the load test assembly has been reviewed and the results found acceptable. In fact, a more rigorous examination was conducted than called for in the design documents in that a magnetic particle test (MT) was conducted as well as the specified visual examination. The examination results by both methods are in satisfactory compliance with applicable acceptance criteria.

ISSUE 7

Employment of the welding procedure (WPS-111), as well as proper preheat and interpass temperatures, method of temperature measurement, and weld rod storage should be verified, preferably by direct contact with welding craftsmen.

RESOLUTION 7

Direct interviews with craft supervisors, craft foremen, Unit 1 I&C personnel and the craft personnel themselves have been conducted. All those interviewed were told to state what they knew to be fact. They were told that if they did not remember the actual facts to say so.

The results of these interviews are as follows:

- o Weld Procedure WPS-111 was used in the welding of the lifting lugs.
- o All of the full and partial penetration welds were preheated to 200°F. The interpass temperatures were maintained between 200°F and 500°F.
- o A calibrated pyrometer was borrowed from Unit #1. (This was confirmed with Unit #1 personnel).
- o Weld rod was stored in ovens which have calibrated thermometers. A daily log is maintained of the temperatures.

ISSUE 8

A thorough visual and dimensional examination should be conducted on the load test frame to provide assurance that no unauthorized attachments, modifications, or other deviations are present.

RESOLUTION 8

Recovery Operations conducted an inspection of the Head Lift Load Test Assembly, Load Spreading Frame and Lower Missile Shield Lifting Assemblies to verify compliance with the design drawing.

The units were visually inspected to assure there were no unauthorized attachments or modifications to the assemblies. No unauthorized attachments or modifications were found. Items found that do not show on the drawing were "tack welds" on the cross bracing that connects the W 24 x 104 members together. Each bracing assembly has four tack welds, two on each side of the diagonals. These were single-pass, one to two inch long welds. These tack welds were made to assist in lining up the members and to reduce in-containment time. The additional tack welds will have no adverse effects upon the load carrying capability of the test frame assembly.

In addition to the visual inspection, dimensional checks were performed to establish that the items were fabricated and installed in accordance with the drawing. In all cases, fabrication and installation was found to be in compliance with the drawings.

CONCLUSION

Based upon the above identified issues and the resolutions provided, and especially in view of the extreme conservatism elucidated in the stress analysis presented in Issue 5, as well as the veracity of the welding craftsmen exhibited during direct interviews, it is concluded that the load test frame is suitable for its intended use as it now stands.

Furthermore, based upon the conclusions of the polar crane load test SER (which evaluates a complete failure and dropping of the entire test load), the load test frame may be used as-is without presenting undue risk to the health and safety of the public.