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August 16, 1983
4410-83-L-0175

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 - Additional Information

Attached for your review and approval are GPUNC's responses to the NRC's request for additional information on the Polar Crane Load Test. The request was forwarded in a letter from Dr. B. J. Snyder to Mr. B. K. Kanga dated July 18, 1983. Please note that GPUNC is still evaluating the information requested in Question No. 10 regarding the performance of NDE and conformance checks on the load test assembly. This information will be provided at a later date.

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

Sincerely,

B. K. Kanga
Director, TMI-2

BKK/RBS/jep

Attachment

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

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ITEM

1. (a) Did GPUNC comply with all QA requirements applicable to the Reactor Building Polar Crane (PC)? (b) For activities that QA requirements were not applicable, describe how GPU insured quality.

Discuss for example; part installations (for like and unlike kind), post installation inspectors, and criteria for component checks. You should also at a minimum discuss major components such as brakes, limit switches, the wire rope, the main power cable, and the polar crane structure. Other components can be addressed more generally.

RESPONSE

(a) Section 3.0 of the Polar Crane Functional Description (15737-2-M72-MH02, revision 3) delineates the QA/QC Requirements for refurbishment of the crane. These requirements stipulate QC involvement in inspections and witnessing of certain activities. QC receipt inspections were required for any replacement parts for the load bearing components of the main hoist. QC involvement was also required in performance of the structural inspection of the crane, nondestructive examination of the hook and witness of the operational and load tests. Additional QC involvement was required if it was determined that repair welding of load supporting structural components was required. Independent, knowledgeable crane inspectors were also required to inspect important crane components such as the wire rope and brakes. These requirements were fully complied with. Some GPUNC Administrative Procedures were not, however, fully complied with. A discussion of this non-compliance is in our response to question #3 below.

(b) For activities for which QA/QC was not required by Design Engineering, GPUNC assured quality by having work performed, inspected or both by independant recognized crane experts. These experts included two electro-mechanical crane machinery and rigging specialists from United States Crane Certification Bureau in Orlando, Florida. A third consultant from U.S. Crane Certification Bureau, a registered professional engineer, advised on the performance of the load test. Other specialists who performed and inspected polar crane refurbishment work included a former Whiting Corporation Field Engineer, and a registered professional Instrument and Control Engineer currently from United Engineers, Inc. and with previous factory crane operation and maintenance experience. Finally, technical work planning assistance was provided by a registered professional electrical engineer also from United Engineers, Inc.

Details of the QA/QC involvement and the crane inspector's activities to insure quality are provided below under the headings of major components.

b.(1) MAIN HOIST BRAKES The polar crane's two main hoist brakes were replaced in-kind. GPUNC QC performed a receipt inspection of the brakes on October 8, 1982. These were the only replacement parts for the load bearing components of the main hoist. The brakes, manufactured by Westinghouse Electric Corporation, were installed by GPUNC maintenance personnel according to the manufacturer's instructions. Installation work was personally supervised by our most experienced crane inspector - a consultant from United States Crane Certification Bureau. This same inspector personally adjusted the brakes in accordance with Westinghouse printed instructions. These two brakes were each adjusted twice after checking their application while lowering the main block and hook. Finally, during the no load test, QC inspectors visually checked both brakes and recorded satisfactory results (see (8) below).

b.(2) LIMIT SWITCHES The four trolley travel limit switches - two inboard and two outboard, all on the A girder - were checked for proper operation by the GPUNC electrical maintenance team on the crane. The outboard switches were adjusted by the electrical maintenance team in accordance with the switch manufacturer's printed instructions and written instructions from Design Engineering based on input from the crane manufacturer. The Polar Crane Task Group electrical inspector verified proper operation of the trolley limit switches. Similarly, the main hoist upper geared-type limit switches were adjusted by the same electrical maintenance team and verified operational by the Task Group's electrical inspector. The main hoist lower geared-type limit switch has not been checked; however, administrative and physical controls are in place to prevent lowering the main hook beyond allowable limits. GPUN QC inspectors verified proper operation of the main hoist upper paddle-type limit switch during the no-load test (see (8) below).

b.(3) MAIN HOIST WIRE ROPE (No QA/QC requirements.) Four Polar Crane Task Group inspectors performed a detailed inspection of the two 2,310 foot sections of main hoist wire rope. The inspection was performed in accordance with instructions contained in the Wire Rope Users Manual published by the American Iron and Steel Institute. The fact that experienced inspectors performed a hands-on inspection of the rope - including the opening up of the rope to inspect the core - in accordance with recognized criteria assured an accurate reliable inspection. Additionally, a sample of the rope was sent to Pittsburgh Testing Laboratories for a comparative analysis with a like piece of new rope. All test results concluded that the main hoist wire ropes are in satisfactory condition to perform the load test.

b.(4) MAIN POWER CABLE (No QA/QC requirements.) The main power cable was installed in accordance with normal electrical practices. After installation, the system was megger checked first from the motor control center to the open disconnect at the 352' elevation in the Reactor Building. Then the cable itself was meggered from the line side of the polar crane main disconnect in the cab to the open disconnect at the 352' elevation. In each instance there were no unusual indications. Standard strain relief connections support the power cable at the polar crane and the D-ring. Installation of the cable was performed using ECM 1017 and accepted in accordance AP 1043.

b.(5) POLAR CRANE STRUCTURE A GPUNC QC welding inspector performed an inspection of structural welds on the polar crane. The inspection was performed in accordance with Design Engineering's inspection plan transmitted to the field via letter BIBC-0245, dated September 7, 1982. The results of the QC weld inspection are presented in Plant Inspection Report (PIR) WE43313/82.

b.(6) LOAD CELL RIGGING GPUNC QA reviewed, commented upon, and approved purchase order 111339 for steel plates and cylinders for load cell rigging -- reference Bechtel Drawing 2-COP-1302. GPUNC QC performed a complete receipt inspection of this rigging on March 29, 1983. The Receipt Inspection Report No. is JCR-2412-83.

b.(7) MAIN HOOK GPUNC QA reviewed and commented upon the Work Package for NDE of the polar crane main hook. GPUNC QC performed the NDE of the entire hook in accordance with procedure MTIS-004, and reported the results in PIR No. CS/33058/83.

b.(8) NO LOAD TEST (limit switches, brakes, wire rope)

GPUNC QA reviewed and concurred with Unit Work Instruction 4374-3891-83-PC2, no-load limited and full operation tests of the polar crane. During their review, QA Engineering developed an Inspection Surveillance Plan and placed QC hold points for their witnessing of the test. While on the polar crane during the no-load test, two QC inspectors inspected the operation of the two main hoist brakes, main hoist upper paddle type limit switch, main hoist wire rope, and other crane components. The results of their visual inspections of these three crane components - reported in Plant Inspection Report (PIR) No. ME 03078-83- were satisfactory.

b.(9) POLAR CRANE LOAD TEST GPUNC QA reviewed and concurred with the procedure for load testing the Unit 2 polar crane - UWI 4370-3891-83-PC0001.

Finally, the polar crane has a successful history of many heavy lifts prior to the accident of 1979. For example, the crane was used during the initial construction of the plant to lift the following:

- Pressurizer - (<200 tons)
- Core Flood Tanks - (40 tons each)
- RC Piping (pieces)
- RC Pumps
- RC Motors - (52 tons each)
- 75 ton P&H Electric Hydraulic Crane (2 times)
- RV head (without service structure) - (92 tons)
- RV Service Structure (bare)
- Upper RV Internals with shipping canister
- Lower RV Internals with shipping canister
- RV head, service structure, CRDM assembly
- Missile Shields

The heaviest load was the pressurizer (which was less than 200 tons) followed by the completed head/service structure assembly.

ITEM

2. Explain the safety significance of the PC wire rope not being safety grade.

RESPONSE

The polar crane main cable is Not Important to Safety (NITS) as specified in the original Burns & Roe design and the current QCL. The polar crane refurbishment program was not aimed at upgrading the design of the polar crane.

The main cable is not required to maintain the plant in a safe condition. The main cable does not prevent or mitigate events that could result in an offsite release exceeding the Appendix B Technical Specifications as a result of planned activities. The main cable is not needed to ensure habitability of critical plant areas for the maintenance of the plant in a safe condition. Therefore, there is no reason to change the classification of the main cable from NITS to Important to Safety. In addition, the consequences of a load drop during the load test have been addressed in the load test SER. The consequences were shown to not constitute an undue risk to the health and safety of the public.

ITEM

3. Discuss all applicable administrative procedures that were utilized for the polar crane's refurbishment. If administrative procedures were not followed, explain your rationale and the safety significance of your actions.

RESPONSE

Applicable TMI-2 administrative procedures that were utilized for the polar cranes refurbishment are listed below:

Procedure No.	Revision	Title
AP 1002	23	Rules for the Protection of Employees Working on Electrical and Mechanical Apparatus
AP 1013	10	Bypass of Safety Functions and Jumper Control
AP 1021	10	Engineering Change Memorandum
AP 1022	10	Control of Measuring and Test Equipment
AP 1043	2	Work Authorization Procedure
AP 1047	0	Startup and Test Manual
AP 1060	1	Procedure Usage and Implementation
* 4000-ADM-1218.01	0	TMI Unit 2 Procedure Numbering Format Content, Implementation and Compliance
* 4000-ADM-1218.02	0	Procedure and Unit Work Instruction Evaluation, Review and Approval
* 4000-ADM-3000.01	0	TMI-2 Unit Work Instructions
4000-ADM-3050.01	0	Job Tickets
* 4000-ADM-7310.01	0	TMI-2 Cognizant Engineer Procedure
4300-ADM-3240.01	0	Access to and Work in the Containment Building.

Not all of these administrative procedures were utilized throughout the polar crane refurbishment period, which began in August, 1982. Those procedures marked with an asterisk above were utilized as they became effective in January, 1983. However, each of the procedures was applied to the refurbishment of the polar crane.

AP 1002 was utilized to control electrical energization of the polar crane via the main disconnect switch located on the operating floor of the Reactor Building. This control assured the safety from shock hazard of personnel working on the polar crane.

AP 1013 was utilized for the approval and documentation of the installation of electrical jumpers in the crane's load cell circuits, and for the installation of nonfuseable fuse links in the cab main disconnect.

AP 1021 was utilized for documentation review and approval for installation of the temporary power feeder to the polar crane, for the installation of the nonfuseable fuse links in the cab main disconnect, and for changing crane motor thermal overloads.

AP 1022 is used to insure plant measuring and test equipment is properly maintained and calibrated regularly. The megger check and ampprobe devices' calibration dates were always checked and annotated on polar crane work packages prior to work implementation.

AP 1043 was utilized to permit proceeding with and document completion of those items identified above with AP 1022.

AP 1047 was utilized for the adjustment of limit switches on the polar crane. This procedure establishes the authority of the Test Working Group (TWG), which discussed the plans to adjust these switches. Adjustment of these limit switches was one of the last refurbishment activities performed on the polar crane.

AP 1060 provided guidance for the usage and application of all the above administrative procedures. It provided guidance to technicians in the utilization and deviation from established step by step procedures such as AP 1013.

4000-ADM-1218.01 provided directions on numbering Unit Work Instructions (UWIs) to facilitate future information retrieval.

4000-ADM-1218.02 was applied to all Unit Work Instructions written for polar crane refurbishment. This procedure establishes the process for Unit Work Instruction evaluation, review and approval.

4000-ADM-3050.01 was utilized to request and document work done outside the Reactor Building by Plant Maintenance in support of polar crane refurbishment. This procedure was utilized to request and document for machinery history, the bench testing and adjustment of motor thermal overload relay/heater assemblies.

4000-ADM-7310.01 was utilized to establish a Cognizant Engineer over the polar crane (among other responsibilities) and define that Engineer's responsibilities. With respect to Unit Work Instructions, under which significant refurbishment was accomplished, Cognizant Engineers are assigned broad responsibilities for ensuring UWI's meet technical and review requirements.

4300-ADM-3240.01 is the single most important administrative procedure applicable to refurbishment of the TMI-2 polar crane. Revision 0 became effective on May 4, 1982, about three months prior to commencement of refurbishment activities. This procedure's purpose is "to describe the procedural requirements which govern access to containment and work inside containment." This procedure recognized the Work Package as a required document - properly approved - along with an approved schedule, in order to implement work in the Containment Building. This recognition of the Work Package is significant in that much of the polar crane refurbishment was done via the Work Package. Replacement of main hoist brakes, inspection of wire rope; structural inspection of polar crane; replacement of resistor banks, and pendant and festoon cable; installation of trolley power/control bypass cables are major Work Package implemented activities.

In the case of three modifications to the polar crane - installation of replacement pendant control station, installation of trolley power/control bypass cables and installation of temporary 1000 pound capacity jib crane on polar crane trolley - administrative procedures were not followed. Additionally, Administrative Procedure 1047 was not invoked for all tests during polar crane refurbishment, and the Crane was turned over to the Construction Department - now Recovery Operations - without any administrative procedure. As a result of these administrative non-compliances, GPUNC QA conducted an audit of all polar crane refurbishment work packages. The packages were reviewed to verify appropriate approvals were obtained, inspection results were documented, acceptable material was used, required tests were performed and test results were documented, modifications were approved by engineering, and compliance to administrative controls. The review found no material or design problems; however, the administrative problems were documented on a Quality Deficiency Report, and corrective action has been taken in all cases.

The rationale for proceeding without completed Engineering Change Memorandums and Work Permits was based on turnover of the entire crane to Recovery Operations (then Construction) in July 1982 for refurbishment. At that time, the understanding was that construction would refurbish the crane in accordance with an approved functional description; and, upon completion, turn the crane back to the plant with complete documentation of all refurbishment work. In essence the crane was "handed" to Construction much the same way a valve, pump or motor is shipped to a repair facility. Nevertheless, each modification was either initiated or reviewed and approved by Design Engineering. Consequently, there are no safety concerns regarding these modifications.

ITEM

4. In Section 5.0 of your Safety Evaluation Report you state that criteria a), "the probability of occurrence or the consequence of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report may be increased," is not strictly applicable to TMI-2. It is the staff's opinion that this criteria is applicable and you should therefore state your justification as to why the proposed test does not involve an unreviewed safety question for that criteria.

RESPONSE

The subject activity of the SER is the load test of the polar crane. Load testing of the polar crane has not been previously evaluated in the safety analysis report. Further, the polar crane is not classified as important to safety for activities in connection with the load test.

It is therefore concluded that the probability of occurrence or the consequence of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report is not increased in connection with the accomplishment of the subject activity.

With regard to "strict applicability" of the 10CFR50.59 criterion, TMI-2 is in a unique circumstance. The criterion references the SAR which is a defined document submitted on the docket. Other plants are required to update this document on an annual basis; however, TMI-2 is exempted from this requirement. On the other hand, TMI-2 supplements the existing SAR through the submittal of, and obtaining NRC approval of, Technical Evaluation Reports (TER's), System Descriptions (SD's), and Safety Evaluation Reports (SER's). The comment provided on "strict applicability" was made in light of the fact that the criterion reference only the SAR, while at TMI-2 this is supplemented by TER's, SD's, and SER's.

ITEM

5. Provide a list of all repairs and part replacements for the polar crane. You should indicate which of the replacements utilized an unlike kind component and justify that the original margin of safety for using the polar crane has not been reduced. This should include a discussion in detail on why dummy fuses were installed and the safety significance of that modification.

RESPONSE

The following listed items were "replacement-in-kind" parts on the polar crane.

a. Main contactor "M"
b. "B" relay
c. "1SCR" relay
d. "2SCR" relay
e. time delay relays - 1AT, 2AT, 3AT bridge
f. time delay relays - 1AT, 2AT, 3AT trolley
g. time delay relays - 1BR, 1AT, 2AT, 3AT main hoist
h. pendant cable
i. overload relays and heaters
   24 relays, 24 heaters - bridge
   4 relays, 6 heaters - trolley
   6 relays, 6 heaters - main hoist
j. (4) - bridge clutch fuses
k. (2) - main hoist eddy current brake fuses
l. (4) - main hoist shunt brake fuses
m. main hoist brakes

The following provides a discussion on replacements/repairs made to the polar crane which were not "replacement-in-kind."

The bridge conductor/current collector system which supplies power and control for the main and auxiliary hoists and the trolley drive motors was damaged during the accident and was replaced by a temporary cabling system consisting of 33 conductors (sized to match original design) of various sizes. This bypass cabling was installed as a single loop of single and multiconductor extra flexible cables strung from the center of the crane bridge end girder to the center of the trolley on the edge closest to the operators cab. This installation was selected for ALARA concerns as replacment in kind of the original equipment would have been very labor intensive requiring construction of access platform at the conductor level (approximately 80 feet above the 347'-6" elevation in the reactor building.) The replacement cable meets all necessary criteria for the application including ampacity (same sizes), insulation levels (600 volts), flexibility of movement (extra stranded cabling), and installation requirements (cable grips for support, curved dropouts to limit bending.) The installation was verified for non-interference with existing structure/equipment however, a cable tender will be on hand during crane movement to assure the cable does not hang up or twist.

Based on the foregoing safe operation of the crane has not been reduced below original design due to the modified bridge conductor/collector system.

The polar crane runway conductor/collector system was also damaged during the accident and a temporary feeder was installed from the load side of the polar crane disconnect switch at elevation 347'-6" via a 225 ampere breaker and a 2/0 AWG insulated cable. The cable runs from the disconnect switch/circuit breaker near the elevator around the periphery of the containment (inside) to the top of the D-ring and then to the point on the crane walkway nearest the center of the bridge (minimizes cable movement.) This method was chosen to achieve ALARA radiation exposure since replacement in kind would have been labor intensive due to the location of the crane conductor system.

Selection and sizing of the temporary breaker/feeder combination was based on the following criteria.

a. The circuit breaker that was installed for protection of the polar crane temporary feeder and the temporary feeder itself were based on the actual load requirements (including substantial margin) that are anticipated during the recovery activities. The heaviest lift anticipated for recovery is 220 tons estimated for the load test. Based on this, the main hoist motor will be loaded to no more than 50% of its capability of 150 hp or, conservatively, 95 amperes. The control circuit transformer rating of 2KVA would add only 4 amperes if near fully loaded. Since the total of these two loads is just under 100 amperes, the 225-ampere breaker and the feeder cable are very conservatively sized for the anticipated loading.

b. The original Whiting drawings give a current requirement of only 230 amperes for normal full load (500 tons) rating of the crane. The cable selection of 3/c #2/0 AWG, based on a short time rating of 60 minutes, is good for 222 amperes based on a 75°C cable (the limiting cable type used.) As indicated previously the actual maximum current required for worst-case loading of this crane is just under 100 amperes so the cable is adequate from a current carrying standpoint. The main power conductor on the crane was sized at 2/0 AWG by Whiting Crane Corp.

Regarding flexibility, 600-volt welding cable was used for the cable drop from the crane to the top of the D-ring, a distance of 58 feet more or less. The welding cable consists of 3332 individual strands, has a capacity of 375 amperes, and will be subjected to a maximum twist of 180° over the full length of the cable which is approximately 95 feet long to allow for crane movement. Therefore, the cable meets insulation level and flexibility requirements.

In addition, the welding cable is of rugged design/construction so that it will withstand abuses (dragging around on rough surfaces in industrial plants or outdoors) encountered in normal service. This design provides increased protection for cable movement during crane operation.

Based on the foregoing the temporary feeder/breaker combination, which meets all pertinent design considerations, does not jeopardized the safe operation of the crane for recovery activities anticipated.

The existing vendor-furnished 300 ampere fuses in the Polar Crane main disconnect switch were replaced with dummy fuses for the following reasons:

- o To preclude the possibility of single phasing of the power supply due to a single phase fault on the crane which causes only one fuse to blow. Single phasing under load conditions has the potential for uncontrolled load handling due to loss of motor torque, failure of brake deenergization and unintentional load descent in the hoisting mode.

- o Discussion with the crane vendor on this subject and their statement that their current crane designs incorporate circuit breakers or undervoltage relays to preclude the single phasing possibility from a single blown fuse on three phase circuits.

- o The fuse protection originally provided is supplanted by a 225 ampere breaker installed for the temporary power supply to the crane.

Based on the foregoing, the current installation has enhanced the polar crane operational safety, meets National Electrical Code requirements for crane electrical installation and does not reduce or impair safe operation and protection of the crane electrical system.

In addition to the above, the pendant and festoon system were replaced. The pendant provides the same functions as the original pendant except a key lock is not included. Neither the festoon nor the pendant replacement impact the margin of safety of the crane.

Repairs made to the crane include the following:

a. Main Hoist load cell jumpered out
   (1) pressure switches jumpered out at all contacts
   (2) selector switch jumpered out
b. trolley drive coupling repaired - locking rings replaced
c. lead to #4 bridge drive clutch repaired

The function of the 200 ton load cell on the crane was replaced with an in-line 200 ton load cell. Therefore, there was no reduction in the margin of safety.

ITEM

6. Discuss the safety significance of not performing a full length load test for the wire rope.

<u>RESPONSE</u>

Acceptance of the wire rope is based on a comprehensive inspection of virtually 100% of the rope in accordance with Section 2-2.4 of ANSI B30.2. This inspection, per the Polar Crane Functional Description, is required before and after the load test. Rated load testing per ANSI B30.2, Section 2-2.2-2, has no criteria or limitations based upon rope length. ANSI B30.2 bases the acceptability of continued use of wire rope on inspection rather than load testing.

As shown in the Safety Evaluation for the Polar Crane Load Test, a drop of a heavy load, caused by any mechanism including failure of the wire rope, will not result in unacceptable risk to the health and safety of the public during the performance of the polar crane load test. Therefore, there is no safety significance in not performing a full length load test for the wire rope.

ITEM

7. Discuss the safety significance and explain your rationale for proposing not to test the load frame prior to its use in the Polar Crane load test per ANSI N14.6.

<u>RESPONSE</u>

Conformance with ANSI N14.6-1978 is not considered necessary for the load test assembly since it is specifically designed to be used only once (to load test the polar crane) and is not a lifting device which will be used on a regular basis to handle heavy loads in the reactor building. This is documented in Section 3.3 of the Safety Evaluation for the Polar Crane Load Test and in Section 2.1.3.d of the Response to the Generic Letter on the Control of Heavy Loads contained in Letter No. 4410-83-L-0028 to the NRC, dated February 14, 1983.

The load test assembly was designed to satisfy the requirements of the AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings." Since it will undergo only a few dead weight lifts, the load test assembly is not considered to be any different than other structural framing arrangements in a nuclear power plant which are subjected to constant loading conditions, i.e., not affected by fatigue considerations. Current standard practice for such framing arrangements does not require a load test.

The load the assembly will handle has been established by calculation and will be closely monitored, by actual load cell readings, to assure that the design load is not exceeded. A major portion of the safety factor provided in the design of a steel structure is due to the uncertainty of the load and consideration of cyclic loading during its service life. The absence of these considerations provide additional confidence in the safety margins in the design and construction of the load test assembly.

Finally, the sequencing of the polar crane load test will provide adequate assurance that the load test assembly can safely handle the test load. The initial phase of the load test involves raising the assembly 6" above the floor and holding this position for a specified period of time. Dropping the assembly from this height will not collapse the existing floor slab. Among the items that will be visually checked for during this initial 6" lift will be the yielding or excessive deformation of the structural components of the assembly. This step will provide adequate assurance that the load test assembly can safely handle the load for the remainder of the test.

ITEM

8. Provide a description of the PC's electrical system. You should include an evaluation of any electrical failures that could keep the crane brakes from operating properly in emergency and non-emergency situations.

<u>RESPONSE</u>

An evaluation of the polar crane electrical system and potential failure modes was completed in early 1983. A copy of the report which documents this evaluation is provided as Attachment 1. The report addresses comprehensive failures beyond the main hoist brake concern.

ITEM

9. The staff was informed per your June 17, 1983 addendum to the Safety Evaluation Report, that you have selected different rigging for the missile shields and have added a load equalizing component to the load test assembly rigging. Provide the staff with "actual vs. allowable" stress information for this rigging, the equalizing component and its associated rigging.

<u>RESPONSE</u>

Attachments 2 and 3 provide the requested information.

ITEM

10. Discuss any plans and the bases for performing or not performing a non-destructive examination of the load test assembly structural elements and the polar crane structure. Also discuss any visual and dimensional conformance checks that were done.

RESPONSE

Load Test Assembly

The response to the Load Test Assembly portion of this question will be provided at a later date.

Polar Crane

The intent of the structural inspection plan for the refurbishment/requalification of the TMI-2 polar crane was to identify any damage to the crane structure which may have resulted due to the TMI-2 accident conditions. During the accident, the reactor building polar crane was exposed to elevated pressure, temperature, and radiation levels. The crane was also subjected to containment spray (borated water/sodium hydroxide solution) for a brief time.

Based on an engineering evaluation of the polar crane design and the accident conditions, no damage to the crane was anticipated. The peak accident pressure and temperature were well within the limits of the design values originally specified in Burns & Roe Specification No. 2555-22 for the polar crane. See Attachment 4 for design values as compared to accident conditions. The possibility of containment spray washing over the polar crane was also addressed in the original criteria for the crane design contained in the B&R Specification. A metallurgical evaluation which reviewed the accident conditions, including the increased radiation levels and exposure to containment spray, concluded that there should have been no detrimental effect on the structural material of the polar crane. The only area of particular concern was the rate of pressurization that occurred during the accident. Although the accident peak pressure was much less than the design pressure, the rate of pressurization is not precisely known. However, pressure damage to the structural components of the crane was not anticipated since the structural components are vented. Preliminary inspections of the crane found no signs of pressure damage to lightweight crane components such as electrical cabinets.

Therefore, the structural inspection plan for the reactor building polar crane was written to confirm that the crane structure was undamaged by the accident conditions. It consisted primarily of visual inspections of accessible areas for corrosion, due to containment spray, and cracks and unusual deformations, due to the pressure spike. Inspections were limited to accessible areas only because enough areas were accessible to allow adequate inspection of representative areas of the crane structure, without requiring the addition of inspection platforms or other means of access which would not be ALARA. Attachment 5 summarizes the structural inspections performed on the TMI-2 polar crane. Dimensional checks were not performed since they were not required to identify structural damage that may have occurred due to the accident conditions. NDE, other than visual, was not required for the initial inspection of the crane but would have been required if structural damage, such as buckled or cracked plates, had been found. The results of the structural inspection have been forwarded to the NRC via memorandum 4410-83-M-0316 dated April 5, 1983. The inspection of the polar crane confirmed the engineering evaluation that the crane was structurally undamaged by the TMI-2 accident. Only slight surface rusting was noted.

ITEM

11. Provide the staff with quantitative dose estimates for performing the proposed load test and compare it to dose estimates associated with a load test which conforms with standards, ANSI B30.2 and ANSI N14.6.

RESPONSE

The applicable ANSI standard (ANSI B30.2-1976) recommends, but does not require, a load test prior to use of the crane. According to the standard, this advisory recommendation (denoted by "should") is "to be considered, the advisability of which depends on the facts in each situation." We have concluded that a load test prior to lifting the missile shields is not advisable since a failure on initial missile shield lift has been shown to pose no substantive hazard and therefore would imply an unjustifiable expenditure of worker radiation esposure (see below).

Calculations are available which demonstrate that crane or rigging failure on the initial missile shield lift will not fail the missile shield. Additionally, the traverse of the first missile shield over the remaining missile shields has been shown safe by analyses which demonstrate that a crane or rigging failure at this point will not fail the remaining shields. Once the first missile shield is placed on the load test fixture, one can view this as a 100% load test for the missile shields. Since the load is only 8% of the design load of the crane, and subsequent missile shield movements are similarly fail-safe, the preliminary load test is deemed of no engineering value. We estimate an expenditure of over 50 man-rem to bring in 50 tons of dead weight and perform a preliminary load test. Since this is deemed unnecessary from an engineering standpoint, it is not ALARA to perform the preliminary load test, regardless of the specific man-rem expenditure involved.

ANSI B30.2 also recommends, but does not require that the load rating not be more that 80 percent of the test load. A conservative estimate of the test load is 200 tons. The final crane rating of 170 tons will be about 85 percent of the test load. If the actual weight of the test assembly is 212.5 tons then the final rating of the crane will be 80 percent of the test load. If the test load exceeds 212.5 tons then the crane will be rated at 80 percent of the test load.

ITEM

12. Discuss how you will assure that all other type loads, including those with unique shapes not considered in the SER, will not be lifted prior to a full safety evalution and NRC approval.

RESPONSE

Lifting activities associated with "unique shapes" will be submitted to the NRC for approval.

The Cognizant Engineer will determine which lifting activities are associated with these shapes. The basis for this determination will be the Polar Crane Load Test Safety Evaluation Report and the "In-Containment Load Handling Guidelines for a 5 ton load and various lesser loads above Elevation 347'-6" (Attachment to DESE-0078, dated May 19, 1983). A load outside the calculated bounds of these bases will constitute a "unique shape" and appropriate safety evaluation will be submitted to NRC for approval.

Further, section 2.2 of the Polar Crane Operating Procedure states that the polar crane, even unloaded, will not be moved or used to move a load in any area of the containment without previous safety evaluation.