POWER AUTHORITY OF THE STATE OF NEW YORK

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December 6, 1982
IPN-82-78

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Mr. Steven A. Varga
Operating Reactors Branch No. 1
Division of Licensing

Subject: Indian Point 3 Nuclear Power Plant
Docket No. 50-286
Control of Heavy Loads

Dear Sir:

By letter dated September 20, 1982 (IPN-82-64) the Authority provided responses to items 1, 3, 4 and 8 of Enclosure 1 to your March 15, 1982 letter. The Authority provides, in Attachment A to this letter, responses to items 2 and 6(a). However, the responses to items 5, 6(b) and 7 are not complete at this time. It is anticipated that the Authority will provide responses to items 5, 6(b) and 7 by March 1, 1983.

Should you or your staff have any questions, please contact Mr. P. Kokolakis of my staff.

Very truly yours,

for J. P. Bayne
Executive Vice President
Nuclear Generation

Att.

cc: Resident Inspector's Office
Indian Point Unit 3
U.S. Nuclear Regulatory Commission
P.O. Box 38
Buchanan, New York 10511

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ATTACHMENT A

RESPONSES TO NRC MARCH 15, 1982
REQUEST FOR ADDITIONAL INFORMATION
CONCERNING CONTROL OF HEAVY LOADS

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DECEMBER, 1982

ATTACHMENT A

RESPONSES TO NRC MARCH 15, 1982
REQUEST FOR ADDITIONAL INFORMATION
CONCERNING CONTROL OF HEAVY LOADS

ITEM 2

The fuel storage building crane is not included in your analysis because no heavy loads are allowed to be handled by this crane, and no operations are expected to incur until after 1990. This is a major generic review by the NRC concerning handling of heavy loads. We desire to complete the review so that no items will be deferred to a future unspecified date. Therefore you are requested to supply the information requested on the fuel storage building crane. If you do not desire to submit this information, as a minimum you will maintain the present technical specification limits on the use of this crane. Also you are requested to provide justification for operation of this unqualified, physically heavy equipment near the spent fuel pool for an extended period of time. To receive our authorization for full use of the crane, the crane must comply with the guidelines of NUREG 0612.

RESPONSE

To further justify operation of the Fuel Storage Building Crane for an extended period of time, the crane design has been evaluated against and found to meet (with several justifiable exceptions) Guideline 7, Section 5.1.1 of NUREG 0612. In addition, the crane will be inspected, tested and maintained in accordance with Guideline 6, Section 5.1.1 of NUREG-0612.

These evaluations and measures in conjunction with those described in the previous response to Item 3 of the Authority's June 22, 1982 submittal provide substantial justification for operation of this crane until such time that heavy load movements in the vicinity of the spent fuel pool are anticipated. The results of the crane design evaluation are presented below.

The Fuel Storage Building Crane was built prior to the issuance of ANSI B30.2-1976 and CMAA 70-1975. This crane was designed and fabricated by Whiting Corporation in accordance with EOCI-61, "Specifications for Electric Overhead Traveling Cranes-1961." These specifications addressed certain, but not all, of the criteria in ANSI B30.2-1976 and CMAA 70-1975. Accordingly, additional drawings and design details were obtained from Whiting Corporation and a detailed point-by-point comparison performed of the Fuel Storage Building Crane design with the criteria in ANSI B30.2-1976 and CMAA 70-1975. This comparison considered only those components that are load bearing or are necessary to prevent conditions that could lead to a load drop. The components considered are those listed in Table I. In performing this comparison it was necessary to calculate stress levels in various components, moments of inertia, dimensional proportions, factors of safety, and other mechanical characteristics in order to verify compliance with ANSI B30.2-1976 and CMAA 70-1975. The following summarizes our findings for those areas where EOCI-61 criteria are different from those in CMAA 70-1975 or ANSI B30.2-1976 for the Fuel Storage Building Crane:

1. <u>Fuel Storage Building Crane</u>

a. <u>Welding</u> - CMAA 70-1975 and ANSI B30.2-1976 require that welding be performed in accordance with the latest edition of AWS D.1.1, "Structural Welding Code" and AWS D14.1, "Specifications for Welding Industrial and Mill Cranes." These current standards are more recent and were not available at the time of the fabrication of the Fuel Storage Building Crane; however, the welding procedures used are judged to be equivalent to the welding criteria in ANSI B30.2-1976 and CMAA 70-1975 based on the following:

(1) Welding was performed in accordance with the version of AWS D1.1 "Structural Welding Code" that was current at that time;

(2) AWS D14.1 "Specification for Welding Industrial and Mill Cranes" was not issued at that time; however, the Whiting practices and procedures used for the welding were equivalent to what was later issued as AWS D14.1;

(3) The welders were qualified to AWS criteria; and

(4) All welds were visually inspected.

b. Impact Allowance - CMAA 70-1975 requires use of an impact allowance of ½% of the load per foot per minute of hoisting speed (which is 2 tons), but not less than 15% of the rated capacity (which is 6 tons). EOCI-61 only specified use of 15% for the impact allowance. For the Fuel Storage Building Crane, the CMAA 70 specification is still met.

c. Lateral Forces - EOCI-61 is more conservative than CMAA 70-1975 for consideration of lateral loads due to acceleration or deceleration; therefore CMAA 70 is satisfied.

d. Torsional Forces - CMAA 70 specifies that twisting moments be determined based on the horizontal distance between the center of gravity and the shear center of the girder section. EOCI-61 requires twisting moments to be based on the distance between the load center of gravity and the beam center of gravity. Since the Fuel Storage Building Crane girders are symmetrical box sections, these two requirements are the same. Since the trolley rails are located over the centerline of the girders, there are no appreciable torsional forces on the girders.

e. Box Girder Proportions - CMAA 70 specifies that l/h (l = girder span; h = web height) should be less than 25; EOCI-61 has no limit on l/h. For the Fuel Storage Building Crane, l/h = 552 in./46 in. = 12. Therefore, CMAA 70 is satisfied.

In addition, CMAA 70 specifies that h/t be less than

$$C(K+1)\sqrt{\frac{17.6}{f_c}}$$ and less than M, where:

t = web thickness = 1/4 in.

C = 162 (Fuel Storage Building Crane has one longitudinal stiffener)

$K = f_t/f_c = 1.0$

f_t = max. tensile stress = 16.0 ksi

f_c = max. compressive stress = 16.0 ksi

M = 376

Therefore according to CMAA 70, h/t should be less than 218.9 and less than 376. h/t = 46/(1/4) = 184. Therefore, CMAA 70 is satisfied.

f. Longitudinal Stiffeners - CMAA 70 specifies a minimum moment of inertia for longitudinal stiffeners, maximum width to thickness ratio, and stiffener location along the web plate. EOCI does not provide similar guidance. For the Fuel Storage Building Crane, the moment of inertia should be greater than I_o = 0.875- in.^{4}, the width to thickness ratio should be less than 38, and the stiffener should be located 0.4 of the distance from the compression plate to the web neutral axis. The actual moment of inertia is 3.59- in.^{4}, the stiffener width to thickness ratio is 14,and the stiffener centerline is located 0.59 of the distance from the compression plate to the web neutral axis. The location of stiffener criterion is not satisfied for this crane. Since the purpose of the stiffener is to prevent buckling, the actual placement is considered more conservative than the CMAA-70 criteria.

g. Basic Allowable Stresses - EOCI-61 is more conservative than CMAA 70 for allowable tension, compression, and shear stresses, if b/c is less than 38 (b is distance between web plates and c is the thickness of the cover plate). For the Fuel Storage Building Crane, b/c is 11 in./0.75 in. = 14.7. Therefore, CMAA 70 is satisfied.

CMAA 70 also specifies an allowable stress range for crane structural members that are subject to cyclic loading of greater than 20,000 over the life of the crane. The number of cycles for any of the crane members will be less than 2,000 over the life of the Fuel Storage Building Crane. Based on this, failure due to cyclic fatigue should not be of concern for this crane.

h. Transverse Stiffeners - CMAA 70 specifies a minimum moment of inertia for transverse stiffeners about their interface with the web plate; this is not addressed in EOCI 61. For the Fuel Storage Building Crane, this criterion is not applicable as full depth diaphragms are used.

i. Bridge End Trucks and Trolley Frames - CMAA 70 specifies maximum tension (14.4 ksi), compression (14.4 ksi), and shear (10.8 ksi) stresses in bridge end trucks and trolley frames; while EOCI does not specify allowable vertical stresses for these members. CMAA 70 also specifies maximum drop height (1 in. max.) in case of axle failure in the bridge truck or trolley. For the Fuel Storage Building Crane, the maximum stresses with the rated load are 12.3 ksi for tension and compression and 1.4 ksi shear for the trolley frame, and 7.8 ksi tension and compression and 4.9 ksi shear for the bridge and end trucks. Therefore, the crane satisfies CMAA-70 for the maximum bridge truck and trolley frames stressed.

The maximum drop would be 1½ in. for a bridge truck and 1 in. for a trolley axle failure. Therefore the crane satisfies CMAA 70 for the trolley frame, but not for the bridge truck axle. Since it is not anticipated that the crane will be used to carry heavy loads approaching its rated capacity, e.g. a shipping cask, the stresses on the bridge axles will be limited. Based on this, the likelihood of such a failure is considered extremely small. If such a failure were to occur, the load would only be dropped 3/4 of an inch.

j. Hoisting Ropes - CMAA 70 specifies a 5:1 hoisting rope safety factor for the rated load plus bottom block divided by the number of parts of rope. For the Fuel Storage Building Crane main hoist:

CMAA-70 required breaking strength > 25.5 tons
6 x 37 7/8" stainless steel rope with wire core
8 part reeving
stainless steel rope published breaking strength = 29.9 tons
safety factor = 5.8:1

For the aux. hoist:

CMAA-70 required breaking strength > 3.2 tons

6 x 37 3/8" stainless steel rope with wire core

8 part reeving

stainless steel rope published breaking strength = 5.85 tons

resulting safety factor = 9.1:1

Therefore the rope satisfies the criteria in CMAA 70.

k. Hoist Drum - CMAA-70 specifies minimum drum groove depth and drum groove pitch; EOCI 61 does not provide such specific guidance. For the Fuel Storage Building Crane, this guidance would require minimum drum groove depth and pitch of 0.328 in. and 1.0 in. respectively for the main hoist, and 0.141 in. and 0.5 in. for the aux. hoist. The actual dimensions are 0.406 in. and 1.0 in. for the main hoist and 0.188 in. and 0.5 in. for the aux. hoist. Thus, the criteria are satisfied.

l. Bridge Parking Brake - CMAA-70 requires the brake to be at least 75% of bridge motor torque, for cab on trolley controls, 100% if cab on bridge, and 50% if remote or floor control; EOCI-61 only requires 50%. For the Fuel Storage Building Crane, the bridge motor torque is 8.75 ft.-lbs. To satisfy CMAA-70 the brake should be at least 50% of the motor torque, or 4.4 ft.-lbs. The actual rating is 35 ft.-lbs., therefore, CMAA-70 is satisfied.

m. Hoist Holding Brakes - CMAA 70 and ANSI B30.2 include the following criteria for holding brakes that are not addressed in EOCI 61:

(1) Minimum torque ratings (relative to motor torque) of 125% if used with control braking other than mechanical; 100% if used with mechanical control braking;

(2) Thermal capacity for the frequency of operation required by the service; and

(3) Wearing surfaces free of defects that may interfere with operation.

For the Fuel Storage Building Crane, the following holding brake characteristics are provided:

(1) This crane uses mechanical-friction disk type braking for lowering of the load with the main hoist. A magnetic type (spring set and solenoid released) holding brake is used for the main hoist. This brake has a torque rating of 152% of the full load torque of the motor. The aux. hoist uses a similar load brake method, and has one holding brake of the same type as the main hoist brakes, with a torque rating of 229% of the full load torque of the motor.

(2) These brakes are rated for 1/2 hour continuous duty. Due to the intermittent use of the holding brakes and the short time interval that the brakes are subject to friction, this rating is more than adequate for the Fuel Storage Building Crane.

(3) Wearing surfaces are designed free of defects; periodic inspection will verify continued compliance and assure replacement of worn components.

Therefore, the holding brakes satisfy CMAA 70.

n. <u>Bridge Bumpers</u> - CMAA 70 has the following specific criteria on bridge bumpers and stops that are not included in EOCI 61:

(1) Max. deceleration of 3 ft./sec^2 when bridge is travelling at 20% of rated load speed;

(2) Capable of stopping crane when travelling at 40% of rated load speed;

(3) No direct shear on bolts;

(4) Installed to minimize parts falling;

(5) Runway stops attached to resist force applied; and

(6) Stops engaging tread of wheel not recommended.

For the Fuel Storage Building Crane, the following bridge bumper features are provided:

(1) Bridge deceleration from 20% of rated load speed is less than 1 ft./sec^2;

(2) Bumpers have adequate capacity to stop bridge from 40% of full speed in 1/3 of bumper travel;

(3) Bridge bumper mounting bolts are not in shear;

(4) Bumper components are arranged to minimize the potential for parts falling (mounted inside frame box);

(5),(6) Bumpers serve to limit travel at ends of runway; stops are also provided.

Based on the above, the bridge bumper design satisfies the requirements of CMAA 70.

o. Trolley Bumpers - CMAA 70 establishes the following design criteria for trolley bumpers that are addressed in EOCI 61:

(1) Maximum deceleration of 4.7 ft./sec^2 when trolley is traveling at 1/3 of rated load speed;

(2) Bumpers shall be designed and installed to minimize parts from falling;

(3) Attaching bolts should not be in shear.

For the Fuel Storage Building Crane, trolley bumpers are not provided; however, wheel stops are provided at the ends of the trolley rails. The addition of trolley bumpers is a more recent practice of crane manufacturers that resulted from OSHA requirements and was incorporated into CMAA-70. OSHA did not backfit this requirement for cranes preceding issuance of the requirement. Operation of the Fuel Storage Building Crane has not resulted in unsafe conditions due to the lack of trolley bumpers. Crane operators will be cautioned not to run the trolley against the wheel stops. On this basis, this exception to CMAA-70 is judged to be acceptable.

p. Wheels - CMAA 70 specifies that wheel load be determined based on the trolley handling the rated load in the position to produce the maximum load, and that a total clearance of 3/4" to 1" be provided between wheel flanges and rail head. EOCI 61 does not include these specific criteria. For the Fuel Storage Building Crane, both the bridge truck and the trolley wheels have a clearance of 1". The wheels were designed based on locating the trolley for the maximum load. Therefore CMAA-70 is satisfied.

q. Static Controls - CMAA 70 includes various criteria for crane static controls; EOCI only addresses crane magnetic controls. Since the Fuel Storage Building Crane uses a magnetic control system, the criteria on static controls are not applicable.

r. Resistors - CMAA 70 requires resistors used for control braking to have a thermal capacity of Class 160 or better; EOCI 61 does not specify resistor requirements for control braking applications. The Fuel Storage Building Crane uses mechanical control braking; therefore, resistor thermal capacity is not applicable.

s. Restart Protection - CMAA 70 establishes criteria for restart protection for cranes not provided with spring-return controllers or momentary contact pushbottons; this is not addressed in EOCI 61. These criteria are not applicable to the Fuel Storage Building Crane since this crane has spring-return pushbutton controls.

TABLE I

CRITICAL CRANE COMPONENTS

Critical load bearing parts are those parts whose failure as a single component would result in a drop of the load, or would result in conditions that could lead to a load drop.

1. Hoisting Cable

   The hoisting cable is critical.

2. Drum

   The drum bearings and drum bearing housing structure and pedestal are critical. So are their related welds. The drum tube, hub, shaft and all welds are critical, as well as the cable clamp.

3. The Block

   The hook, nut, swivel, sheaves, and hanger plates are critical.

4. Sheave Nest

   The sheave pins, equalizer sheave hanger and the major parts of the structural sheave nest including welds are critical.

5. Trolley Frame

   The load girts and connecting angles including their related welds and the trolley truck frames are critical.

6. Bridge

   The girders, related cover plate and web plate welds are critical.

7. Trolley Spacers

   The trolley spacers and related welds and connections are critical.

TABLE I
CRITICAL CRANE COMPONENTS
(continued)

8. Brakes

   Hoist motion holding brakes and hoist control brakes are critical.

9. Motor Shafts and Couplings

   Motor shafts and couplings required to hold the load under braking are critical.

10. Bridge and Trolley Wheels

    Bridge and trolley wheels and their axles are critical.

11. Controller

    The controller pendant, cabling, and hoist upper limit switch are critical.

ITEM 6

An initial load test under a load substantially greater than that for which the tested device is rated, followed by a comprehensive examination, provides a degree of assurance that design safety margins have been realized. This assurance is particularly important in situations where original design margins are not well documented as at Indian Point. In this regard, we need further information on the following lifting devices to complete our review:

(a) You should verify that the inspection and testing called for in sections 5.2.1 or 5.3.1 of ANSI N14.6-1978 has been performed for the internals lifting rig or will be performed on a periodic basis.

RESPONSE

The Authority, in its letter dated April 21, 1982 (IPN-82-34), provided to the NRC the inspection and testing that will be performed for the internals lifting rig.