GPU Nuclear

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Writer's Direct Dial Number:

February 18, 1983

Darrell G. Eisenhut, Director
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Eisenhut:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
Generic Letter 81-07 (Heavy Loads)

Your letter dated December 22, 1980 requested a review of the controls for handling heavy loads at Oyster Creek. This first phase of the requested review of the Oyster Creek facility was addressed in our letter to you of September 22, 1981. However, at that time, certain evaluations had not been completed. The attached information describes the remaining reviews that have been performed to complete the first phase of our evaluation of heavy load handling operations at Oyster Creek.

The report also contains additional information requested by the NRC on July 9, 1982 when a conference call was held between the NRC, TERA, GPU, and FRC (WESTEC) to discuss the evaluation and conclusions presented in the draft technical evaluation report by WESTEC which reviewed the September 22, 1981 submittal by GPU. In addition, as a result of that conference call, revisions to our original submittal were deemed necessary and are included as attachment A to this submittal. Please insert these pages into our initial submittal.

If there are additional questions, please contact me or Mr. Michael Laggart of my staff at (609) 971-4643.

Very truly yours,

Peter B. Fiedler
Vice President and Director
Oyster Creek

A033

PBF:jal

cc: Mr. Ronald C. Haynes, Administrator
Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

NRC Resident Inspector
Oyster Creek Nuclear Generating Station
Forked River, NJ 08731

SUPPLEMENTAL RESPONSES TO REQUESTS
FOR INFORMATION IN SECTION 2.1
OF ENCLOSURE 3 TO DECEMBER 22, 1980
LETTER FROM D. EISENHUT

ITEM 1: Report the results of your review of plant arrangements to identify all overhead handling systems from which a load drop may result in damage to any system required for plant shutdown or decay heat removal (taking no credit for any interlocks, technical specifications, operating procedures, or detailed structural analysis).

SUPPLEMENTAL RESPONSE: A review of plant arrangements was described in our initial submittal in the responses to Items 1 and 2. The results of that review identified the handling systems at the Oyster Creek facility that must be addressed within the scope of NUREG-0612. For several additional handling systems (spent fuel pool jib cranes and refueling platform auxiliary hoists), the review was left incomplete pending a decision as to whether these handling systems would be derated to 800 lbs. The decision has been made not to derate the spent fuel pool jib cranes and to derate the refueling platform auxiliary hoists and the main fuel grapple. Accordingly, the spent fuel pool jib cranes have been included as handling systems within the scope of NUREG-0612. For the spent fuel pool jib cranes, and for the recirculation pump monorail (which was not fully addressed in our initial submittal), compliance with the General Guidelines of NUREG-0612 is addressed in the following supplemental responses to the requests for information in Section 2.1 of Enclosure 3 to the NRC's letter of December 22, 1980.

ITEM 2: Justify the exclusion of any overhead handling system from the above category by verifying that there is sufficient physical separation from any load-impact point and any safety-related component to permit a determination by inspection that no heavy load drop can result in damage to any system or component required for plant shutdown or core decay heat removal.

SUPPLEMENTAL RESPONSE: As indicated in the supplemental response to Item 1, the spent fuel pool jib cranes are no longer excluded from compliance with NUREG-0612. The following supplements our September 22, 1981 submittal and provides the basis for excluding certain handling systems.

Drywell Airlock Monorail - Our previous submittal discussed a potential safety concern with use of the Drywell Airlock Monorail. Further evaluation of this handling system has determined that it may be excluded from the NUREG-0612 criteria. Since this monorail only handles the airlock a few inches off the floor and there is no safe shutdown equipment in proximity to the airlock, a load drop will not affect safe shutdown capability.

Refueling Platform Auxiliary Hoists (2) - Oyster Creek Plant Engineering has researched and evaluated the lifts which the Refueling Bridge auxiliary hoists are typically used to perform. Derating these hoists from their current rating of 1000 lbs. to 750 lb. is planned and should not affect the lifts from which they were intended to serve. This reduced capacity will be posted on both the pendant controls and housing of each hoist and will be implemented prior to outage operations.

Equipment Jib Crane - GPU excluded a one ton jib crane located adjacent to the reactor building equipment hatch from compliance with NUREG-0612 based on very conservative structural analyses of the potential for damage to equipment below the railroad bay floor at elevation 75 feet.

As requested in our telecon with the NRC of July 9, 1982, GPU submits the following information regarding structural evaluations performed by TERA of drops from the equipment hatchway jib crane.

OYSTER CREEK
REACTOR BUILDING EQUIPMENT HATCH
JIB CRANE

For the equipment hatch jib crane, an analysis was performed of the potential for underside scabbing or perforation from impact on the railroad bay floor. The analysis considered a one ton load of various impact areas to cover the various type loads expected to be handled by this jib crane.

Procedures recommended in References 1 and 2 were followed. The modified National Defense Research Committee (NRDC) formula (Reference 3) was chosen because it has been shown to give the best fit with available experimental data (References 4 and 5). The NRDC formula for the depth of penetration, x (inches), of a solid cylindrical missile is given by:

$$x = \left(4 KNWd(V)^{1.8}/(1000\ d) \right)^{1/2} \text{ for } x/d \quad 2.0 \qquad (1)$$

or

$$x = (KNW(V)^{1.8}/(1000\ d) = d \text{ for } x/d \quad 2.0 \qquad (2)$$

where W = weight of the missile (pounds)
d = diameter of missile (inches)
V = impact velocity of missile (feet/second)
N = missile shape factor
= 0.72 flat-nosed missiles
= 0.84 blunt-nosed missiles
= 1.00 spherical-nosed missiles
= 1.14 sharp-nosed missiles
K = concrete penetrability factor
= $180/\sqrt{f'c}$ (f'c = concrete compressive strength - pounds/square inch)

The thickness of reinforced concrete needed to resist impact without perforation and scabbing are given by the following Army Corps of Engineers formulae (Reference 6) which can be used in conjunction with equations (1) and (2).

$$ts/d = 2.12 + 1.36\,(x/d) \text{ for } 0.65 \quad x/d \quad 11.75 \qquad (3)$$

$$tp/d = 1.32 + 1.24\,(x/d) \text{ for } 1.35 \quad x/d \quad 13.5 \qquad (4)$$

where ts = concrete thickness required to prevent scabbing

tp = concrete thickness required to prevent perforation

Equations (3) and (4) were later extrapolated for small values of x/d (Reference 7) giving,

$$ts/d = 7.91\,(x/d) - 5.06\,(x/d)^2 \text{ for } x/d \quad 0.65 \qquad (5)$$

$$tp/d = 3.19\,(x/d) - 0.718\,(x/d)^2 \text{ for } x/d \quad 1.35 \qquad (6)$$

A 10 percent margin on thickness has been applied in the use of equations (3) thru (6) as recommended in Reference 1.

Using the above methodology for load drops from the equipment hatch jib crane, no scabbing or perforation is predicted for the set of bounding heavy load drops considered.

REFERENCES

1. Civil Engineering and Nuclear Power, Report of the ASCE Committee on Impactive and Impulsive Loads, Vol. V, American Society of Civil Engineers, September 1980.

2. Structural Analysis and Design of Nuclear Power Facilities, American Society of Civil Engineers, 1980.

3. Effects of Impact and Explosion, Summary Technical Reports of Division 2, National Defense Research Committee, Vol. I, Washington, D. C., 1946.

4. Vassallo, F. A., Missile Impact Testing of Reinforced Concrete Panels, HC-5609-D-1, Calspan Corporation, January 1975.

5. Stephenson, A. E., "Full Scale Tornado Missile Impact Tests", Electric Power Research Institute, Final Report NP-440, July 1977.

6. Beth, R. A. and Stipe, J. G., "Penetration and Explosion Tests on Concrete Slabs", CPPAB Interim Report No. 20, January 1943.

7. Beth, R. A., "Concrete Penetration", OSRD-4856, National Defense Research Committee Report A-319, March 1945.

6. Beth, R. A. and Stipe, J. G., "Penetration and Explosion Tests on Concrete Slabs", CPPAB Interim Report No. 20, January 1943.

7. Beth, R. A., "Concrete Penetration", OSRD-4856, National Defense Research Committee Report A-319, March 1945.

ITEM 3: With respect to the design and operation of heavy load-handling systems in the containment and spent-fuel-pool area and those load-handling systems identified in I above, provide your evaluation concerning compliance with the guidelines of NUREG-0612, Section 5.1.1. The following specific information should be included in your reply:

ITEM 3.a: Drawings and sketches sufficient to clearly identify the location of safe load paths, spent fuel, and safety-related equipment.

SUPPLEMENTAL RESPONSE: For the recirculation pump monorail and the spent fuel pool jib cranes addressed in this supplement, safe load paths are limited by the physical capabilities of the equipment. Operating procedures shall be developed, however, that caution operators not to carry loads over or in the vicinity of spent fuel or safety-related equipment unless absolutely necessary and, if so, to limit the height and duration of the lifts.

ITEM 3.b.: A discussion of measures taken to ensure that load-handling operations remain within safe load paths, including procedures, if any, for deviation from these paths.

SUPPLEMENTAL RESPONSE: As indicated in 3.a. above, revisions are being made to plant procedures utilizied in performing heavy lifts by the recirculation pump monorail and by the spent fuel pool jib cranes. Work involving heavy lifts will be supervised by job supervisors, who will be responsible for enforcing the procedural requirements. Any deviations from these requirements will require the prior approval of appropriate station management personnel.

ITEM 3.c.: A tabulation of heavy loads to be handled by each crane which includes the load identification, load weights, its designated lifting device, and verification that the handling of such loads is governed by a written procedure containing, as a minimum, the information identified in NUREG-0612, Section 5.1.1(2).

SUPPLEMENTAL RESPONSE: For the recirculation pump monorail and hoist, the types of loads that may have to be lifted are those related to performing maintenance on the pumps, such as the floor grating, pump motor (13,000 lbs.), case (with case wear ring assembled - 17,000 lbs.), motor mount (5,000 lbs.), and cover (2,800 lbs.). These loads will be lifted using slings or other standard lifting equipment. As indicated previously, written procedures shall be developed to govern heavy lifts with this monorail.

With regard to the spent fuel pool jib cranes, no specific loads in excess of 800 lbs. have been identified that must be lifted with these handling systems. Nonetheless, in order to address the case of lifting heavy loads with this equipment, they have been included within the scope of NUREG-0612 and operating procedures developed to govern their use for such lifts.

ITEM 3.d.: Verification that lifting devices identified in 2.1.3-3, above, comply with the requirements of ANSI N14.6-1978 or ANSI B30.9-1971 as appropriate. For lifting devices where these standards, as supplemented by NUREG-0612, Section 5.1.1(4) and 5.1.1(5), are not met, describe any proposed alternatives and demonstrate their equivalency in terms of load-handling reliability.

SUPPLEMENTAL RESPONSE: For heavy lifts by the recirculation pump monorail and the spent fuel pool jib cranes, operating procedures will require that sling selection and use be in accordance with ANSI B30.9-1971.

Our September 22, 1981 submittal indicated that further details were being obtained, and that design analyses would be performed if required, for the load strongback, the cavity shield plug lifting beam, and the equipment storage pool plug lifting beam. The following supplements the information contained in our first submittal and provides the results of these design evaluations.

Head Strongback: Our first submittal indicated that at that time we only had a single drawing of the head strongback available for evaluation to ANSI N14.6, and that additional information was being obtained from General Electric to complete the review. Further review by G.E. has determined that no records are available as to whether stress analyses had been performed for this lifting rig or to indicate what stress design safety factor had been used for the original design. As a result of this, we have performed a stress analysis of the head strongback for the various loads that this device is used to handle, in order to verify compliance with the critical criteria of ANSI N14.6, 1978. Figure 3.d.1 is a sketch of the Oyster Creek head strongback prior to modifications that resulted from this review.

ANSI N14.6, 1978, Section 3.2.1.1 specifies that the lifting device shall be capable of lifting three times the actual load without exceeding the yield strength of the material and five times the load without exceeding the ultimate strength of the material. In addition, NUREG-0612 requires the applied load used in these calculations to be the combined static and dynamic load. CMAA 70-1975 requires, for the hoisting speeds used on the Oyster Creek reactor building crane, that an impact factor of 15% of the load be used for crane components. However, calculations were performed to determine the maximum dynamic loading that could be imparted on lifting devices by this crane. These

calculations conservatively used: no load on the crane to determine maximum deceleration; lowering of the hook at 110% of hoist speed when both holding brakes are suddenly applied; rotational inertia of only the motor (ignoring gearing, drum, and brake wheel inertia); and operation of the brakes at full rated torque. These calculations determined that maximum deceleration load due to the load brakes would be less than 3% of the load due to gravity. With the rated load, the deceleration load would be smaller. Based on these calculations, a conservative factor of 5% was used for dynamic loads on the head strongback.

The strongback was also evaluated in terms of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" dated November 1, 1978, by the American Institute of Steel Construction. Although compliance with the AISC Specification is not mandatory in this case, it is useful to evaluate the strongback with respect to the most commonly used specification for structural steel in the United States.

Static loads used were 62 tons (drywell head) applied at the outer turnbuckles and 92 tons (vessel head) applied at the inner turnbuckles. The major findings of the evaluation are summarized below:

1. Anchor Shackles - According to General Electric Drawing 719E448, anchor shackles were to be Crosby-Laughlin #G-213 or equal. Capacities are shown in the Crosby Group "Engineering Journal" and were confirmed by telephone with a Crosby engineer. As shown below, each of the three anchor shackles meets the design safety factors of ANSI for ultimate strength. Yield strength information was not available from the manufacturer.

ANCHOR SHACKLES

		Ultimate Load	
Size	Applied Load	Load	F.S.
1-3/4"	43.2 kips	300.0 kips	6.94
2"	64.2	420.0	6.54
2-1/2"	64.2	660.0	10.30

2. Turnbuckles - G.E. Drawing 719E448 specifies Crosby-Laughlin turnbuckles. Capacities are shown in the Crosby "Engineering Journal" and are in agreement with the standard values shown in the AISC Manual of Steel Construction. As shown below, the loads on the turnbuckles result in factors of safety that do not quite meet the ANSI standards.

TURNBUCKLES

		Ultimate Load	
Size	Applied Load	Load	F.S.
2½x6"	63 kips	300.0 kips	4.76
2½x24"	64.2	300.0	4.67

These factors of safety are considered sufficiently close to ANSI standards to be acceptable. In addition a detailed inspection program is being implemented that includes the following for the turnbuckles, to be performed prior to each refueling:

- o Visual examination for deformation and cracks, all parts.
- o MT overall, including threaded ends on jaw end and on eye end.
- o Dimensional examination of all parts for warpage, elongation of eye end or bolt hole in jaw end, reduction in shank diameter, warpage of bolt, and opening of jaws at bolt hole.

This inspection program will compensate for the marginal deviation in the factor of safety against ultimate.

3. Lifting Arms - The steel lifting arms were evaluated for both shear and bending, but bending was found to be the governing factor. Although the maximum bending

moment occurs near the center of the strongback, the bending stress was determined at various points along the arm because of the variable cross-section. The results of this stress evaluation are summarized below.

BENDING OF LIFTING ARMS

Distance from Outer End	Ratio to AISC Allowable	ANSI Yield F.S.	ANSI Ultimate F.S.
24"	1.04	1.57	3.21
36"	1.05	1.57	3.11
48"	1.12	1.68	3.24
60"	1.21	1.81	3.44
70"	1.20	1.80	2.91
80"	3.66	5.49	6.27
90"	4.37	7.15	7.91
100"	4.34	7.20	7.21

It was determined that the critical area for bending occurs along the top edge of the unstiffened web; i.e., where there is no tension f ange (Refer to Figure 3.d.l). Tensile stresses in this region were calculated to be 20 to 22.8 ksi, which is within the AISC maximum allowable stress.

However, this stress level results in a factor of safety against yielding of 1.5 to 1.8, as compared to the value of 3.0 required by ANSI.

Ultimate strength in bending is determined by the development of a plastic hinge of which the entire cross-section reaches the yield point, creating a collapse condition. A plastic hinge would first develop at the point where the unstiffened web meets the top flange (70 inches from the outer end of the arm). The factor of safety

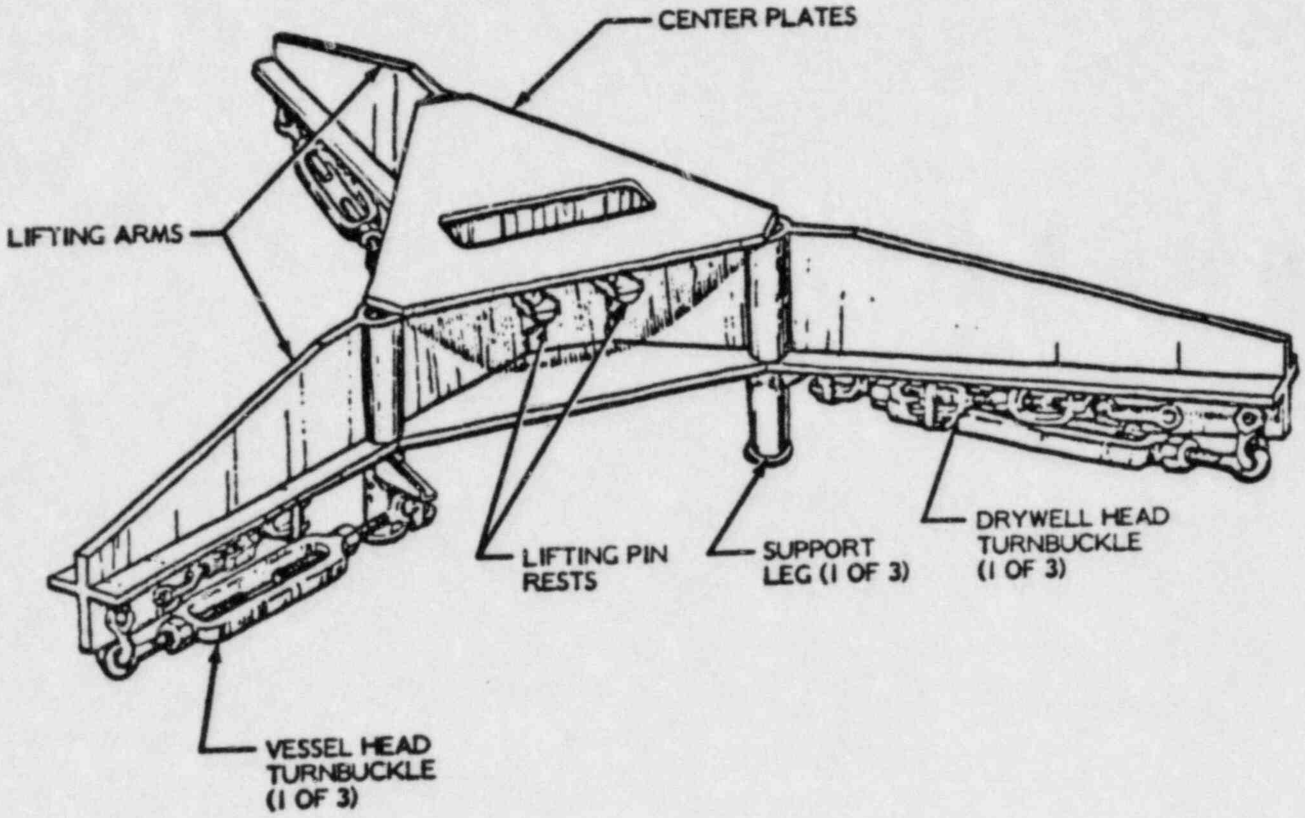

FIGURE 3.d.1: HEAD STRONGBACK

against ultimate load is 2.9, as compared to the ANSI minimum of 5.0. It should be noted that the present configuration satisfies AISC allowables. Further investigation indicated that if a top flange were added, the new configuration would meet ANSI requirements as well.

4. "Box" at Center of Strongback - An analysis of the stress in the box at the center of the strongback was made. Stress was calculated due to three factors:

   a. Shear from transfer of the load from the webs of the arms to the lifting pins: The stress was found to be only about 1.1 ksi from this item as compared to a yield strength of 20.8 ksi.

   b. Bending parallel to the axis of the single arm on one side of the box: Bending from this arm is balanced by the corresponding component from the pair of arms that are 120° apart on the other side of the box. The factor of safety against yield is about 7.1 for this component.

   c. Bending parallel to the length of the box: Bending in this direction exists in the two arms located on one side of the box. The factor of safety against yield is about 6.9 for this component.

5. Lifting Pin - Bending and shear were checked in the lifting pin, and were found to be well within ANSI limits.

In conclusion, the Oyster Creek head strongback was evaluated for compliance with ANSI and AISC specifications, and was found to not fully comply with ANSI specified factors of safety against bending in the lifting arms although stresses were within AISC allowables. Modifications are being made to the lifting arms to bring the head strongback into compliance with ANSI-N14.6. The modifications will consist primarily of an addition of a cover plate over each arm. Following these modifications, the head strongback will be load tested in accordance with 5.3.2 of ANSI-N14.6-1978.

Cavity Shield Plug Lifting Beam and Equipment Storage Pool Plug Lifting Beam: Since GPU was not able to obtain information on the original design criteria for these lifting beams or whether stress analyses were performed, stress analyses of these lifting beams have also been performed to determine compliance with ANSI-N14.6. Additionally, the lifting beams were evaluated in terms of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" by the American Institute of Steel Construction, dated November 1, 1978.

Stress calculations were performed to demonstrate the margins of safety as required by ANSI-N14.6 Section 3.1.3 since a stress analysis by the original designer is not available. Factors of safety required by Section 3.2.1.1 are 3.0 against exceeding the yield strength of the material and 5.0 for ultimate strength. It was assumed that the material is A36 steel, since the beams are standard structural steel I-beam sections. Since A36 steel has a well defined yield point, Section 3.2.3 of N14.6 does not apply in this case. Compliance with the AISC Specifications is not mandatory, but it provides a basis for evaluating the lifting beams in terms of the most common standards for steel structures.

Static loads were increased by an impact factor of 5% as discussed in the head strongback section above to satisfy NUREG-0612 criteria for including static plus dynamic loading. The dead weight of the beams is relatively minor so it was neglected in the analysis. The major findings of the study are summarized below. Factors of safety are shown in Table 3.d-1.

(a) Cavity Shield Plug Lifting Beam - Although the existing cavity shield plug lifting beam very nearly meets the AISC Specification, it does not meet ANSI yield strength and ultimate strength requirements for bending. Various modifications were evaluated for reinforcing the beam in order to meet the ANSI requirements, but no practical solution was found. Instead, a standard wide flange beam (such as W36 x 260) will be used as a replacement for the present girder so that ANSI criteria are met. The existing lifting lugs were determined to be adequate, so the new

beam will be provided with lifting lugs of the same dimensions (Figure 3.d.2).

(b) Equipment Pool Plug Lifting Beam - The main lifting beam exceeds AISC requirements, but does not meet ANSI yield and ultimate criteria for bending. However, the addition of a 2" x 11½" bottom plate to the existing lifting beam in the high moment region is sufficient to provide the required factors of safety. The only other portion of the device not meeting the ANSI requirements is the web of the cross beams. The cross beams easily meet the requirements for bending, but do not possess adequate shear capacity. This will be corrected by adding a 1" x 4" vertical plate above the existing web (Figure 3.d.3).

Load tests will be performed in accordance with 5.3.2 of ANSI-N14.6-1978 following modification of the lifting beams. Based on the above evaluations and modifications to be made, the lifting beams will comply with ANSI-N14.6 criteria.

FIGURE 3.d.2: NEW CAVITY SHIELD PLUGS LIFTING BEAM

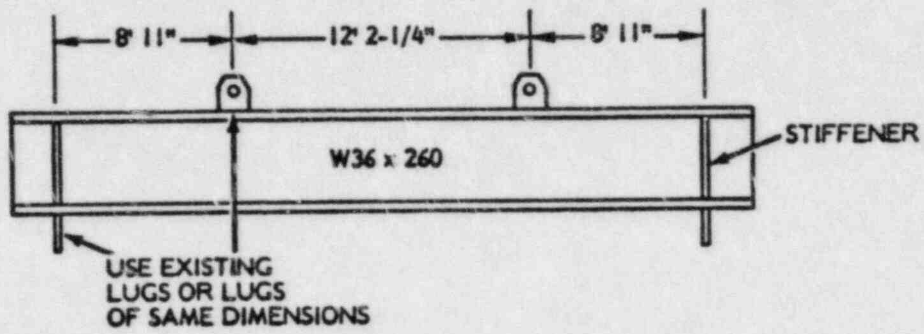

FIGURE 3.d.3: MODIFICATIONS TO EQUIPMENT POOL PLUGS LIFTING BEAM

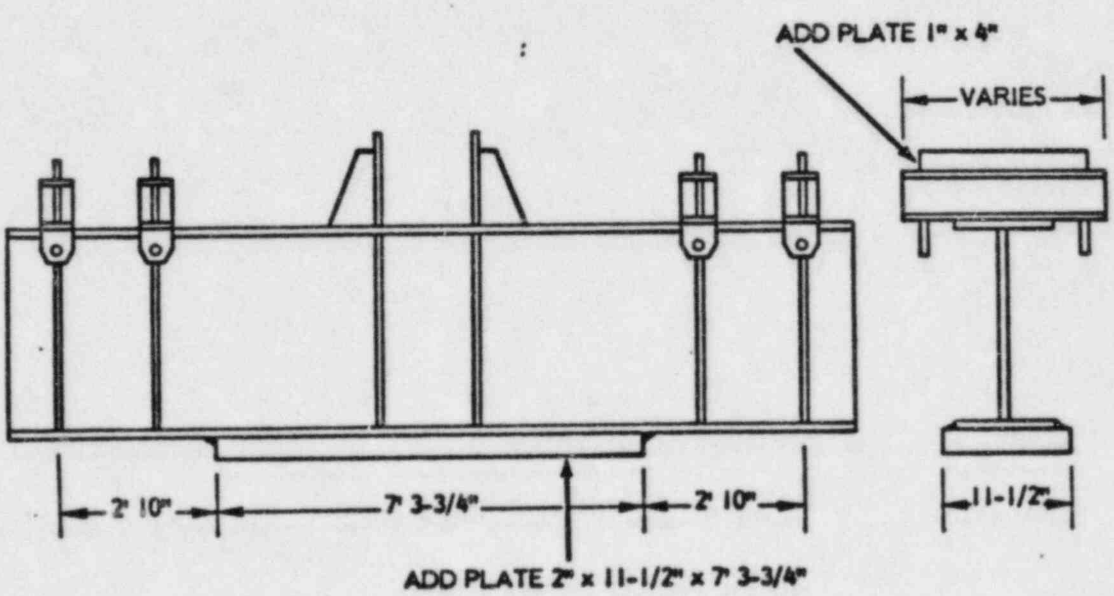

Table 3.d-1: BENDING OF LIFTING ARMS

Item	Mode	Ratio to AISC Allowable	ANSI Yield F.S.	ANSI Ultimate F.S.
A. CAVITY PLUGS				
Original Lifting Beam	Bending	1.1	1.75	2.0
Lifting Lugs	Tension	5.4	13.7	22.1
New W36x260 Lift. Bm.	Bending	3.1	5.0	6.1
B. EQUIPMENT POOL PLUGS				
Existing Lifting Beam	Bending	2.0	3.2	3.8
Proposed Modified Lifting Beam	Bending	2.5	4.1	5.5
Center Lifting Lugs	Tension	6.0	9.8	15.9
End Lifting Lugs	Tension	6.5	10.6	17.0
Turnbuckles	Tension	2.0 (Mfr)	-	10.6
Existing Cross Beams	Shear	1.9	2.5	2.7
Proposed Modified Cross Beams	Shear	-	4.4	5.5
MINIMUM FACTORS		1.0	3.0*	5.0*

* From ANSI N14.6, Section 3.2.1.1

ITEM 3.e.: Verification that ANSI B30.2-1976, Chapter 2-2, has been invoked with respect to crane inspection, testing, and maintenance. Where any exception is taken to this standard, sufficient information should be provided to demonstrate the equivalency of proposed alternatives.

SUPPLEMENTAL RESPONSE: New procedures are being developed for inspection, testing, and maintenance of the recirculation pump monorail and spent fuel pool jib cranes. In addition, provisions are being included in handling system operating procedures for appropriate operator inspections prior to load movement. With these revisions and additions, the procedures satisfy the criteria of ANSI B30.11-1980, "Monorail and Underhung Cranes", and ANSI B30.16-1971, "Underhung Hoists". These standards were utilizied in lieu of ANSI B30.2-1976 because they more appropriate address such handling systems.

ITEM 3.f: Verification that crane design complies with the guidelines of CMAA Specification 70 and Chapter 2-1 of ANSI B30.2-1976, including the demonstration of equivalency of actual design requirements for instances where specific compliance with these standards is not provided. (From NRC December 22, 1980 letter).

Reactor Building Crane

The Oyster Creek reactor 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 Travelling Cranes-1961," and additional criteria contained in Burns and Roe specification S-2299-32, March 1965. 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 Oyster Creek reactor 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 3.f-1. In performing this comparison it was necessary to calculate stress levels in various components, moments of inertia, gear ratings (strength and durability), 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:

a. Welding - 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 Oyster Creek reactor building crane; however, the welding procedures used for the Oyster Creek reactor building crane 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, but not less than 15% of the rated capacity. EOCI-61 only specified use of 15% for the impact allowance. For the Oyster Creek reactor building crane (hoist speeds of 5.5 and 30 fpm for the main and aux. hoists respectively), 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 Oyster Creek reactor building crane girders are box sections, these two requirements are the same. Since the trolley rails are located down 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 Oyster Creek reactor building crane, l/h = 1240 in./88 in. = 14.1. 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 = 5/16 in.

C = 162 (Oyster Creek 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

Thus, according to CMAA 70, h/t should be less than 339.5 and less than 376. h/t = 88/(5/16) = 281.6. Therefore CMAA 70 is satisfied.

f. Longitudinal Stiffeners - CMAA 70 specifies a minimum moment of inertia for longitudinal stiffeners, width to thickness ratio, and stiffener location along the web plate. EOCI does not provide similar guidance. For the Oyster Creek reactor building crane, the moment of inertia should be greater than I_o = 13.43-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 17.96-in.^{4}, the stiffener width to thickness ratio is 26, and the stiffener centerline is located 0.42 of the distance from the compression plate to the web neutral axis. Therefore CMAA 70 is satisfied.

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 Oyster Creek reactor building crane, b/c is 23 in./1.25 in. = 18.4. 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 Oyster Creek reactor 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 Oyster Creek reactor building crane, the moment of inertia should be greater than 57.6-in.^{4}; the actual is 1487-in.^{4}. Therefore the crane complies with CMAA 70.

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-61 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 Oyster Creek reactor building crane, the maximum stresses with the rated load are 6.5 ksi for tension and compression, and 4.6 ksi shear. The maximum drop would be 5/8 in. for a bridge truck or trolley axle failure. Therefore the crane satisfies CMAA 70.

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 Oyster Creek main hoist:

bottom block = 7600 lbs.
rated load = 200,000 lbs.
parts of rope = 12 (1-1/8" each)
rope published breaking strength = 113,000 lbs.
resulting safety factor = 6.5:1

For the aux. hoist:
block = 500 lbs.
load = 10,000 lbs.

parts of rope = 2 (9/16" each)

rope published breaking strength = 29,000 lbs.

resulting safety factor = 5.5

Therefore the rope satisfies the criteria in CMAA 70.

k. Hoist Drum - CMAA 70 specifies that drum design should consider combined crushing and bending loads; however, EOCI-61 is not as specific. The Burns and Roe procurement specification for this crane required the design to consider combined crushing and bending loads. Therefore CMAA 70 is satisfied.

CMAA 70 also specifies minimum drum groove depth and drum groove pitch; EOCI-61 does not provide such specific guidance. For the Oyster Creek reactor building crane, this guidance would require minimum drum groove depth and pitch of 0.42 in. and 1.25 in. respectively for the main hoist, and 0.21 in. and 0.64 in. for the aux. hoist. The actual dimensions are 0.438 in. and 1.25 in. for the main hoist and 0.225 in. and 0.688 in. for the aux. hoist.

l. Gearing - CMAA 70 provides specific criteria for establishing allowable strength horsepower and allowable durability horsepower for hoist gearing, and also specifies a factor for estimating the actual horsepower imposed on the gearing. For the Oyster Creek reactor building crane, the following values apply:

	Main Hoist	Aux. Hoist
N_p	500 rpm	650 rpm
F	4 in.	4 in.
J	0.41 (motor pinion)	0.38
S_{at}	41,000 psi	41,000 psi
K_m	1.3	1.3

P_d	3.0 in.	3.5 in.
d	3.25 in.	2.95 in.
K_v	0.875 (curve 2, 500 fpm)	0.88 (curve 2, 400 fpm)
I	0.27	0.49
C_v	(.795 (curve 3, 500 fpm)	0.80 (curve 3, 400 fpm)
C_m	1.4 (F/d = 1.2)	1.4 (F/d = 14)
C_c	0.4	0.4
S_{ac}	105,000 psi	105,000 psi
C_h	1.027 (7.2 ratio)	1.024 (6.5 ratio)
C_p	2300	2300

Helix angle = 15° - main hoist,
30° - aux. hoist

$L_{min.}$ = 9.7 in. - main, 10.2 in. - aux.

Applied horsepower factor - 75%

These result in the following gear ratings:

	Main Hoist	Aux. Hoist
P_{af} (allowable strength h.p.)	195	183
P_{ac} (allowable durability h.p.)	141	274

The applied horsepower is 38 for the main hoist and 8 for the aux. hoist. Based on the above the gearing satisfies CMAA 70 criteria.

m. Bridge Parking Brake - CMAA 70 requires the brake to be at least 75% of bridge motor torque, while EOCI-61 only requires 50%. For the Oyster Creek reactor building crane, the bridge motor torque is 45.6 ft.- lbs. To satisfy CMAA 70 the brake should be at least 34 ft- lbs, since this crane has a cab on the trolley. The actual rating is 40 ft.- lbs., therefore CMAA 70 is satisfied.

n. 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 Oyster Creek reactor building crane, the following holding brake characteristics are provided:

(1) This crane uses regenerative type dynamic braking for lowering of the load with the main hoist. Two D.C. rectified magnetic type (spring set and solenoid released) holding brakes are used for the main hoist. These each have a torque rating of 105% of the full load torque of the motor. The aux. hoist uses a similar load brake method, and has two holding brakes of the same type as the main hoist brakes, with a torque rating each of 250% 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 Oyster Creek reactor building crane.

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

Our initial evaluation was based on design information for the reactor building crane which stated that the crane was fitted with G.E. brake Model IC 9528-A102 rated at 550 ft.-lbs., which is 105% of the full load torque of the motor. The existing G.E. motor is a 50 HP, 500 RPM motor producing a full load torque of 525 ft.-lbs.

To meet the intent of NUREG-0612, it was our intention to replace the model IC 9528-A102 brakes with IC 9528-C102 brakes rated at 630 ft.-lbs. This modification would increase braking efficiency to 120% of full load torque of the motor.

However, the hoist holding brake nameplate data revealed that the current brakes are Model IC 9528X (a special brake shoe with a higher coefficient of friction) rated at 735 ft.-lbs. originally produced by Railroad Friction Products. This brake has a minimum torque rating (relative to motor toque) of 140%.

In light of this new information, replacement of the actual brake shoes on the crane (IC 9528X) with IC 9528-C102 would result in reducing the safety factor.

Based on the above, the existing brakes exceed the requirements of CMAA 70, and therefore GPU does not propose to modify the existing brakes.

o. Bridge Bumpers - 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 Oyster Creek reactor 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 ½ of bumper travel;

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

(4) Bumpers providea with safety cable to retain bumper if it comes loose;

(5) Runway stops are provided; and

(6) Runway stops do not contact the wheels.

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

p. 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 travelling 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 Oyster Creek reactor building crane, the trolley bumper design includes the following:

(1) Bumpers will stop the trolley at an average deceleration of less than 1 ft./sec^2 when travelling at 1/3 of rated load speed;

(2) Bumpers have safety cables to prevent falling if bumpers come loose; and

(3) Attaching bolts are not in shear.

Based on the above the trolley bumper design satisfies CMAA 70.

q. 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 Oyster Creek reactor building crane, the bridge truck and the trolley wheels have a clearance of 7/8". The actual maximum wheel loads and the recommended maximum by Table 4.11.3 of CMAA 70 are as follows:

Wheel	Rail Section	Max. Wheel Load	Recommended Max. Load
Trolley	100#	72,000 lbs.	81,600 lbs.
Bridge	135#	89,900 lbs.	86,400 lbs.

The Bridge wheels do not satisfy the CMAA 70 recommendations for the size rail that is used; however, the recommendations in CMAA 70, Table 4.11.3, are only a guide and are not firm specifications. The change required in order to satisfy CMAA 70 would be to replace the bridge rail with a rail that has an effective rail head that is only 0.09 in. wider. This change does not appear warranted, particularly since a failure of one of these wheels would only result in a drop of 5/8 inch.

r. Static Controls - CMAA 70 includes various criteria for crane static controls; EOCI-61 only addresses crane magnetic controls. Since the Oyster Creek reactor building crane uses a magnetic control system, the criteria on static controls are not applicable.

s. 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 Oyster Creek reactor building crane uses Class 160 resistors for control braking.

t. 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 Oyster Creek reactor building crane since this crane has spring-return pushbutton controls.

TABLE 3.f-1

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. Hoist Gear Case Units

   All the gearing and shafts are critical excluding mechanical brake parts.

2. Extra Reduction Gearing

   The gearing and the pinion shaft, also the pinion bearing housing structure and pedestal, including their related welds, are critical.

3. Hoisting Cable

   The hoisting cable is critical.

4. 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.

5. The Block

   The hook, nut, swivel, and sheaves are critical. In the case of a long type block the sheave pin and hanger plates become critical.

6. Sheave Nest

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

7. Trolley Frame

   The separators and connecting angles including their related welds are critical.

TABLE 3.f-1
(CONTINUED)

8. Bridge

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

9. Girder End Connections

The structural girder end connection and welds are critical.

10. Trolley Spacers

The trolley spacers and related welds and connections are critical.

11. Brakes

Hoist motion holding brakes and hoist control brakes are critical.

12. Motor Shafts and Couplings

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

13. Bridge and Trolley Wheels

Bridge and trolley wheels and their axles are critical.

14. Controller

The controller pendant, cabling, resistors used for braking, and hoisting upper limit switches are critical.

Recirculation Pump Monorail; SFP Jib Cranes

Design details are not available for these handling systems. In addition, discussions with representatives of the manufacturers of these handling systems have not provided sufficient information to allow a detailed comparison to appropriate standards. These discussions did reveal, howver, that in general these older handling systems would meet today's specifications in terms of design safety factors. Because of this lack of information, alternative approaches to demonstrating design adequacy will be utilized.

For the recirculation pump monorail, load tests in the drywell region, particularly in proximity to recirculation loop piping, are not advisable. Since this handling system is relatively noncomplex in its structural design, the preferred approach is to perform a stress analysis of the monorail and monorail support systems as well as components of the hoist unit to demonstrate adequate design safety margins for these components. Since sufficient documentation is not available to perform the stress analyses, access to the drywell area by GPU personnel will be required to obtain the necessary dimensional and configuration information that is required. This information will be obtained during the 1983 refueling outage and the stress analyses performed. The results of the stress analyses and our assessment of the design adequacy will be reported to the NRC when completed.

The hoists on the spent fuel pool jib cranes are too complex to perform a reasonable stress analysis in a cost-effective manner. For this reason, the performance of a load test for each of these handling systems using a load that is 125% of the rated capacity of the handling system will be performed as recommended in ANSI B30.11 and ANSI B30.16. This load test in conjunction with the detailed periodic inspection and maintenance procedures that shall be implemented for these handling systems will provide reasonable assurance of continued handling system reliability and the existing of adequate safety margins to failure.

ITEM 3.g.: Exceptions, if any, taken to ANSI B30.2-1976 with respect to operator training, qualification, and conduct.

SUPPLEMENTAL RESPONSE: Operators utilizing the spent fuel pool jib cranes will be required to be familiar with the appropriate handling system operating procedure and to have passed a practical operating examination with the handling system. These requirements will provide reasonable assurance that operators are qualified to operate the equipment and will conduct themselves in a manner that is commensurate with plant and personnel safety.

ATTACHMENT A
REVISIONS TO FIRST SUBMITTAL

As a result of a July 9, 1982 conference call with NRC, TERA, GPU and FRC (WESTEC), changes or additions, beyond the supplemental information contained in the body of this report, were required to certain items in our first report. The required changes are contained in this Attachment. The following is a summary of the changes that have been made.

Response to NRC Related Safe Load Paths (Items 3.a and 3.c)

The responses to Items 3.a and 3.c (pages 10, 11, 14 and 15) of our September 22, 1981 submittal have been revised to eliminate the distinction between Safety Class 3A and 3B loads. A single Safety Class 3 with its corresponding procedural requirements replaces previously proposed 3A and 3B Safety classes. As indicated by the procedural actions required for Safety Class 3 loads on page 10, all loads so designated have specific safe load paths shown on drawings attached to load handling procedures. These load paths are indicated in Figures 1 and 2 of our original submittal. Additionally, a signalman will be used to assure that the load is carried along its designated load path. The signalman will walkdown the load path prior to load movement. Revised Items 3.a and 3.c are attached.

Load Handling Procedures (Item 3.c)

Plant Procedure 205.0, "Reactor Refueling", has been reviewed and meets the guidelines of NUREG-0612, and has been added to the response to Item 3.c.

Plant Procedures 219.1, "NAC-1 Spent Fuel Cask Handling Procedure for Non-Fuel Bearing Components", 219.2, "Handling of the G.E. Series 200 Cask", 219.4, "NAC-1 Spent Fuel Cask Handling Procedure", have been deleted. New guidelines have been established for cask handling operations. Any cask lift requires a new procedure each time with special lifting requirements applicable to that particular cask. These new procedures shall be reviewed by Plant Operations Review Committee, Rad. Waste, QA, and Plant Engineering and shall

conform to NUREG-0612. Attached is a revised response for Item 3.c to replace the response in our September 22, 1981 submittal.

Special Lifting Devices (Item 3.d)

GPU maintains its position as stated on pages 23 and 24 of the September 22, 1981 submittal to the NRC. That position stated that if inspection of a special lifting device does not reveal any damage following a suspected overload of the device, load testing is not required. If there is a suspected overload to a special lifting device, an NDE test shall be performed to validate structural integrity. No change is required to the response to Item 3.d with respect to special lifting devices beyond the supplemental information contained in the body of this report.

Slings (Item 3.d)

GPU Procedures require that slings be in accordance with ANSI B30.9, and that slings be selected based on the maximum static load. Dynamic load may be ignored for the reactor building crane as described in the attached revised response to Item 3.d.

ITEM 3: With respect to the design and operation of heavy load-handling systems in the containment and spent-fuel-pool area and those load-handling systems identified in 1, above, provide your evaluation concerning compliance with the guidelines of NUREG 0612, Section 5.1.1. The following specific information should be included in your reply:

ITEM 3.a Drawings and sketches sufficient to clearly identify the location of safe load paths, spent fuel, and safety-related equipment.

Since there are different safety concerns for each of the heavy loads that must be handled by the Reactor Building Crane and there are a large variety of heavy loads that must be handled, defining safe load paths in the manner described in NUREG 0612, Section 5.1.1(1), is neither required nor prudent for every situation. To do so, such as trying to put markings on the floor for each load, would cause unnecessary confusion. To address this problem, the possible load handling situations that could be encountered have been identified in Table 2 below. Each load handling situation has been assigned a safety class designation, roughly in order of safety significance. As an alternative to the specific requirement in NUREG 0612, Section 5.1.1(1) but to still satisfy the intent of NUREG 0612, safe load path and load handling procedural requirements have been defined for each safety class as shown in Table 2.

TABLE 2

LOAD SAFETY CLASSES AND SAFE LOAD PATH ACTIONS

Heavy Load[1] Handling Situation	Safe Load Path/Procedural Actions Required
Safety Class 1. Load must be carried directly over (i.e., there are no intervening structures such as floors) irradiated fuel, the reactor vessel or safe shutdown equipment.	1. Procedurally limit time and height load is carried over the area of concern; define laydown area; show on drawings included in the procedure the prescribed laydown area. Procedures will be reviewed with crane operators and signalmen prior to lifts over an open reactor vessel.

(Item 3.a - continued)

TABLE 2 (continued)

Heavy Load[1] Handling Situation	Safe Load Path/Procedural Actions Required
Safety Class 2. Load could be carried directly over irradiated fuel, the reactor vessel, or safe shutdown equipment, i.e., load can be handled during the time when spent fuel or the reactor vessel is exposed or safe shutdown equipment is required to be operable and there are no physical means (such as interlocks or mechanical stops) available to restrict load movement over these objects.	2. Procedurally limit time and height load is carried over area of concern; define laydown area; show on drawings attached to procedure the prescribed safe load path and laydown area.
Safety Class 3. Load could be carried over irradiated fuel or safe shutdown equpment, but the fuel or equipment is not directly exposed to the load drop, i.e., intervening structures such as floors provide some protection.	3. Define safe load paths that follow, to the extent practical, structural floor members. Define laydown areas. Limit load travel height to minimum height practical. Load paths and laydown areas shown on drawings attached to procedures.
Safety Class 4. Load cannot be carried over irradiated fuel or over safe shutdown equipment when such equipment is required to be operable, i.e, design or operational limitations prevent movement over fuel or safe shutdown equipment.	4. No safe load path required.

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1 A heavy load is defined as a load that is greater than the weight of a fuel assembly and its associated handling tool.

Each of the heavy loads listed in the response to Item 3.c has been assigned to one or more safety classes (see Table 3). In some cases, more than one safety class assignment is required because more than one of the load handling situations could be encountered when handling the load.

For each of the heavy loads listed in the response to Item 3.c, the safe load path/procedural requirements corresponding to the assigned safety class have been added to the appropriate plant operating or maintenance procedures. When more than one safety class assignment was made for a particular load, the safe load path/procedural requirements of all safety class assignments were included in the procedures. Figures 1 and 2 illustrate the laydown areas and safe load paths developed for these loads. Figures 1 and 2 have also been incorporated into applicable load handling procedures. GPU policy is that crane operators should not be required to locate and follow markings on the floor. That is, it is the crane operator's responsibility to watch the signalman who is responsible for assuring the load is carried along its load path.

The signalman with the job supervisor will walkdown the designated load path prior to a load movement in order to assure that there are no obstructions that could affect the ability of the operator to follow the designated path.

ITEM 3.c.: A tabulation of heavy loads to be handled by each crane which includes the load identification, load weights, its designated lifting device, and verification that the handling of such loads is governed by a written procedure containing, as a minimum, the information identified in NUREG-0612, Section 5.1.1(2).

RESPONSE: The requested information is provided in Table 3. Handling Procedures 205.0, "Reactor Refueling," 701.1.001, "Reactor Vesel Head Remoal and Replacement," 701.1.002, "Reactor Vessel Steam Dryer and Separator Removal and Replacement," 701.1.003, "Reactor Vessel Insulation Removal and Replacement," 704.1.002, "Drywell Head Removal and Replacement," 756.1.002, 'Fuel Transfer Shield Installation and Removal," 756.1.003, "Shield Plugs Removal and Replacement," and 756.1.004, "Fuel Pool Gates Removal and Installation," have been revised so that they now include the following items to satisfy the requirements of Section 5.1.1(2) of NUREG-0612: description of the safety concern in handling heavy loads with the Reactor Building Bridge Crane; defined safe load paths; precautions; prerequisites; identification of proper handling equipment; training and qualification reuqirements for crane operator; verification that required detailed inspections have been performed; sling selection criteria; required crane inspection by operator prior to load handling; supervision of work involving a heavy load lift by a designated job supervisor; and critical steps in order to perform the lift.

TABLE 3

HEAVY LOADS CARRIED BY THE REACTOR BUILDING CRANE

LOAD	SAFETY CLASS	WEIGHT (TONS)	LIFTING PROCEDURE	LIFTING DEVICE
Drywell Head	1/3	62	704.1.002[4]	Head Strongback
Reactor Vessel Head	1/3	92	701.1.001[6]	Head Strongback
Cavity Shield Plugs (8)	3	85 ea.	756.1.003[7]	Cavity Shield Plug Strongback and Head Strongback
Reactor Vessel Head Insulation	3	5	701.1.003[8]	Slings
Steam Dryer	1/3	26	701.1.002[9]	Steam Dryer/ Separator Sling Assembly
Steam Separator	1/3	44	701.1.002[9]	Steam Dryer/ Separator Sling Assembly
Fuel Pool Gates (2)	2	Approx. 1	756.1.004[10]	Slings, Shackles
Spent Fuel Cask	2/3	Note 13	Note 11 and 205.0	Associated Cask Yoke
Fuel Transfer Shield ("Cattle Chute")	2	16.5	756.1.002[12] and 205.0	Slings, Shackles
Equipment Storage Pool Shield Plugs (4)	2/3	37.5 to 39[3]	756.1.003[8]	Equipment Storage Pool Shield Plug Strongback
Dryer/Separator Sling Assembly	2	1.5	701.1.002[9]	Main Hook

TABLE 3 (continued)

LOAD	SAFETY CLASS	WEIGHT (TONS)	LIFTING PROCEDURE	LIFTING DEVICE
Fuel Storage Pool Shield Plugs (4)	2/3	4.5 ea.	756.1.003[8]	Slings, Shackles
Plant Equipment	3	less than 20 tons	Note 14	Slings
New Fuel and Shipping Containers	3	1	Note 14	Slings
Head Strongback	2	3.2	701.1.001, 704.1.002, 756.1.003	Main Hook
Stud Tensioner Assembly	2	10	Note 14	Main Hoist

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1. NUREG 0612 defines a heavy load as one that weighs more than the combined weight of a single spent fuel assembly and its associated handling tool. For reference, the weight of a spent fuel assembly and its handling tool at Oyster Creek is approximately 800 lbs.

2. Safety Class designations are explained in the response to Item 3.a.

3. The top Equipment Storage Pool Shield Plug weighs 39 tons; the remaining three plugs weigh 37.5 tons each.

4. 704.1.002, "Drywell Head Removal and Replacement."

5. 205.0, "Reactor Refueling."

6. 701.1.001, "Reactor Vessel Head Removal and Replacement."

7. 756.1.003, "Shield Plugs Removal and Replacement."

8. 701.1.003, "Reactor Vessel Insulation Removal and Replacement."

9. 701.1.002, "Reactor Vessel Steam Dryer and Separator Removal and Replacement."

TABLE 3 (continued)

10. 756.1.004, "Fuel Pool Gates Removal and Installation."

11. Cask specific procedures developed prior to cask handling operations.

12. 756.1.002, "Fuel Transfer Shield Installation and Removal."

13. NAC-1: 30 Tons

    GE-200: 5 Tons

14. New procedure(s) pertaining to operation of the Reactor Building Bridge Crane.

(Item 3.d - continued)

practical to perform the dimensional examinations for deformation and the nondestructive examinations for defects to determine whether the device is still acceptable for use rather than to subject the device to 150% load testing. If defects or deformation are detected, then the device shall be repaired or modified and then tested to 150% load followed by examination for defects or deformation. This alternative achieves the same objective as Section 5.3.3 of the standard.

C. Slings

To assure that appropriate slings are selected for use in handling miscellaneous loads and that slings are properly maintained, the following changes have been made:

1) Load handling procedures require use of ANSI B30.9 criteria for sling selection and rigging techniques.

2) A new preventive maintenance procedure has been developed for annual inspections of slings;

3) Load handling procedures require a visual inspection of slings for damage prior to making a lift; and

4) A tagging procedure has been devloped for slings to identify: sling rating, application, last examination, and expiration date of examination.

With these changes, the criteria to ANSI B30.9 will be satisfied.

As noted in the response to Item 3.d in the main body of this report, an analysis was performed to determine the dynamic loads that the Oyster Creek reactor building crane could impart on slings. For this crane, the maximum calculated dynamic load would be on the order of 3% of the static load based on the crane characteristics. This 3% increase in loading is insignificant in terms of the margin to breaking strength of 500% that is available when slings are selected in accordance with ANSI B30.9. Based on this, the dynamic loading may be ignored, and with the changes noted above, GPU procedures satisfy NUREG-0612 for sling selection.