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April 7, 1982

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Station Units 1 and 2
Braidwood Station Units 1 & 2
Control of Heavy Loads
NRC Docket Nos. 50-454, 50-455,
50-456, and 50-457

References (a): December 22, 1980, letter from D. G. Eisenhut to All Licensees and Applicants.

(b): February 3, 1981, letter from D. G. Eisenhut to All Licensees and Applicants, Generic Letter 81-07.

(c): December 24, 1981, letter from T. R. Tramm to H. R. Denton.

Dear Mr. Denton:

This is to provide information requested in references (a) and (b) regarding the control of heavy loads at Byron and Braidwood after the operating licenses are issued. Interim actions for control of heavy loads were described in reference (c).

Attachment A to this letter contains the information requested in Sections 2.1, 2.2, 2.3 and 2.4 of Enclosure 3 of reference (a). In accordance with the NUREG-0612 definition of a heavy load, all loads weighing more than one fuel assembly plus its associated handling tool have been evaluated. At Byron and Braidwood this threshold is 2000 pounds.

Procedures regarding inspection, testing, and maintenance of cranes, special load handling, and use of equipment removal paths will be developed prior to to fuel load. These procedures will incorporate ANSI B30.2-1976 requirements. For cranes having limited usage such as the polar cranes, inspections and tests will be performed prior to use rather than at the frequencies required in ANSI B30.2.

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Attachment B to this letter lists the drawings that are enclosed to identify the location of load handling systems and safe load paths.

Please address questions regarding this material to this office.

One signed original and fifteen copies of this letter and the attachments are provided for your use. Seven copies of the drawings listed in Attachment B are provided.

Very truly yours,

T. R. Tramm

T. R. Tramm
Nuclear Licensing Administrator

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Attachments

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ATTACHMENT A

BYRON/BRAIDWOOD STATIONS

RESPONSE TO REQUEST FOR ADDITIONAL

INFORMATION ON CONTROL OF HEAVY LOADS

1.1 SUMMARY OF LOAD HANDLING OPERATIONS AT BYRON/BRAIDWOOD

The guidelines of Section 5.1.1 of NUREG-0612 are generally satisfied at the Byron & Braidwood Stations. No major changes are planned because adequate provisions have been made to assure plant safety. Two points of deviation have been identified. The deviations are:

1) Load paths should be clearly marked on the floor in the area where the load is to be handled.

   Discussion:

   Due to the nature of the load paths, it is not apparent that marking the load paths on the floor is generally feasible or would contribute to reactor safety. Load paths go over grating, vertically up hatchways, over pipes and rotating equipment. Generally, an operator is restricted to the load path shown on the drawings by design and/or interferences if the operator intends to use an overhead handling system. Trolley Beams 53 and 54, for instance, are located over the charging pumps and motors, and Trolley Beam 23 is located over a hatchway that extends past four floors.

   Procedures will be developed to cover load handling operations for the heavy loads identified in Table 3.1-1 of NUREG-0612. These procedures will identify the required equipment, the inspections and acceptance criteria prior to load movements, the steps and sequence in handling the load, the safe load path and other special precautions.

2) The load bearing members of a special lifting device shall be capable of lifting three times the combined weight of the shipping container plus the weight of the intervening components. They shall also be capable of lifting five times that weight without exceeding the ultimate strength of the materials.

   Discussion:

   The special lifting devices (reactor vessel head lift rig and internals lift rig) were designed using AISC allowables and 200% of the rated load. ANSI N-14.6-1978 did not exist at the time these rigs were constructed. The rigs have been load tested to 125% of the rated load.

2.1 GENERAL REQUIREMENTS FOR OVERHEAD HANDLING SYSTEMS

Request 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 a.y system required for plant shutdown or decay heat removal (taking no credit for any interlocks technical specification, operating procedures, or detailed structural analysis).

Response 1:

The cranes, trolley beams and winches planned and under consideration which are capable of a load drop which may damage any safety-related (Class 1, 2 or 3) system or impair its operation are listed by building in Tables A through F.

Request 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 decay heat removal.

Response 2:

Tables A through F list the load handling systems where there is equipment or system components underneath which could be potentially damaged by a load drop from that load handling system. The tables also identify whether or not the equipment or system components listed are required for safe shutdown as identified in the Safe Shutdown Analysis.

Based on horizontal separation, there are no load handling systems which can be excluded from further review. Without taking credit for detailed structural analysis, there are no load handling systems which can be excluded from further review based on vertical separation.

All load handling systems in non-safety-related structures are excluded from the hazard evaluation for one of the following reasons:

a) There is no equipment under the load handling system which is required for operation or shutdown of the plant (e.g., Trolley Beam 48).

b) Non-safety-related equipment or components are located underneath which are required for plant operation but not safe shutdown (e.g., Trolley Beam 49).

Exceptions to the above are noted in Tables D, E, and F.

Certain load handling systems are provided exclusively for the maintenance of the equipment underneath and carry no other loads. Since the equipment underneath must be out of service to perform maintenance, a load drop on or of such equipment would have no effect on safe shutdown as the redundant train will be operable. These load handling systems are: Trolley Beams 53 and 54, PTS-4 and 5, SG-1, SG-2, SG-3 and SG-4.

Trolley Beams 28 and 29 are located over pipes and valves for filters which are used during operation but not required for safe shutdown.

The cable tray drawbridge winch is located over the reactor vessel head cable tray drawbridge. The purpose of this winch is to raise and lower the cable tray drawbridge during refueling outages. It carries no other loads. The winch is permanently installed. All the cables to the reactor vessel head are routed under the winch, into the drawbridge and to the head. Dropping of the cable tray drawbridge will not impact the reactor vessel head and will therefore not affect safe shutdown or cooling of the reactor.

Request 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 2.1-1 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.

Request 3a:

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

Response 3a:

Prints of sheets 1 through 17 of M-27 Equipment Removal drawings are provided herewith. Sheet 9 does not exist. These drawings show the equipment removal paths for all areas of the plant. Although not specifically noted on the drawings, the equipment removal path for the reactor vessel head and internals is vertically up off of the reactor vessel then horizontally to their respective laydown areas which are marked on the drawings and will be specifically covered by procedures to be developed by fuel load.

Prints of M-517 sheets 1 through 11 indicate where the major load handling systems are located. M-913 sheets 23 and 24 are provided to show the location of the RCP seal removal jib cranes.

Request 3b:

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

Response 3b:

Safe load paths have been defined for the movement of the heavy loads identified in Tables A through F, which, if dropped, could impact irradiated fuel or safe shutdown equipment. Deviations from defined load paths will require alternative procedures approved by the plant safety review committee. Load paths are not defined for loads less than 2,000 lbs., however, they typically follow the safest and shortest route with the load as close to the floor as practical.

Procedures will be developed to cover load handling operations for the heavy loads identified in Table 3.1-1 of NUREG-0612. These procedures will identify the required equipment, the inspections and acceptance criteria prior to load movement, the steps and sequence in handling the load and define the safe load path and other special precautions.

Crane operators will be trained, qualified and will conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, "Overhead and Gantry Cranes".

Special attention will be given to procedures, equipment and personnel for the handling of heavy loads over the reactor core.

Approved procedures will be in effect prior to fuel loading.

Request 3c:

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

Response 3c:

A tabulation of the heavy loads, load identification and load weight is provided in Tables A and B.

All loads will be handled under a generic rigging practice procedure which will be developed prior to fuel load. This procedure will prohibit handling of loads over the spent fuel pool or over the open reactor vessel when fuel assemblies are in place except where such action is required to facilitate fuel handling, e.g., the reactor upper internals. Procedures covering designation and inspection of lifting devices will be developed prior to fuel load.

All crane operation within the station is performed by trained Commonwealth Edison personnel. Crane Operation follows the "Commonwealth Edison Work Practice Manual for Generating Stations".

Request 3d:

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

Response 3d:

The lifting devices have been or will be designed in accordance with industrial standards using good engineering practices.

Special lifting devices for the reactor vessel head and upper internals have been provided by Westinghouse. Both lifting rigs have been designed for 200% of the dead load using AISC allowables and load tested to 125% of their rated load.

Request 3e:

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.

Response 3e:

Cranes will be inspected, tested and maintained in accordance with Chapter 2-2 of ANSI B30.2-1976, with the exception that tests and inspections should be performed prior to use where it is not practical to meet the frequencies of ANSI B30.2. For cranes having limited usage, the inspections and tests will be performed prior to their use. Approved procedures will be in effect prior to fuel load.

Request 3f:

Verification that the 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.

Response 3f:

The polar cranes and fuel handling building cranes were designed in accordance with the 1975 Revision of CMAA-70 and the AISC specifications for those portions not covered by CMAA-70. Welding was performed in accordance with AWS D.1.1. Both cranes are designed for Class "A" service per CMAA-70 and have a minimum safety factor of 5 on all lifting tackle and gearing. Seismically, both cranes were designed to survive the OBE and SSE assuming a load of 20% of design rated load located at the quarter points and midpoints of the cranes using 2% and 4% damping. For the OBE, stresses in compression members were limited to 90% of the buckling load. For the SSE, stresses limited to 90% of yield were allowed. In addition, the polar crane was analyzed seismically for a 40 ton load on the auxiliary hook located at each end and the midpoint of the crane.

The polar crane is provided with limit switches for bridge overtravel, plus two upper and one lower limit switch for each hoist. Mechanical end stops are also provided on the bridge.

The Fuel Handling Building Crane is provided with end stops on the runways and bridge, plus upper and lower limit switches on both hoists.

The manipulator crane was designed for Class C service per EOCI-61 and in accordance with the 1970 revision of CMAA-70. The manipulator crane is provided with interlocks to prevent fuel assemblies from colliding with the cavity walls and other objects. Structually, the crane is designed for 4,500 pounds lifted by the main hoist. The main hoist has a 4,000 pound capacity and each of the two ropes supporting the gripper tube is rated for 100% of the lifted load.

The spent fuel pit bridge crane was designed for Class A service, and in accordance with the 1970 Revision of CMAA-70 and AWS D14.1. The spent fuel pit bridge crane is provided with end stops on the trolley beam and runway, plus upper and lower limit switches on each of the two 2 ton capacity hoists. The hoists are interlocked so that they cannot both be operated at the same time.

The spent fuel pit bridge crane was designed using a 4,000 pound lifted load.

Request 3g:

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

Response 3g:

Byron/Braidwood will comply with ANSI B30.2-1976 with respect to operator training, qualification, and conduct.

2.2 SPECIFIC REQUIREMENTS FOR OVERHEAD HANDLING SYSTEMS IN THE VICINITY OF FUEL STORAGE POOLS

Request 1:

Identify by name, type, capacity and equipment designator, any cranes physically capable (i.e., ignoring interlocks, movable mechanical stops or operating procedures) of carrying loads which could, if dropped, land or fall in the spent fuel pool.

Response 1:

The cranes listed in Table B can operate over the spent fuel pit.

The Fuel Handling Building Crane is a top running double girder bridge crane.

The spent fuel pit bridge crane was designed and constructed by Dwight-Foote and purchased through Westinghouse as part of the NSSS contract. It is similar in design to a gantry crane except that it is built in a "T" frame fashion instead of an "A" frame.

The tool inspection winch, when purchased, will only be capable of lifting the fuel handling tools. The winch location has not been determined. The maximum load carried by the winch will be nogreater than 1,500 pounds.

Request 2:

Justify the exclusion of any cranes in this area from the above category by verifying that they are incapable of carrying heavy loads or are permanently prevented from movement of the hook centerline closer than 15 feet to the pool boundary or by providing a suitable analysis demonstrating that for any failure mode, no heavy load can fall into the fuel storage pool.

Response 2:

The tool inspection winch is excluded from further analysis because it will not be capable of carrying heavy loads. A heavy load is defined as any load carried in a given area after a plant becomes operational, that weights more than the combined weight of a single spent fuel assembly and its associated handling tool per Article 1.2 of NUREG-0612. This weight is approximately 2000 lbs.

Request 3:

Identify any cranes listed in 2.2-1 above which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small for all loads to be carried and the basis for this evaluation (i.e., complete compliance with NUREG-0612, Section 5.1.6 or partial compliance supplemented by suitable alternative or additional design features). For each crane so evaluated, provide the load handling system (i.e., the crane-load combination) information specified in Attachment 1.

Response 3:

There are no cranes excluded under this category.

Request 4:

For cranes identified in 2.2-1 above, not categorized according to 2.2-3, demonstrate that the criteria of NUREG-0612, Section 5.1, are satisfied. Compliance with Criterion IV will be demonstrated in response to Section 2.4 of this request. With respect to Criteria I through III, provide a discussion of your determination of compliance. This response should include the following information for each crane.

Request 4a:

Which alternative (e.g., 2, 3, 4) from those identified in NUREG-0612, Section 5.1.2, have been selected?

Alternative 4 applies to the spent fuel pit bridge crane.

Two analyses have been performed for fuel assembly drops. The first analysis is located in FSAR Subsection 9.1.2.3, and discusses effects on criticality of a dropped fuel assembly in the spent fuel pit. The second analysis is located in FSAR section 15.7.4. This analysis discusses the effect of rupturing some or all of the rods in a spent fuel assembly in the refueling cavity or the spent fuel pit floor. The spent fuel storage cells are located on 14 inch rectangular pitch centers. The maximum damage to stored fuel could be caused by dropping a filled failed fuel cannister directly on top of one cell. Dropping of a cannister on any other location would reduce the number of rods which could be damaged. The maximum height from which a fuel assembly may be dropped is approximately 30 inches from the top of the fuel storage cells. Assuming that all the rods in the dropped fuel assembly rupture, the resulting offsite dose remains well within 10CFR 100 limits for thyroid and whole body. FSAR Table 15.0-11 provides the doses for the fuel handling accidents.

NOTE No reliance was placed on any of the considerations in 4b, 4c, or 4d because alternative 4 was chosen. No exceptions are taken to part 4e guidelines.

The fuel handling building crane has been analyzed in FSAR Subsection 15.7.5 for a fuel cask drop which is the heaviest load which will be carried within 14 feet of the spent fuel pool. Alternative 2 applies to the fuel handling building crane.

Request 4b:

If Alternative 2 or 3 is selected discuss the crane motion limitation imposed by the electrical interlocks or mechanical stops and indicate the circumstances, if any, under which these protective devices may be bypassed or removed. Discuss any administrative procedures invoked to ensure proper authorization of bypass or removal and provide any related or proposed technical specification (operational or surveillance) provided to ensure the operability of such interlocks or mechanical stops.

Response 4b:

Additional mechanical stops are provided to prevent motion of the main crane hook north of 17'-6" of column 15 (Byron). These end stops plus the permanent end stops on the runways keep the main crane hook approximately 8'-0" from the spent fuel pit. The additional end stops will be installed whenever the fuel handling building crane will be carrying a heavy load within 25 feet of the spent fuel pit. The installation and removal of these end stops will be controlled administratively. Procedures governing this will be in effect prior to fuel load.

No reliance is placed on the considerations in 4c and 4d and are, therefore, not applicable. Additional analyses for the Fuel Handling Building crane cask load drop are provided in FSAR Section 15.7.5 and are in accordance with the guidelines in 4e.

2.3 SPECIFIC REQUIREMENTS OF OVERHEAD HANDLING SYSTEMS OPERATING IN THE CONTAINMENT

Request 1:

Identify by name, type, capacity and equipment designator any cranes physically capable (i.e., taking no credit for any interlocks or operating procedures) of carrying heavy loads over the reactor vessel.

Response 1:

The polar crane is the only crane capable of carrying heavy loads over the reactor vessel. Refer to Table A for the capacity. The polar crane is a double girder, top running bridge crane.

The manipulator crane is a gantry type crane designed by Stearns-Rogers, and is used solely for fuel transfer operations.

The stud tensioner hoists (three per head) are mounted off the reactor vessel head and are used for removal and installation of the reactor vessel studs. The hoists are 2 ton capacity each.

Request 2:

Justify the exclusion of any crane in this area from the above category by verifying that they are incapable of carrying heavy loads, or are permanently prevented from the movement of any load either directly to the reactor vessel or to such a location where in the event of any load handling system failure the load may land in or on the reactor vessel.

Response 2:

The following systems are excluded from further analysis as discussed below.

The manipulator crane is structurally designed for a maximum load of 4,500 pounds lifted by the main hoist. However, the only load which can be lifted by this hoist is one fuel assembly. An electric monorail auxiliary hoist of 2,000 pound capacity is provided for latching and unlatching the control rods, drive shafts, and RCC transfer operations between fuel assemblies. These loads are all under 1,500 pounds.

The stud tensioner hoists mounted on the reactor vessel head are 2 ton capacity hoists which are provided for installation and removal of the studs from the reactor vessel flange. They also carry the stud tensioners. These hoists are only used at the beginning and end of a refueling outage while the head is still on the reactor vessel, and the reactor is in a cold shutdown condition. An inadvertent drop of the stud and stud tensioner would, therefore, have no effect on safe shutdown or cooling of the reactor.

Request 3:

Identify any cranes listed in 2.3.1 above, which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small for all loads to be carried and the basis for this evaluation (i.e., complete compliance with NUREG-0612, Section 5.1.6 or partial compliance supplemented by suitable alternative or additional design features).

For each crane so evaluated, provide the load handling system (i.e., crane load combination) information specified in Attachment 1.

Response 3:

The design of the polar cranes is provided in Response 2.1.3f. In addition, the bridge girders were designed for a 460 ton lift of the reactor vessel during the construction phase.

For the following reasons, the likelihood of a load drop from the polar crane is extremely remote:

1) A safety factor of 5 was used for the design of the 230/40 ton polar cranes.

2) The box girders were designed for a 460 ton load and the maximum normal load is the 411,750 pound reactor vessel head which is only 44% of the design rating of the girders.

3) The main hook makes a maximum of 2 head lifts per outage. The auxiliary hook makes a maximum of 8 lifts per outage of the reactor coolant pump motors although experience has shown that an average of 2 RCP motors are moved per outage.

4) The cranes were designed in accordance with CMAA-70 and are inspected in accordance with ANSI B30.2-1976 and Section 179 of 29 CFR 1910 prior to use to the beginning of each outage.

5) Crane operators at the Byron/Braidwood Stations will be trained in accordance with a Commonwealth Edison Crane Operator Training Program that is in compliance with ANSI B30.2-1976.

Request 4:

For cranes identified in 2.3.1 above not categorized according to 2.3.3, demonstrate that the evaluation criteria of NUREG-0612, Section 5.1 are satisfied. Compliance with Criterion IV will be demonstrated in your response to Section 2.4 of this request. With respect to Criteria I through III, provide a discussion of your evaluation of crane operation in the containment and your determination of compliance.

Response 4:

With respect to Criterion I, it has shown that the manipulator crane and SG-12 (SG-13) are incapable of dropping heavy loads. The analysis for dropping of a spent fuel assembly is discussed in Response 2.2.4a.

The stud tensioner hoists mounted on the reactor vessel head are permanent features and are, therefore, incapable of dropping anything on the open core since the upper internals are in place when the head is moved.

The only heavy loads carried over the reactor vessel are the reactor head and upper internals. The lower internals and core barrel cannot be removed until the core has been removed. Dropping of the upper internals is considered unlikely for the following reasons:

1) The upper internals plus lifting rig weight is less than 40% of the nominal (230 ton) design rating of the crane.

2) Removal and installation of the internals is strictly controlled by procedure and supervision.

3) The lifting rig is designed for 200% of the lifted load and load tested to 125% of the lifted load.

4) The cranes were designed in accordance with CMAA-70 and are inspected in accordance with ANSI B30.2-1976 and Section 179 of 29 CFR 1910 prior to use to the beginning of each outage.

Procedures will be developed to ensure that the polar crane hooks will not be over the reactor vessel except when removing or installing the head and/or upper internals.

The effect of dropping of a spent or new fuel assembly on the spent fuel racks noted in Criterion II has been analyzed and the results of this analysis is discussed in Response 2.2.4a.

In November, 1976, the NRC completed a review of a reactor vessel head drop analysis performed by Westinghouse for the South Texas Project (Docket No. STN 50-480). The results of this study concluded that a postulated head drop will not result in unacceptable damage to the reactor coolant pressure boundary or to the fuel, or the loss of core cooling capability, although leakage of water from the refueling cavity may result. Furthermore, the results also support the conclusion that a single failure proof reactor vessel head handling system is not required.

This analysis covers projects referencing RESAR-41. The Byron/Braidwood reactor vessel assemblies were originally based on RESAR-3S but were later upgraded to incorporate some of the features of the rapid refueling system described in RESAR-41. As a result, the South Texas integrated head assembly (less upper internals) weighs slightly more than the integrated head assembly provided for Byron and Braidwood. The upper internals assembly for South Texas is similar to the Byron and Braidwood upper internals assembly. The results of a vessel head drop analysis for Byron and Braidwood would therefore be very similar to the South Texas Study. Criterion III is thus satisfied. No reliance was placed on the considerations in 4a or 4b.

2.4 SPECIFIC REQUIREMENTS FOR OVERHEAD HANDLING SYSTEMS OPERATING IN PLANT AREAS CONTAINING EQUIPMENT REQUIRED FOR REACTOR SHUTDOWN, CORE DECAY HEAT REMOVAL OR SPENT FUEL POOL COOLING

Request 1:

Identify any cranes listed in 2.1.1 above, which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small for all loads to be carried and the basis for this evaluation (i.e., complete compliance with NUREG-0612, Section 5.1.6 or partial compliance supplemented by suitable alternative or additional design features). For each crane so evaluated, provide the load handling system (i.e., crane-load combination) information specified in Attachment 1.

Response 1:

The Safe Shutdown Analysis transmitted on November 17, 1981, defines the systems and equipment required for safe shutdown and decay heat removal. Tables A, B, C, D, E, and F list all the load handling systems in the Containment, Fuel Handling Building, Auxiliary Building, Byron River Screen House, Turbine Building and Braidwood Lake Screen House, respectively, which have system components underneath.

The analyses in 2.2 and 2.3 above, show the polar crane, the Spent Fuel Pit Bridge crane and the manipulator crane as having sufficient design features to make the likelihood of a load drop extremely small. The load drop analyses have shown that the consequences of a load drop from any of these cranes will not exceed the limits set by the evaluation criteria I through IV in Section 5.1 of NUREG-0612.

The load handling system for the Spent Fuel Pit Bridge Crane consists of the fuel handling tool, the fuel assembly and crane.

The load handling system for the manipulator crane consists of the crane and fuel assembly and fuel handling tool

The load handling system for the polar crane is the crane load blocks, hook, lifting rig and reactor vessel head or internals.

Request 2:

For any cranes identified in 2.1-1 not designated as single failure proof in 2.4-1 a comprehensive hazard evaluation should be provided which includes the following information:

Request 2a:

The presentation in a matrix format of all heavy loads and potential impact areas where damage might occur to safety related equipment. Heavy loads identification should include designation and weight for cross-reference to information provided in 2.1.3c. Impact areas should be identified by construction zones and elevations or by some other method such that the impact area can be located on the plant general arrangement drawings.

Response 2a:

Tables A through F provide the required matrix data for all load handling systems identified in 2.1.1.

Request 2b:

For each interaction identified, indicate which of the load and impact area combinations can be eliminated because of separation and redundancy of safety-related equipment, mechanical stops and/or electrical interlocks or other site specific considerations. Elimination on the basis of the aforementioned considerations should be supplemented by the following specific information:

Request 2b (1):

For load-target combinations eliminated because of separation and redundance of safety-related equipment, discuss the basis for determining that load drops will not affect continued operation (i.e., the ability of a system to perform its safety related function).

Response 2b (1):

None of the load handling systems listed in Tables A through F may be deleted on the basis of horizontal or vertical separation without a detailed structural analysis.

All the load handling systems designated as "B" in the Hazard Elimination Category (HEC) column may be deleted on the basis of redundancy. The redundant equipment cannot be damaged by a load drop from any of these systems due to separation between the system components.

The jib cranes for the RC loop stop valve operators and RCP seal removal can only impact one division of piping at a time. In addition, the reactor must be shutdown and depressurized before work utilizing these jibs may begin.

No safety-related equipment other than the reactor vessel is located within the refueling cavity. Only the vessel head, upper internals and fuel assemblies are moved over the core. Load drops in the refueling cavity which might damage a primary coolant leg would not disable the core cooling systems as they are located outside the missile wall.

The reactor coolant pump motors and any other load carried by the polar crane must be carried in a clockwise manner (looking down, Byron-1) around the containment. Load carrying past the pressurizer is not possible as this area is blocked off by the containment electrical penetrations, galleries, and VQ penetrations. The worst case load drop for the polar crane would include the auxiliary hook, and either one accumulator or one of two RHR loops plus one of four SI loops plus one CS loop. The RHR loop can be isolated by valves inside the secondary shield wall. Other piping would also be damaged but it would not be required for safe shutdown or long term cooling of the reactor vessel.

Based on the above all load handling systems inside containment are removed from further discussion.

Load handling systems in non-safety-related areas not listed in the attached tables are excluded per the discussion in 2.1.1 as are systems in safety-related structures which do not have system components underneath.

Trolley beam 23 may be excluded from further review because of the design considerations and redundancy of equipment below. The largest load expected is 6 tons which is only 60% of the rated capacity of the trolley beam and hoist. The hoist has safety lugs on the trolley so that an axle failure will not cause loss of the load and hoist. Loads will only be lifted as high as necessary to clear the floor and hatchway on El. 401'-0". A load dropped down the hatchway may be able to impact at El.346'-0", possibly damaging the discharge line of the Unit 1 B train ESW pump. The A train ESW pump would be unaffected by this load drop as it is over 30 feet away from the impact areas.

If installed, Trolley beams 30 and 35 would be excluded similarly to Trolley beam 23.

The Turbine Building Crane is included in this section because of the SX supply and discharge piping in the basemat of the Turbine Building. The heaviest load which the Turbine Building Crane can carry is the turbine LP spindle which weighs 138 tons. The rigging weighs approximately 10 tons in addition to the rotor weight.

At the Braidwood Lake Screen House the SX supply pipes are embedded in the Screen House basemat also. PTS-8, PTS-9 and Trolley beam 42 travel over all six supply pipes. Trolley beam 42 services the non-essential service water pumps and fire pumps. PTS-8 and PTS-9 services the circulating water pumps.

It is considered unlikely the SX piping could be significantly affected for the following reasons:

1) The pipes are embedded in the Turbine Building Basemat which is 6 feet thick, and in the Braidwood Lake Screen House basemat, which is 5 feet thick.

2) There is an intervening floor between the loads to be dropped and the pipes which is designed to carry the weight of the pumps and motors at the Lake Screen House.

3) A circulating water pump motor would hit the pump casing of at least one other pump before impacting the intervening floor.

4) PTS-8 and PTS-9 are designed for a 30 ton load each and the the motor only weighs 75,000 pounds.

5) Only one SX pipe could be affected by a load drop affecting one SX pump slightly at the Lake Screen House.

6) The turbine LP spindle must impact with three intervening floors before hitting the basemat of the Turbine Building and can only damage one SX pipe due to separation of the pipes.

Single Girder Crane SG-11 located in the Byron River House services the SX Makeup Pumps. It may be possible to cause both pumps to be put out of service if the crane operator inadvertently causes damage to the active pump while performing maintenance on the other pump. Although this situation is highly unlikely, an alternative safety-related source of makeup water is available from the onsite wells, which will supply 100% of the makeup requirements.

Request 2b (2):

Where mechanical stops or electrical interlocks are to be provided, present details showing the areas where crane travel will be prohibited. Additionally, provide a discussion concerning the procedures that are to be used for authorizing the bypassing of interlocks or removable stops, for verifying that interlocks are functional prior to crane use and for verifying that interlocks are restored to operability after operations which require bypassing have been completed.

Response 2b (2):

Trolley Beams 10 and 11 are presently designed such that the hoist may impact with several cable pans located at one end of the beam. To correct this, the end stops will be relocated so this cannot occur. The relocated end stops will be considered as permanent features and not removable.

The manipulator crane has been discussed and eliminated per Responses 2.1.3f, 2.3.1, and 2.3.2.

The fuel handling building crane design was discussed in Response 2.1.3f. Procedures governing the carrying of heavy loads and the control of the removable end stops will be developed and in effect prior to fuel load as discussed in Response 2.1.3c.

Request 2b (3):

Where load/target combinations are eliminated on the basis of other site specific considerations (e.g., maintenance sequencing), provide present and/or proposed technical specifications and discuss administrative procedures or physical constraints involved to ensure the continued validity of such considerations.

Response 2b (3):

The following load handling systems fall under the maintenance sequencing category: Trolley beams 53 and 54, PTS-4 and 5 and SG-1, SG-2, SG-3 and SG-4. These systems were discussed in Response 2.1.2.

Patented Track Systems PTS-2, PTS-3, SG-11 and Trolley beams 24 and 25 fall under the site specific categories.

Patented Track Systems PTS-2 and 3 are excluded from further review per the following discussion. Loads will be carried on PTS-2 and 3 under the following circumstances: Removal and reinsertion of the concrete plugs; raising and lowering of a containment spray or RHR motor; carrying any of the loads listed in Table C over the safety injection lines. The remainder of the equipment removal path is either on or very close to the floor. Therefore, a load drop from PTS-2 or 3 can, at most, affect only one RHR or Containment Spray Pump taking no credit for the cover plugs on the floor.

Trolley beams 24 and 25 are excluded from further review because the heat exchanger will only be able to damage itself if it is dropped before it has been removed from the hatchway. Once out of the hatchway, there is no safety related equipment below which can be damaged if the heat exchanger is dropped. The HVAC ducts which are routed under the central portion of the trolley beams are required for operation at all times. Only the hoist itself will be traveling over the ducts. Loads will not be carried over the ducts as there is no clearance for them.

Request 2c:

For interactions not eliminated by the analysis of 2.4.2-b, above, identify any handling systems for specific loads which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small and the basis for this evaluation (i.e., complete compliance with NUREG-0612, Section 5.1.6 or partial compliance supplemented by suitable alternative or additional design features). For each crane so evaluated, provide the load handling system (i.e., crane-load combination) information specified in Attachment 1.

Response 2c:

All load handling systems have been eliminated.

Request 2d:

For interactions not eliminated in 2.4.2b or 2.4.2c above, demonstrate using appropriate analysis that damage would not preclude operation of sufficient equipment to allow the system to perform its safety function following a load drop (NUREG-0612, Section 5.1, Criterion IV). For each analysis so conducted, the following information should be provided:

1) An indication of whether or not for the specific load being investigated, the overhead crane handling system is designed and constructed such that the hoisting system will retain its load in the event of seismic accelerations equivalent to those of a safe shutdown.

2) The basis for any exceptions taken to the analytical guidelines of NUREG-0612, Appendix A.

3) The information requested in Attachment 4.

Response 2d:

There are no overhead handling systems which fall into the category indicated in Request 2d.

BYRON/BRAIDWOOD
CONTROL OF HEAVY LOADS
Table A
Load Handling Systems in Containment

System Designation	System Elevation	System Capacity	H,E,C.	System Design Loads and Weights	System Components Underneath (Required for Safe Shutdown)	Impact Area
Polar Crane	500'-0"	230/40 ton	B,C,E	Reactor Vessel Head - 411,750 lb Reactor Upper Internals-145,000 lb Reactor Lower Internals-269,600 lb Reactor Coolant Pump Motors-77,500 lb Reactor Core Barrel Assembly-217,300lb Main Hook Lower Load Block-6783 lb Auxiliary Hook Lower Load Block - 1770 lb	Accumulators (NO) Reactor Coolant Pumps/Motors (NO) Steam Generators (NO) Reactor Vessel (YES) Reactor Containment Fan Coolers (NO) Pressurizer (NO) Piping for FP, RH, RC, RY, CC, CV, VQ, AF, SX, SD, etc. (YES) Electrical Conduits and Cable Pans for the above systems (YES)	Outside the secondary shield wall on El. 426'-0" for all loads noted except RPV head, Internals, Core Barrel Assembly. The RCP Motor and Pump Components may also be dropped down the vertical lift points noted.
SG-12 (Unit 1) SG-13 (Unit 2)	454'-0" 454'-0" (est.)	1 ton 1 ton	B,C,E B,C,E	Reactor Vessel Head Stud Collars - 20 Reactor Vessel Head Studs - 806 Reactor Vessel Head Stud Hole Plugs - 30 (est.)	Reactor Vessel (YES)	Refueling Cavity - Elevation varies
Manipulator Crane	426'-0"	1 ton	A,B,C,E	Fuel Assembly - 1700 lb	Reactor Vessel (YES)	Refueling Cavity - Elevation varies
Cable Tray Drawbridge Winch	447'-9"	10 ton	C,E	Cable Tray Drawbridge - 9000 lb	Cable Tray Drawbridge (NO) (Contains all cables to Reactor Vessel Head)	Cable Tray Drawbridge El. 426'-0". Winch must come off its mounting first
Reactor Coolant Pump Seal Removal Cranes for Loops 1,2,3,4	402'-0"	1 ton	B,E	Reactor Coolant Pump Seal Housings - 1500 lb Reactor Coolant Pump Couplings-1500lb	Reactor Coolant Pump (NO)	Reactor Coolant Pump Housing and El. 377'-0" directly underneath the pump.
RCP Seal Removal Jib Crane Loop 1	405'-6"	1 ton	B	Reactor Coolant Pump Seal Housing - 1500 lb Reactor Coolant Pump Coupling - 1500 lb	Line 1SI09BA10 (YES)	See M-913-23 El. 401'-0"/377'-0"
RCP Seal Removal Jib Crane Loop 2	405'-0"	1 ton	B	Reactor Coolant Pump Seal Housing - 1500 lb Reactor Coolant Pump Coupling - 1500 lb	Line 1SI09BB10 (YES) Line 1SI05DB6 (YES)	See M-913-23 El. 401'-0"/377'-0"
RCP Seal Removal Jib Crane Loop 3	409'-6"	1 ton	B	Reactor Coolant Pump Seal Housing - 1500 lb Reactor Coolant Pump Coupling - 1500 lb	Valve 1RH8702B (YES) Line 1RH01AB12 (YES) Line 1SI09BC10 (YES)	See M-913-24 El. 401'-0"/377'-0"
RCP Seal Removal Jib Crane Loop 4	405'-6"	1 ton	B	Reactor Coolant Pump Seal Housing - 1500 lb Reactor Coolant Pump Coupling - 1500 lb	Line 1SI09BD10 (YES)	See M-913-24 El. 401'-0"/377'-0"

BYRON/BRAIDWOOD
CONTROL OF HEAVY LOADS
Table A
Load Handling Systems in Containment

System Designation	System Elevation	System Capacity	H.E.C.	System Design Loads and Weights	System Components Underneath (Required for Safe Shutdown)	Impact Area
Stud Tensioner Hoists (3)	416'-10"	2 ton	E	Reactor Vessel Head Stud Tensioner - N/A Reactor Vessel Head Studs - 806 lb	Reactor Vessel Head Flange (YES)	El. 400'-0"
Loop 3 Jib 5	412'-6"	2 ton	B	RC Loop Stop Valve Operator - 2760 lb	Line 1RC04AB12 (YES) Line 1SI04D8 (YES) Line 1RC01AC29 (YES) Valve 1RC8001C (NO)	See M-517-11 El. 401'-0"/377'-0"
Loop 4 Jib 3	410'-7"	2 ton	B	RC Loop Stop Valve Operator -2760 lb	Line 1RC03AD27.5 (YES) Valve 1RC8002D (NO) Line 1RC29AD10 (YES) Valve 1SI8948D (YES) Line 1RH01AA12 (YES) Line 1SIA4B8 (YES) Line 1SI09BD10 (YES) Line 1SI05DD6 (YES)	See M-517-11 El. 401'-0"/377'-0"
Loop 4 Jib 4	410'-7"	2 ton	B	RC Loop Stop Valve Operator -2760 lb	Line 1RH01AA12 (YES) Line 1RC01AD29 (YES) Valve 1RC8001D (NO) Valve 1RH8701B (YES) Line 1SIA4B8 (YES) Valve 1SI8949A (YES)	See M-517-11 El. 401'-0"/377'-0"
Loop 1 Jib 5	410'-7"	2 ton	B	RC Loop Stop Valve Operator -2760 lb	Line 1RC01AA29 (YES) Valve 1RC8001A (NO) Valve 1RH8701B (YES) Line 1RH01AA12 (YES) Line 1SIA4B8 (YES) Valve 1SI8949A (YES)	See M-517-11 El. 401'-0"/377'-0"
Loop 1 Jib 6	410'-7"	2 ton	B	RC Loop Stop Valve Operator-2760 lb	Valve 1RC8002A (YES) Line 1RC03AA27.5 (YES) Line 1RC29AA10 (YES) Valve 1SI8948A (YES) Line 1SI05DA6 (YES) Line 1SI09BA10 (YES)	See M-517'-11" El. 401'-0"/377'-0"
Loop 2 Jib 3	410'-7"	2 ton	B	RC Loop Stop Valve Operator-2760 lb	Line 1SI05DB6 (YES) Line 1RC29AB10 (YES) Valve 1RC8002B (YES) Valve 1SI8948B (YES) Line 1SI09BB10 (YES) Line 1RC03AB27.5 (YES)	See M-517-11 El. 401'-0"/377'-0"

BYRON/BRAIDWOOD
CONTROL OF HEAVY LOADS
Table A
Load Handling Systems in Containment

System Designation	System Elevation	System Capacity	H.E.C.	System Design Loads and Weights	System Components Underneath (Required for Safe Shutdown)		Impact Area
Loop 2 Jib 4	410'-7"	2 ton	B	RC Loop Stop Valve Operator-2760 lb	Line 1RC01AB29	(YES)	See M-517-11 El. 401'-0"/377'-0"
					Line 1SI03DA2	(YES)	
					Valve 1SI8949B	(YES)	
					Valve 1RC8001B	(NO)	
					Line 1RC29AB-10	(YES)	
Loop 3 Jib 6	410'-7"	2 ton	B	RC Loop Stop Valve Operator-2760 lb	Valve 1RH8702B	(YES)	See M-517-11 El. 401'-0"/377'-0"
					Valve 1SI8948C	(YES)	
					Valve 1RC8002C	(NO)	
					Line 1SI05DC6	(YES)	
					Line 1RC29AC10	(YES)	
					Line 1RC03AC27.5	(YES)	

BYRON/BRAIDWOOD
CONTROL OF HEAVY LOADS
Table B

Load Handling Systems in the Fuel Handling Building

System Designation	System Elevation	System Capacity	H.E.C.	System Design Loads and Weights	System Components Underneath (Required for Safe Shutdown)		Impact Area
Fuel Building Crane	434'-8"	125 ton	A,E	Spent Fuel Cask - 218,000 lb(TN-12) Fuel Assembly - 1467 lb (Main Hoist Lower Load Block - 5600 lb) Auxiliary Hoist Lower Load Block - (1500 lb est.) Failed Fuel Cannister - 940 lbs. Control Rod Cluster - 158 lbs.	New Fuel Storage Racks New Fuel Elevator Spent Fuel Storage Racks Fire Protection Lines Spent Fuel Pit Cooling System Failed Fuel Storage Rack Spent Fuel Pit Bridge Crane	(NO) (NO) (NO) (NO) (NO) (NO) (NO)	All areas of the Fuel Handling Building within reach of the crane.
Spent Fuel Pit Bridge Crane	426'-0"	2 ton	E	New Fuel Assembly - 1467 lb Spent Fuel Assembly - 1467 lb Fuel Handling Tools - 375 lb max. Failed Fuel Cannister - 940 lbs. Control Rod Cluster - 158 lbs.	Spent Fuel Racks Failed Fuel Racks New Fuel Elevator Spent Fuel Pit Cooling Systems	(NO) (NO) (NO) (NO)	Spent Fuel Pit and Fuel Transfer Canal El. 385'-0"

BYRON/BRAIDWOOD

CONTROL OF HEAVY LOADS

Table C

Load Handling Systems in the Auxiliary Building

System Designation	System Elevation	System Capacity	H.E.C.	System Design Loads and Weights	System Components Underneath (Required for Safe Shutdown)		Impact Area
Trolley Beam 10	442'-3"	3 ton	A,B	Motor Control Center Components - 1500 lb Electrical Penetration Assembly Components - 2000 lb Pressurizer Heater Transformer Components - 2000 lb (EST.)	Cable Pans	(NO)	El. 401'-0" /426'-0''
Trolley Beam 11	442'-3"	3 ton	A,B	Motor Control Center Components - 1500 lb Electrical Penetration Assembly Components - 2000 lb Pressurizer Heater Transformer Components - 2000 lb (EST.)	Cable Pans	(NO)	El. 401'-0" /426'-0"
Trolley Beam 24	420'-10"	12 ton	E	RHR Heat Exchangers Tube Bundle - 14,500 lbs Concrete Plugs - 15,000 lbs	Hydrogen Recombiner and Piping HVAC Ducts	(NO) (NO)	El. 401'-0"
Trolley Beam 25	420'-10"	12 ton	E	RHR Heat Exchangers Tube Bundle - 14,500 lbs Concrete Plugs - 15,000 lbs	Hydrogen Recombiner and Piping HVAC Ducts	(NO) (NO)	El. 401'-0"
Trolley Beam 28	399'-4"	3 ton	E	---	Instrument Lines	(NO)	El. 383'-0"
Trolley Beam 29	399'-0"	3 ton	E	Valve Operator for 1CV112A - weight N/A	Valve 1CV112A Piping for CV, AB systems	(NO) (NO)	El. 383'-0"
Trolley Beam 53	375'-6"	8 ton	E,B	Charging Pump - 7500 lb Charging Pump Motor - 4345 lb	Charging Pump and Motor	(YES)	El. 364'-0"
Trolley Beam 54	375'-6"	8 ton	E,B	Charging Pump - 7500 lb Charging Pump and Motor - 4345 lb	Charging Pump and Motor	(YES)	El. 364'-0"
SG-1	420'-0"	2 ton	E,B	Diesel Generator Cylinder Head Covers - 830 lb	Diesel Generator	(YES)	El. 401'-0" for loads dropped to either side of the diesel generators
SG-2	420'-0"	2 ton	E,B	Diesel Generator Cylinder Head Covers - 830 lb	Diesel Generator	(YES)	
SG-3	420'-0"	2 ton	E,B	Diesel Generator Cylinder Head Covers - 830 lb	Diesel Generator	(YES)	
SG-4	420'-0"	2 ton	E,B	Diesel Generator Cylinder Head Covers - 830 lb	Diesel Generator	(YES)	

BYRON/BRAIDWOOD
CONTROL OF HEAVY LOADS
Table C

Load Handling Systems in the Auxiliary Building

System Designation	System Elevation	System Capacity	H.E.C.	System Design Loads and Weights	System Components Underneath (Required for Safe Shutdown)		Impact Area
PTS - 2 PTS - 3 (UNIT 2)	375'-4"	6 ton	E,B	Concrete Plugs - 11,700 lb Containment Spray Pump/Motor - 7307 lb RHR Pump/Motor - 6200 lb Charging Pump - 7500 lb Safety Injection Pump - 5260 lb Charging Pump Motor - 4345 lb Safety Injection Pump Motor - 4345 lb	Valves 1SI8811A,B (2SI8811A,B) Line 1SI06BA24 Line 1SI06BB24 Line 1CS02AA10	(NO) (NO) (NO) (NO)	El. 364'-0" See M-517-4
PTS - 4 PTS - 5 (UNIT 2)	375'-6"	6 ton	E,B	Safety Injection Pump - 5260 lb Safety Injection Pump Motor - 3100 lb	Safety Injection Pump Safety Injection Pump Motor	(NO) (NO)	El. 364'-0" See M-517-4
Trolley Beam 23	422'-4"	10 ton	B	Charging Pump - 7500 lb Containment Spray Pump/Motor - 7307 lb RHR Pump/Motor - 6200 lb Safety Injection Pump - 5260 lb Safety Injection Motor - 4345 lb ESW Pump - 9500 lb ESW Motor - 12,000 lb	Line 1SXC6AA24 Line 1SX02AB36	(YES) (YES)	El. 346'-0" See M-517-2 and M-517-5
Trolley Beam 55	483'-7"	8 ton	E,B	Charcoal Filters - 500 lb Fan Motors - 2000 lb Other HVAC Equipment - 12,000 lb	2 Demineralizers under El. 426'-0" for the Recycle Evaporator		See M-517-1 El. 426'-0"

BYRON/BRAIDWOOD
CONTROL OF HEAVY LOADS

Table D

Load Handling Systems in the Byron River Screen House

System Designation	System Elevation	System Capacity	H.E.C.	System Design Loads and Weights	System Components Underneath (Required for Safe Shutdown)	Impact Area
SG-11	740'-6"	12 ton	B	Essential Service Water Makeup Pump - 7000 lb Circulating Water Makeup Pump - Circulating Water Makeup Pump Motor - ESW Makeup Pump Driver - 2250 lb ESW Makeup Pump Gearbox - 2250 lb	Essential Service Water Makeup Pumps and Drivers (NO)	Column-Row B to C / 1 to 7

TABLE E

LOAD HANDLING SYSTEMS IN THE TURBINE BUILDING

System Designation	System Elevation	System Capacity	H.E.C.	System Design Loads and Weights	System Components Underneath (Required for Safe Shutdown)	Impact Area
Turbine Building Cranes Unit 1 (*Unit 2)	506'-6"	125/25 ton 148/25 ton*	B B	Turbine Components: LP Spindles-294,000 lb HP Spindles-131,000 lb HP Cylinder Cover-166,000 lb LP Cylinder Cover-172,300 lb Other Lighter Loads	SX supply and discharge piping (yes)	El 451'-0" or El 369'-0" Any area within crane reach.

TABLE F

LOAD HANDLING SYSTEMS IN THE BRAIDWOOD LAKE SCREEN HOUSE

System Designation	System Elevation	System Capacity	H.E.C.	System Design Loads and Weights	System Components Underneath (Required for Safe Shutdown)	Impact Area
PTS-8 & PTS-9	638'-11"	30 ton	B	Circulating Water Pump Motor 75,000 lb	SX supply pipe (yes)	See M-517-9
Trolley Beam 42	638'-3"	12 ton	B	WS Pump - 41,300 lb WS Motor - 22,500 lb	SX supply pipe (yes)	See M-517-9

CONTROL OF HEAVY LOADS

NOTES

System Designation

1. Trolley Beams are S shape beams designed by Sargent & Lundy.
2. PTS (Patented Track Systems) are monorail systems for electric or manual hoists and designed by others.
3. All jib cranes except the RCP seal removal jibs are designed by others (RCP by S&L). Jib type is noted in the listings.
4. Single Girder Cranes (SG) are all designed by others.
5. All Double Girder Cranes are design by Harnischfeger unless noted as Stock Equipment Company.
6. Winches are wall or column mounted and provided by others.
7. All cranes, trolley beams, PTS and winches in Category 1 structures are seismically supported.

System Elevation

1. System Elevations are given to the nearest inch or approximated if the elevation is not known precisely.

System Capacity

1. The nominal design rating of the load handling system (which may vary depending on the hoisting equipment used) is provided.

Hazard Elimination Category (H.E.C.)

Hazard Elimination Category -
- A- Crane travel for this Area prohibited by electrical interlocks or mechanical stops.
- B- System Redundancy and separation precludes loss of capability of system to perform its safety related function following a load drop in this Area.
- C- Likelihood of handling system failure for this load is extremely small.
- D- Analysis demonstrates that crane failure and load drop will not damage safety related equipment.
- E- Special Station procedures for heavy loads or operation.

System Design Loads

1. The principle loads and their weights used in the system design is noted. Other loads may be carried that are not listed.

Safety Systems Underneath

1. Any Class 1, 2 or 3 System Component (pipe, valve, cable pan, pump, etc.) is referred to regardless of its function.
2. Any load listed under "System Design Loads" may be dropped on any component listed in this column with the exception noted. The reactor vessel head and internals move in either a north or south direction inside the refueling cavity and do not pass over any other piping or equipment except the reactor vessel.

NOTES (cont'd)

Interlocks

1. Standard Interlocks for Trolley Beams: Mechanical End Stops are provided.
2. Standard Interlocks for PTS: Mechanical End Stops are provided.
3. Standard Interlocks for Jib Cranes: Mechanical End Stops on the boom are provided.
4. Standard Interlocks for Single Girder Cranes: Mechanical End Stops on bridge girder and runways are provided.
5. Standard Interlocks for all Double Girder Cranes: Bumpers on Runway/Bridge and Mechanical End Stops on the Runway and Bridge.
6. All electric hoists have upper and lower limit switches which may be geared or block type or both.
7. Manual hoists have no interlocks.
8. Special Interlocks for the Fuel Building Crane are: Electrical Interlocks and Mechanical Stops on the Bridge to prevent travel over the spent fuel pool with a load over 2,000 lbs. plus upper and lower limit switches on both hoists.
9. The manipulator crane is provided with interlocks to prevent a fuel assembly from colliding with the refueling cavity walls or equipment attached to the cavity walls; upper and lower limit switches on the gripper hoist.
10. Stock Equipment Drum Storage Crane is remotely operated.
11. The Turbine Building Crane has trolley chocks and limit switches on the bridge rails plus upper and lower limit switches on the hoists plus a second upper limit switch if the lifting beam is used.
12. The Polar Crane has limit switches for overtravel of the bridge trolley, 2 upper limit switches per hoist and 1 lower limit switch per hoist, and trolley chocks.
13. The stud tensioner hoists have geared upper and lower limit switches and overload limit switch.
14. The Turbine Building Cranes, Fuel Handling Building Cranes and Polar Cranes are top running double girder bridge cranes designed by Harnischfeger.

Impact Area

The area underneath the trolley beam is the impact area and may include more than one elevation. If more than one elevation is given, only the highest and lowest impact elevations are provided. Please refer to the M-517 series drawings for trolley beam and crane location. The M-27 series indicate equipment removal routes.

ATTACHMENT B

List of Drawings Enclosed

I. Byron/Braidwood - Equipment Removal Drawing M-27

Sheet 1,	Rev. B	Main Floor at El. 451'-0"
Sheet 2,	Rev. B	Mezzanine Floor El. 426'-0"
Sheet 3,	Rev. B	Grade Floor at El. 401'-0"
Sheet 4,	Rev. B	Floor Plan at El. 383'-0"
Sheet 5,	Rev. B	Basement Floor at El. 364'-0"
Sheet 6,	Rev. B	Floor Plan at El. 346'-0"
Sheet 7,	Rev. B	Fuel Handling Building
Sheet 8,	Rev. B	Miscellaneous Plans
Sheet 10,	Rev. B	Circulating Water Pump House - Byron
Sheet 11,	Rev. B	Lake Screen House - Braidwood
Sheet 12,	Rev. B	River Screen House - Byron
Sheet 13,	Rev. B	River Screen House - Braidwood
Sheet 14,	Rev. B	Radwaste/Service Building Complex
Sheet 15,	Rev. D	Radwaste/Service Building at El. 397'-0"
Sheet 16,	Rev. D	Radwaste/Service Building at El. 410'-0"
Sheet 17,	Rev. A	Turbine Laydown - Main Floor at El. 451'-0"

II. Byron/Braidwood - Containment Building Jib Crane Drawing M-913

Sheet 23,	Rev. B	Removal of Seals, Loops 1 and 2
Sheet 24,	Rev. B	Removal of Seals, Loops 3 and 4

III. Byron/Braidwood - Crane/Trolly Beam Drawing M-517

Sheet 1,	Rev. E	Mezzanine Floor at El. 426'-0"
Sheet 2,	Rev. G	Grade Floor at El 401'-0"
Sheet 3,	Rev. C	Floor Plan at El. 383'-0"
Sheet 4,	Rev. G	Basement Floor at El. 364'-0"
Sheet 5,	Rev. F	Floor Plan at El. 346'-0"
Sheet 6,	Rev. F	Radwaste/Service Building Complex
Sheet 7,	Rev. B	Circulating Water Pump House - Byron
Sheet 8,	Rev. C	River Screen House - Byron
Sheet 9,	Rev. E	Lake Screen House - Braidwood
Sheet 10,	Rev. D	River Screen House - Braidwood
Sheet 11,	Rev. D	Floor Plan at El. 401'-0"