CP&L

Carolina Power & Light Company

NOV 16 1982

Office of Nuclear Reactor Regulation
ATTN: Mr. D. B. Vassallo, Chief
Operating Reactors Branch No. 2
United States Nuclear Regulatory Commission
Washington, D.C. 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324
LICENSE NOS. DPR-71 AND DPR-62
CONTROL OF HEAVY LOADS

Dear Mr. Vassallo:

By letter dated December 22, 1980, NRC requested that Carolina Power & Light Company (CP&L) provide information regarding control of heavy loads at nuclear power plants. Our June 22, 1981 letter provided the Part I report which addresses the general requirements for overhead-handling systems. The attached information is provided to supplement that response for the Brunswick Steam Electric Plant Unit Nos. 1 and 2.

You will find enclosed a copy of the Part II report for Brunswick Units 1 and 2. The Part II report addresses the specific requirements for overhead-handling systems identified in Sections 2.2 and 2.3 of Enclosure 3 to your December 22, 1980 letter. Also enclosed is Revision 1 to the Part I report which supersedes the Part I report previously submitted by our letter of June 22, 1981.

If you have any questions regarding this information, please contact my staff.

Yours very truly,

S. R. Zimmerman

S. R. Zimmerman
Manager
Licensing & Permits

SRZ/pgp (402C5T1)
Enclosure

A033

cc: Mr. T. Hofkin (Westec Services, Inc.)
Mr. D. O. Myers (NRC-BSEP)
Mr. J. P. O'Reilly (NRC-RII)
Mr. I. H. Sargent (Franklin Research)
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CAROLINA POWER & LIGHT COMPANY

BRUNSWICK STEAM ELECTRIC PLANT UNITS 1 & 2
CONTROL OF HEAVY LOADS

RESPONSE TO REQUEST BY
NRC FOR ADDITIONAL INFORMATION

PART I

Revision 1

PART I

RESPONSE TO REQUEST FOR ADDITIONAL
INFORMATION ON
"CONTROL OF HEAVY LOADS"

The following report constitutes CP&L's response to the NRC regarding their request for additional information on "Control of Heavy Loads". As requested in the December 22, 1980 NRC letter; Part I, answers those questions identified in Section 2.1, "General Requirements for Overhead Handling Systems" of Enclosure 3.

2.1 General Requirements for Overhead Handling Systems

Request 2.1 (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)."

Response to 2.1 (1)

The overhead-handling systems identified during our plant review are listed by building below.

Reactor Building

Cranes

Reactor Building Crane - 125-ton whiting overhead traveling bridge with 5-ton Auxiliary Hook
Refueling Platform - Stearns-Rogers
Refueling Jib Crane 1,000 lbs. @ 15'r

Monorails/Hoists

MR-2	10-ton	Hand-Operated Chain Hoist
MR-4	10-ton	Hand-Operated Chain Hoist
MR-7	10-ton	Monorail
	12-ton	Electric Hoist and Trolley for HPCI Pump and Turbine (Hoist is down-graded to monorail capacity.)
MR-10	5-ton	Hand-Operated Chain Hoist
MR-11	5-ton	Hand-Operated Chain Hoist
MR-12	5-ton	Hand-Operated Chain Hoist
MR-13	5-ton	Hand-Operated Chain Hoist
MR-20	20-ton	Hand-Operated Chain Hoist
MR-21	20-ton	Hand-Operated Chain Hoist

NOTE: The Hand-Operated hoists are removed during plant operation - only installed during required maintenance periods.

Diesel Generator Building

Cranes

5-ton Single Bridge Crane Hand-Operated D/G (1)
5-ton Single Bridge Crane Hand-Operated D/G (2)
5-ton Single Bridge Crane Hand-Operated D/G (3)
5-ton Single Bridge Crane Hand-Operated D/G (4)

Intake Structure

Intake Structure Crane - 30-ton P&H traveling gantry

Request 2.1 (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 2.1 (2)

Reactor Building

Channel-Handling Boom	80-lb. Capacity Hand-Operated Chain Hoist and Trolley

The channel-handling boom has been excluded since it is not capable of handling a heavy load.

Monorails/Hoists

MR-1	2-ton	Hand-Operated Chain Hoist for Vacuum Breakers
MR-3	2-ton	Hand-Operated Chain Hoist for RCIC Pump & Turbine
MR-5	5-ton	Hand-Operated Chain Hoist for CRD Pump A
MR-6	5-ton	Hand-Operated Chain Hoist for CRD Pump B
MR-8	10-ton	Hand-Operated Chain Hoist for Valve Removal
MR-9	10-ton	Electric Motor Hoist & Trolley for Steam & F. W. Valves
MR-14	1.0-ton	Electric Motor Hoist & Trolley for Contaminated Equipment Room
MR-15	2-ton	Hand-Operated Chain Hoist for Gamma Scan Lead Plug
MR-16	5-ton	Electric Motor Hoist & Trolley for Access Covers
MR-17	2-ton	Hand-Operated Chain Hoist for Removable Platform
MR-18	1-ton	Hand-Operated Chain Hoist for Neutron Monitoring Equipment
MR-19	10-ton	Hand-Operated Hoist for Hatch Covers
(3)ST-4 (Unit 2 Only)	2-ton	Hand Operated Chain HOist & Davit for Relief Valves
CRD Rebuild Hoist	1-1/2-ton	Electric Motor Hoist & Trolley

The above hoists are either removed, physically secured during nonuse periods, or do not carry heavy loads.

A physical inspection confirmed that no safe shutdown or decay heat removal components are adjacent to the monorails or davit arm-load paths; therefore, no safe shutdown or decay heat removal component could be damaged by a heavy load drop.

Turbine Building

Cranes

Turbine Building Crane - 188-ton Whiting Overhead Traveling Bridge with 25-ton box Auxiliary Hook
Auxiliary Bay Crane - 100-ton Whiting Semi Gantry with 5-ton Auxiliary Hook

Monorails/Hoists

6-ton Hand-Operated Chain Hoist for Recirculation Pump M. G/ Set "A"
8-ton Hand-Operated Chain Hoist for Recirculation Pump M. G. Set "B"
5-ton Hand Operated Chain Hoist for Condensate Booster Pumps
1-ton Hand-Operated Chain Hoist for Air Compressor

The above cranes and hoists have been excluded from Item 2.1 (1) since no system or component required for plant shutdown or decay removal is located in the Turbine Building.

Diesel Generator Building Cranes

Monorail/Hoist - 5-ton hand-operated chain hoist for switchgear has been excluded since it does not handle heavy loads.

Stackhouse

Filter Monorail Hoist

The five-ton electric hoist used at the stackhouse filter is over 200 feet from any safety-related system or component and, therefore, has been excluded from consideration as a hazard with regard to handling loads near safety-related systems and components.

Intake Structure

Monorails/Hoists

*2-2-ton Monorails for Service Water Strainers & Miscellaneous Equipment Servicing
*2-2-ton Monorails for Miscellaneous Equipment Servicing

*(Hoists removed during plant operations - only installed during required maintenance periods.)

These hoists have been excluded since they do not carry heavy loads.

Radwaste Building

Monorails/Hoists

MR-1	4-ton	Deleted
MR-2	12-ton	Electric Motor Hoist & Trolley for Filter Demineralizer Tank
MR-3	8-ton	Electric Motor Hoist & Trolley for Fuel Pool Filter and Waste Collector Filter
MR-4	12-ton	Electric Motor Hoist & Trolley for Filter Demineralizer Tank
MR-5	8-ton	Electric Motor Hoist & Trolley for Filter Demineralizer Tank
MR-6	1-1/2-ton	Hand-Operated Chain Hoist for Centrifuge
MR-7	2-ton	Hand-Operated Chain Hoist for Centrifuge
MR-8	3/4-ton	Hand-Operated Chain Hoist for HVAC Equipment

The radwaste monorails/hoists are not included in Item 2.1 (1), above, since they are completely separate from the area of safe shutdown or decay heat removal systems and/or components. The separation is established by concrete walls as well as distance.

Shop Cranes and Miscellaneous Hoists

Cranes

5-ton Hot Machine Shop Crane
5-ton Clean Machine Shop Crane

Monorails/Hoists

2-ton Hand-Operated Chain Hoist for Pumps and Valves
1-ton Hand-Operated Chain Hoist for HVAC Equipment
5-ton Hand-Operated Chain Hoist for AOG Equipment

The above cranes and hoists have been excluded from Item 2.1 (1), above, since no system or component required for plant shutdown or decay heat removal is located in the shop or other areas where the hoists are located.

Request: 2.1 (3)

"With respect to the design and operation of heavy load-handling systems in the containment and the spent fuel pool area and those load-bearing 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".

Reponse to 2.1 (3) Summary

Our review of NUREG-0612, Section 5.1.1, indicates that BSEP is substantially in compliance. There are several minor points of exception or deviation. These points are commented on below:

1. Section 5.1.1 (1) of NUREG-0612, Safe Load Paths, requires that load paths should be "clearly marked on the floor in the area where the load is to be handled".

Comment

Safe load paths have been defined on the drawings referenced in Response 2.1 (3)a. Loads are moved by the safest and shortest paths in accordance with the above drawings and written procedures. Due to the number of paths and their configurations, it is felt that marked load paths could possibly cause confusion and therefore not contribute to assuring the safe handling of loads.

2. Section 5.1.1 (4) requires that "special lifting devices should satisfy the guidelines of ANSI N14.6-1978 'Standard for Special Devices for Shipping Containers Weighing 10,000 Pounds (4,500 kg) or More for Nuclear Materials'. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above".

Comment

The lifting devices identified in Table 3-1 are designed in accordance with accepted industry standards and good engineering practices. ANSI N14.6-1978 was not in existence during Brunswick Steam Electric Plant design. Further discussion regarding adequacy of design is located in Response 2.1 (3)d.

3. Section 5.1.1 (5) requires that "lifting devices not specially designed should be installed and used in accordance with the guidelines of ANSI B30.9-1971 'Slings'" and that "in selecting the proper sling the load used should be the sum of the static and maximum dynamic load".

Comment

Non "Special" lifting devices such as slings, shackles and fittings are in compliance to ANSI B30.9-1971 or other applicable standards such as Federal Specification RR-C-271 for shackles; however, components were sized using only static load. Additional comments regarding design adequacy are located in Response 2.1 (3)d.

Request: 2.1 (3)a

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

Response to 2.1 (3)a

The following drawings identify safe load paths for loads identified in Response 2.1 (1) above. A copy of each drawing is attached to this report.

81020-M-001 SH.1, SH.2, & SH.3	Safe Load Paths Reactor Building Elevation 117'-4"
81020-M-002 SH. 1 & SH. 2	Safe Load Paths Diesel Generator Building
81020-M-003	Safe Load Paths Intake Structure

81020-M-004	Safe Load Paths Reactor Building Elevation 50'-0"
81020-M-005	Safe Load Paths Reactor Building Elevation 20'-0"
81020-M-006	Safe Load Paths Reactor Building Elevation 17'-0"

Request: 2.1 (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".

Response to 2.1 (3)b

The safe load paths indicated on the drawings listed in Response 2.1 (3)a above are referenced in various plant operating procedures. These procedures are identified in the tabulation of heavy loads which is Table 3-1. The procedures refer maintenance and operations personnel to the applicable load path drawing. The load paths follow the safest and shortest routes with consideration given to going around fuel and safety-related equipment. In addition, reference to safe load paths is made in Procedure MP-6 "Operation and Inspection of Cranes and Material-Handling Equipment". During crane operator training and requalification, crane operators are instructed regarding these load paths. The work is performed in accordance with the written approved procedures by experienced personnel and supervised by competent foremen. Prior to initiating the work activities in the procedure, the foreman critiques the procedure with his men to assure each one knows the correct methods to be followed. Electrical interlocks, as well as written instructions in the plant procedures, prevent loads from being handled over the spent fuel and reactor except during specific operations.

To summarize, loads are handled along established safe load paths under the control of qualified and experienced personnel in accordance with written and approved procedures.

Request 2.1 (3) c

"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 a load is governed by a written procedure containing as a minimum the information identified in NUREG-0612, Section 5.1.1 (2)."

Response to 2.1 (3) c

Revised Table 3-1 provides a tabulation by crane/load-handling system of the heavy loads normally handled. Included in the table are load weights, designated lifting devices, and reference to procedures which govern the activities being performed. The procedures generally include sections for purpose, responsibility, precautions, special equipment and descriptions, references, and step-by-step instructions. The procedures in use at Brunswick Units 1 and 2 meet the intent of NUREG-0612, Section 5.1.1 (2).

Request: 2.1 (3)d

'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 as supplemented by NUREG-0612, Section 5.1.1 (4) or 5.1.1 (5) are not met, describe any proposed alternatives, and demonstrate their equivalency in terms of load-handling reliability'.

Response to 2.1 (3)d

The "cask redundant lifting yoke" and the work basket redundant lifting rig are of redundant design, and the crane on which they are used is single-failure-proof. Therefore, a load drop with regard to equipment handled by the above systems is not considered credible.

Load-handling devices at BSEP identified in Table 3-1 (other than those discussed above) were designed in accordance with accepted industry standards and good engineering practices.

Our preliminary review indicated that "Special" lifting devices were designed for a minimum safety factor of 3 based on yield strength, considering only static load. Dynamic loading that could be imparted on the handling devices is considered to be negligible. The two (2) cranes which handle the special lifting devices have hook speeds of 3 FPM for Reactor Building Crane and 13 FPM for the Intake Structure Crane. If a dynamic load factor of .5% of static load for each foot per minute of hook speed is considered (per CMAA - Spec. 70) the percentage of static load for dynamic loading is 1.5% for the Reactor Building Crane and 6.5% for the Intake Structure Crane. Design criteria has been confirmed for the special lifting devices and is included below:

Special Lifting Devices

Adapter Link
* Head Strongback
* Dryer Separator Sling
* Stud Tensioner Frame
Spent Fuel Cask Yoke (Redundant)
Shielded Personnel Work Basket Lifting Apparatus (Redundant)
Stud Handling Tool
General Purpose Grapple
* Invessel Service Platform Strongback
Circulating Water Traveling Screen Strongback

The special lifting devices listed above have been designed with a minimum safety factor of 4.5 based on yield strength or 6 based on ultimate strength. A single failure analysis for each of the special lifting devices marked with an asterisk determined that a failure of a single lifting attachment would not result in a load drop. Failure of a single lifting attachment would result in an approximate 35% reduction of the safety factor which CP&L considers to be acceptable. Should a failure occur, the affected equipment would be safely set down and repaired and reinspected prior to continuing the work effort. Table 3-2 provides the results of our analyses regarding safety factors. The other special lifting devices (excluding the ones that are redundant) do not handle heavy loads near irradiated fuel or safe shutdown equipment or do not handle heavy loads. Since the special lifting devices are considered to be adequate, modifications to accommodate increased requirements of current standards are not planned.

"Non-special" lifting apparatus such as slings, shackles, and fittings are sized to maintain a minimum safety factor of 5, based on ultimate strength and considering only static load.

Slings and Standard Lifting Equipment

All slings, shackles, and standard lifting apparatus, such as eye bolts and turnbuckles, conform to the requirements of ANSI B30.9 and/or other federal standards as may be appropriate. A safety factor of 5 is the minimum allowed; and in many circumstances, a greater safety factor is maintained to provide additional safety margins. Section 2.2 of our Part II report identifies these increased factors.

In addition, as a result of our review of load configurations, several rigging arrangements have been modified to provide greater reliability and to allow for the possibility of a single attachment point failure without a resultant load drop.

Lifting devices are inspected and maintained in accordance with the requirements of ANSI B30.9, B30.10, and N14.6. The existing BSEP inspection, testing and maintenance procedures are considered an extremely important segment for assuring safe load-handling operations.

Request: 2.1 (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".

Response to 2.1 (3)e

The crane inspection, testing, and maintenance program at BSEP is in conformance with ANSI B.30.2-1976, Chapter 2-2 and the Occupational Safety and Health Standards, Section 179, 29CFR, Part 1910. Various written procedures are in effect which implement the requirements of the above standard and regulation. These procedures are reviewed during crane operator training to familiarize the operators with these requirements. Maintenance personnel responsible for performing inspection, testing and maintenance are qualified and experienced with regard to the above standards.

Request: 2.1 (3)f

Verify 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.

Response to 2.1 (3)f

All of the cranes and hoists used at the BSEP except the refueling bridge were purchased in accordance with UE&C specifications as discussed below:

1. The Reactor Building crane is of single-failure-proof design. Details of the crane were provided to the NRC by letter on June 18, 1976 and July 26, 1976.

   The Reactor Building overhead cranes were purchased in accordance with United Engineers and Constructors, Inc., Specification No. 9527-01-257-2. The Specification requires that these "cranes shall conform to the latest editions of CMAA, Specification No. 70 for Electric Overhead Traveling Cranes and ANSI B30.2 for Overhead and Gantry Cranes unless otherwise specified or noted".

2. The Intake Structure crane was purchased in accordance with United Engineers and Constructors, Inc., Specification No. 9527-01-257-10. The Specification requires that "cranes furnished under this specification shall conform to the requirements of American National Standard Safety Code for Overhead Gantry Cranes, ANSI B30.2 and the Crane Manufacturers Association of America, Inc., Specifications for Electric Overhead Traveling Cranes, CMAA Specification No. 70".

3. The Refueling Jib Crane was purchased in accordance with United Engineers & Constructors, Inc., Specification No. 9527-01-257-6. The Specification required that the "jib crane shall conform to applicable portions of the following codes" AISC, NFPA, NEMA, ASA-Safety Codes for Cranes, Derricks and Hoists, AWS, SSPC, ASTM, and ASME Boiler and Pressure Vessel Code. Section VIII, Division 1, and that the hoist shall be designed to the requirements of NEMA and NEC as they apply to a hoist. The jib crane and its components were designed to withstand seismic events (while fully loaded) to the extent that a static loading of 1.0g applied in the direction of least resistance to that loading will not cause any part of the unit to be overstressed and also will not result in a loss of control of load.

4. The remainder of cranes and hoists identified in Response 2.1 (1) above except the refueling bridge were purchased in accordance with United Engineers & Constructors, Inc., Specification No. 9527-01-257-5. The Specification requires that the hoists and cranes "shall be furnished and designed in accordance with the Occupational Safety and Health Administration Standard 29CFR which includes ANSI B30.2-1967. Overhead and Gantry Cranes and electrical equipment shall conform with the National Electric Code". Welding procedures and personnel qualification are required to be in conformance with AWS D14.1.

   In addition, the equipment was specified to be designed such that "all equipment shall be secured in such a manner as not to fall during a seismic reaction while in an unloaded condition", and that 90% of the yield stress shall not be exceeded. Seismic coefficients for vertical and horizontal were specified in the equipment list ranging from .24g to .50g.

Request: 2.1 (3)g

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

Response to 2.1 (3)g

All crane operators are trained in accordance with the requirements of ANSI B30.2-1976. No exceptions are taken.

Crane operators are required to receive classroom instruction and gain practical operating experience under the direction of other qualified operators for each crane on which they are to become qualified. In addition to a physical examination by a medical doctor, each operator trainee must pass a written examination. Crane operators are required to requalify annually. The crane operator training program plays an important part in assuring safe handling of loads at BSEP and therefore is carefully administered by the maintenance supervisor or his designee.

CAROLINA POWER & LIGHT COMPANY

BRUNSWICK STEAM ELECTRIC PLANT

UNITS 1 & 2

CONTROL OF HEAVY LOADS

PART II

Response to NRC Request
for Additional Information

PART II

SUMMARY

A thorough review of loads and load configurations has been performed for Brunswick Units 1 and 2 and the results included in this report. It is the opinion of CP&L that BSEP Units 1 and 2 meet the intent of NUREG-0612.

The ultimate safety factor for assuring the safe handling of heavy loads (regardless of additional safety factors that may be imposed on lifting equipment) remains with our efforts to employ competent, careful, and well-trained personnel. The crane operator training program at BSEP has been designed to provide the crane operators and personnel responsible for handling heavy loads with a thorough understanding of proper crane operation and rigging techniques. Additionally, the inspection testing and maintenance of load-handling systems and rigging apparatus combines with the proper training of personnel to assure the continued safe handling of heavy loads.

Although the lifting devices that have been identified do not meet every criteria within NUREG-0612, we believe the intent has been met.

CP&L takes exception to the application of increased standards that have been imposed on special lifting equipment. As discussed previously, the special lifting equipment was designed with minimum safety factors of 4.5 or 6 based on yield or ultimate strength when considering static and dynamic loading. When considering a single failure condition, the minimum safety factor is 2.5 for yield and 3.8 for ultimate. Since we have placed emphasis on inspection of our lifting equipment annually and prior to each use, we feel these reduced safety factors when considering dynamic loading, provide an acceptable margin of safety. For equipment that is handled by standard lifting equipment, safety factors will be increased when it is considered necessary to maintain a greater margin of safety to ensure maximum load-handling reliability as described herein.

SECTION 2.2 "SPECIFIC REQUIREMENTS FOR OVERHEAD HANDLING SYSTEMS OPERATING IN THE REACTOR BUILDING"

NUREG-0612, Section 5.1.4, provides guidelines concerning the design and operation of load-handling systems in the vicinity of spent fuel in the reactor vessel or in storage. Information provided in response to this section should demonstrate that adequate measures have been taken to ensure that, in this area, either the likelihood of a load drop which might damage spent fuel is extremely small or that the estimated consequences of such a drop will not exceed the limits set by the evaluation criteria of NUREG-0612, Section 5.1, Criteria I through III.

Request 2.2 (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 over spent fuel in the storage pool or in the reactor vessel."

Request 2.2 (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 heavy loads over stored fuel or into any location where, following any failure, such load may drop into the reactor vessel or spent fuel storage pool."

Request 2.2 (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., crane load combination) information specified in Attachment 1".

Response to 2.2 (1), (2), and (3)

Crane	Manufacturer	Type	Capacity	Exclusion Basis
Reactor Building Crane	Whiting	Overhead Bridge	125 tons	3,4
Refueling Jib Crane	Yale Eaton	Jib	1,000 lbs. @ 15' R	1
Channel-Handling Boom	N/A	Davit Arm	80 lbs.	1
Refueling Platform	Stearns-Rodgers	Bridge	1,700 lbs.	1
MR-16	N/A	Monorail(E)	10 tons	1,2
MR-17	N/A	Monorail(H.O.)	2 tons	1,2

Exclusion Basis:

1. load-handling system does not carry heavy loads
2. physical separation
3. single failure proof
4. interlocks prevent crane from carrying heavy loads over spent fuel storage pool

(E) electric

(H.O.) hand-operated

Response to 2.2 (1), (2), and (3), Continued

The reactor building crane, identified above as being single failure proof, has been discussed with the NRC previously in the following correspondence:

July 26, 1976 to Mr. Bernard C. Rusche from Mr. J. A. Jones

Subject: Brunswick Steam Electric Plant Units 1 & 2
Dockets 50-324 and 50-325 - Reactor Building

June 18, 1976 to Mr. Bernard C. Rusche from Mr. J. A. Jones

Subject: Brunswick Steam Electric Plant Units 1 & 2
Dockets 50-324 and 50-325 - Reactor Building Crane

Table 3-1, "Tabulation of Heavy Loads" identifies the crane-load combinations and lifting devices associated with the Reactor Building Crane. During investigation of load-handling operations at BSEP Units 1 & 2, several load-handling configurations were noted that required improvement of sling sizing and configuration. The following discussion provides the evaluation for each lifting device and identifies the lifting devices that will be upgraded to provide greater safety factors and/or single attachment point failure protection. Revisions to the lifting devices will be completed as described below:

Adapter Link - When the Reactor Building Crane was upgraded to be a single failure crane it was necessary to design an adapter link to fit between the redundant crane hook and the following special lifting devices: (a) head strongback, (b) moisture separator and steam dryer sling, and (c) in-vessel service platform strongback to accommodate attachment. The adapter link has a minimum safety factor of 6.0 based on yield strength and 10.1 based on ultimate when considering a maximum load of 141,000 lbs. (R.V., head and adapter link) and a 1.5% impact load.

Access Plugs/Shielding - The current lifting apparatus, consisting of 2-8 parts, 7/8" diameter, IWRC wire rope slings, provides a safety factor of 5 and utilizes a generally accepted rigging configuration. However, the method of attachment does not allow for a failure of one lifting attachment; therefore, a four- (4) leg, matched sling assembly consisting of four (4) minimum 2-1/4" diameter, 6 x 37 extra improved plow steel IWRC slings will replace the existing lifting apparatus. This provides a safety factor of 8.7 and allows for the unlikely failure of one (1) attachment point. A single lift point failure will result in a shifting of the load to two (2) points and a reduction of the sling safety factor to 4.3. The new sling assembly should be in service by July, 1983.

Stud Tensioners - The stud tensioners are handled by a structural frame and slings. The frame has a minimum safety factor of 5.3 based on yield and 9.6 based on ultimate and connects to the Reactor Building Crane Sister Hook with 2-3" diameter pins. Each of the four tensioners are connected to the frame with a 1/2" diameter IWRC sling. Considering the 1300 lb tensioner weight when compared to the rated capacity of a 1/2" diameter sling, the safety factor becomes 14.7. The 1/2" diameter sling is currently connected to the tensioner frame and spreader assembly with a 1/2" diameter 316SS bolt at each end. However, to improve the safety factor (SF) and eliminate bolt thread cutting action on the sling the 1/2" diameter 316SS bolts are being replaced with 1/2" diameter "round pin" shackle pins and locking pin. The shackle pins provide a SF of 10.9 based on ultimate strength. (Refer to Table 3-2, page 3 of 3).

Spent Fuel Cask Redundant Yoke - The spent fuel cask redundant yoke complies with the requirements of NUREG-0612, Section 5.1.6, and ANSI N14.6-1978.

Shielded Personnel Work Basket - This lifting apparatus is redundant. Failure of a single load path would result in transfer to the redundant path and not in a load drop.

Head Strongback - The head strongback is utilized to carry the R.V. Head, Drywell Head and the R.V. Insulation. The connection of the strongback to the Reactor Building Crane is accomplished with 2 pins. Connection to the lifted equipment is made with 4 turnbuckle and clevis pin assemblies. Should a failure of a single attachment point occur, the load would be transferred to either the remaining pin or to two (2) turnbuckles and reduce the design safety factor by 50%, which is considered to be adequate. See Table 3.2.

Debris Cask Lifting Apparatus - Currently utilizes a redundant sling arrangement consisting of 4 legs. Each leg is comprised of 3/4" diameter, 6 x 19 IWRC improved plow steel wire rope. In order to provide greater reliability in the event of a single lift point failure, the sling sizing will be upgraded to 1-1/8", which will provide a safety factor greater than 5 for two lift points. This upgrade should be completed by July, 1983.

Head Stud Rack Sling Assembly - Is a four- (4) leg sling assembly with each leg consisting of 3/8" diameter, 6 x 19 IWRC wire rope. The safety factor is greater than 10, and a single attachment point failure will not result in a load drop.

Cattle Chute Lifting Apparatus - Utilizes a four- (4) point lifting arrangement consisting of 4 slings and a spreader frame and four (4) slings suspended from the spreader frame. The sling arrangement consists of 3/4" diameter, 6 x 19 IWRC wire rope. The arrangement provides a safety factor of 7. Failure of a single attachment point would not result in a load drop. The safety factor of 7 would be reduced to 3.5 since the load would be transferred to two (2) points.

Fuel Rack Sling Assembly - Presently utilizes a four-(4) leg matched, ½" diameter, 6 x 19 IWRC wire rope sling assembly which provides a safety factor of 7.6. Failure of one (1) attachment point would result in a load shift to two (2) points and a reduction of the safety factor to 3.8. The load would not drop. However, after July, 1983, this will be handled with special lifting devices (Mfg. by Lambco Supply Corporation) that will provide a safety factor of 10, and will allow for the possibility of a single liftpoint failure.

HEPA Filter Sling Assembly - The current two (2) ½" diameter slings used to make a four point lift will be upgraded to utilize a four- (4) leg sling assembly consisting of 1/2" diameter, 6 x 19 IWRC wire rope which provides a safety factor of 10 and which allows for a single attachment point failure without a load drop. This should be completed by July, 1983.

RPV Service Platform Lifting Sling - Initial design was a three- (3) leg sling assembly consisting of 5/8" diameter, 6 x 19 IWRC wire rope, a turnbuckle on one (1) leg and safety hooks on each leg. The three (3) slings were joined together with an oval ring and was load rated at 7.2 tons with a safety factor of 5. Since the three- (3) leg assembly would not allow for a single lift point failure without a load drop, the following recommendations should be implemented by July, 1983; this will increase the safety factor to 10.

Recommended Arrangement - A three- (3) leg sling assembly similar to the original assembly (see GE Drawing 117C4530, Service Platform Sling) with slings and fittings sized as follows or engineer approved:

Slings - 7/8" diameter, 6 x 25 IWRC extra improved plow steel preformed right regular lay
Safety Hooks - rated at 7.5 tons, with safety latch
Turnbuckle - 1½" diameter x 24" takeup jaw and jaw
Oblong Link - Crosby, Figure A342, 1½" diameter alloy oblong link (39,900 SWL) or equal

The above sling assembly will provide a safety factor of approximately 10. The three (3) lifting lugs are to be upgraded to provide an approximate safety factor of 6, based on yield, or 10 based on ultimate strength.

Moisture Separator and Steam Dryer Sling - Attaches to the RB crane hook with two (2) pins and the separator or dryer at four (4) points. Failure of any one (1) attachment point would not result in a load drop. The sling's heaviest lift is approximately 83% of the 60-ton rated capacity. See Table 3.2.

Invessel Service Platform Strongback - Attached to the RB crane hook with two (2) pins and the in-vessel service platform at four (4) points by means of special bolts. A single failure of one (1) attachment point would not result in a load drop. See Table 3.2.

Spent Fuel Pool Gate Slings - The two (2) 1-1/4", 6 x 37 IWRC slings used to handle the fuel pool gates provide a safety factor greater than 10. See Table 3.2.

Flux Monitor & Shipping Crate Slings - The two (2) 1/2" diameter, 6 x 19 IWRC wire rope slings provide a safety factor greater than 10.

Request 2.2 (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 evaluation of crane operation in the Reactor Building and your determination of compliance. This response should include the following information for each crane:

Response to 2.2 (4)

With exception of the RB crane, which is single failure proof, all other cranes identified in 2.2.1 above have been excluded since they do not carry heavy loads or are physically separated from the area of the spent fuel pool or reactor vessel. Therefore, no reply to this request is required.

SECTION 2.3 "SPECIFIC REQUIREMENTS FOR OVERHEAD HANDLING SYSTEMS OPERATING IN PLANT AREAS CONTAINING EQUIPMENT FOR REACTOR SHUTDOWN, DECAY HEAT REMOVAL, OR SPENT FUEL POOL COOLING."

NUREG-0612, Section 5.1.5, provides guidelines concerning the design and operation of load-handling systems in the vicinity of equipment or components required for safe reactor shutdown and decay heat removal. Information provided in response to this section should be sufficient to demonstrate that adequate measures have been taken to ensure that in these areas either the likelihood of a load drop, which might prevent safe reactor shutdown or prohibit continued decay heat removal, is extremely small or that damage to such equipment from load drops will be limited in order not to result in the loss of these safety-related functions. Cranes which must be evaluated in this section have been previously identified in your response to 2.1-1 and their loads in your response to 2.1-3c.

Request 2.3 (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 to 2.3 (1)

The only single failure proof cranes are the Reactor Building Cranes on Units 1 & 2, which have been previously discussed in our response to Section 2.2.

Request 2.3 (2)

"For any cranes identified in 2.1 (1) not designated as a single failure proof in 2.3 (1), a comprehensive hazard evaluation should be provided which includes the following information."

Request 2.3 (2)a

"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 or cross-reference to information provided in 2.1 (3)c. 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. Figure 1 provides a typical matrix.

Response to 2.3 (2)a

Table 2.3 (2) provides our hazard evaluation for each of the cranes, identified in 2.1 (1), not designated as single failure proof. Equipment weight and other pertinent information regarding crane/load combinations can be found in revised Table 3-1, "Tabulation of Heavy Loads," resubmitted with this report.

Request 2.3 (2)b

"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 consideration should be supplemented by the following specific information." (See Paragraphs 1 through 3; 2.3 (2)b.)

Response to 2.3 (2)b

Load target combinations eliminated because of separation and/or redundancy of safety-related equipment are as follows:

RHR Pumps B & D - The hoist for monorail (MR-2), which services RHR pumps B & D, is not installed during plant operating periods. During maintenance periods when the hoist is required and in the event of a load drop, RHR Pumps A & C provide an alternate source for decay heat removal. The B & D pumps located on elevation -17'-0" are physicallly separated by two (2) 2' thick concrete walls and approximately 75'. There is no hazard below the pumps.

RHR Pumps A & C - Same as RHR Pumps B & D above.

HPCI Pump and Turbine - The hoist for monorail (MR-7), which services the HPCI pump and turbine, is mounted on the elevation above the HPCI

pump and turbine and is separated by concrete floor plugs. The hoist is designed to withstand seismic loads unloaded. Since this hoist is used only to service the pump and turbine during maintenance periods, the reactor system would be depressurized and backup provided by the low pressure injection system. No other safety-related equipment would be affected.

RHR Service Water Booster Pumps A, B, C, & D - Each of the four (4) RHR Service Water Booster Pumps are serviced by a separate monorail and hoist directly over the pump and motor. The hoist is not installed during plant operating periods. Each pump is a minimum of 14'-3" from the next pump and pumps A & C are also separated by a missile shield from pumps B & D. A hand-operated chain hoist is only installed on a monorail when a pump is to be serviced. Use of the monorail does not affect other safety-related equipment.

Recirculating Pump Motor "A" - The hoist for Recirculating Pump "A" is not installed on the monorail during plant operating periods. During recirculating pump maintenance periods, a hand-operated chain hoist is installed. The rigging apparatus used provides a minimum safety factor of 6.2. The recirculating pumps are not required for safe shutdown or decay heat removal.

Recirculating Pump Motor "B" - See Recirculating Pump Motor "A" above.

Service Water Pumps and Motors - The service water pumps and motors have been eliminated because of system redundancy. In the event of a load drop during handling of a nuclear service water pump or adjacent conventional service water pump, it is possible that one or both of the adjacent service water pumps could be damaged. However, should this unlikely event occur, a minimum of two (2) other service water pumps would remain operable to supply service water to equipment required for safe shutdown and decay heat removal.

Although the intake structure crane is not single failure proof, a more than adequate margin of safety exists since each service water pump (heaviest load) is only approximately 1/5 the crane's 30 ton capacity.

Administrative controls prohibit the crane operator from handling the pumps or motors over other equipment required for safe shutdown or decay heat removal. The lifting apparatus has been sized to provide at least a safety factor of 9 for the service water pumps and motors.

Circulating Water Pumps and Motors - The circulating water pumps and motors have been eliminated as a potential hazard since they are not located near any equipment required for safe shutdown or decay heat removal. Although there are no electrical interlocks or mechanical stops to prevent the crane operator from carrying a heavy load over the service water pump structure, administrative procedures do prohibit the operators from doing so. The crane operators, as part of the crane operator training and qualification programs, are instructed about safe load paths.

Circulating Water Traveling Water Screens - The circulating water traveling water screens have been eliminated as a potential hazard since they are not located near any equipment required for safe shutdown or decay heat removal. (See Circulating Water Pump discussion above for additional information.

Service Water Traveling Water Screens - This equipment has been eliminated as a potential hazard since it is not handled near equipment required for safe shutdown or decay heat removal. The screens are not handled over the service water structure building which houses the service water pumps. (See Circulating Water Pump discussion above for additional information.)

Diesel Generators 1 through 4 Components - Each of the four (4) diesel generators are serviced by a separate hand-operated bridge crane. Each crane is physically secured during nonuse periods at the west end of the D/G. The diesel generators are separated from each other by concrete walls. Since the cranes are only used to service a diesel generator that is not in service and the other provides system redundancy, these crane/load combinations have been eliminated as potential hazards.

Request 2.3 (2)c

"For interactions not eliminated by the analysis of 2.3 (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 supplemental by suitable alternative or additional design features). For each so evaluated, provide the load handling system (i.e., crane/load combination) information specified in Attachment 1."

Response to 2.3 (2)c

No cranes or crane/load combinations fit into this category.

Request 2.3 (2)d

"For interactions not eliminated in 2.3 (2)b or 2.3 (2)c 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."

Response to 2.3 (2)d

All interactions have been eliminated in Response to 2.3 (2)b.

TABLE 3-1

TABULATION OF HEAVY LOADS FOR BRUNSWICK STEAM ELECTRIC PLANT

CRANES	LOAD IDENTIFICATION	WEIGHT	LIFTING DEVICE	PROCEDURE
REACTOR BLDG. CRANE				
Whiting - Overhead Bridge	Shielding/Acess Plugs	7-110 Tons	Slings (2 braided 7/8"x8 parts)[1]	MP-3, MP-6
125 Ton Main 5 Ton Aux.	Drywell Head	43 Tons	Head Strongback	MP-8
	Reactor Vessel Head	70 Tons	Head Strongback	FH-3, MP-7
	Steam Dryers	75,000 Lbs.	Dryer & Separator Sling	FH-3, MP-9
	Moisture Separators	102,000 Lbs.	Dryer & Separator Sling	MP-9
	R.P.V. Service Platform	14,000 Lbs.	Service Platform Sling	FH-3, PT 18.2, FH-5
	R.V. Head Insulation	4,000 Lbs.	Head Strongback	MP-7
	Head Strongback	5 Tons	Main Hook - 2 pins	FH-3, MP-7
	Stud Tensioner assy, Frame & (4) Tensioners	1,800 Lbs. 5,200 Lbs.	Tensioner Frame	MP-7, MP-8
	H.E.P.A. Filter	4,000 Lbs.	2 Slings 1/2" dia. 6x19 IWRC	MP-6
	Spent Fuel Pool Gates	4,500 Lbs. ,500	2-1 1/4" dia.x6' 6x37 IWRC Slings	MP-9
	Spent Fuel Shipping Cask	80 Tons	Redundant Lifting Yoke	MP-27, MP-29
	Fuel Racks PWR BWR	8,720 Lbs. 7,200 Lbs.	4 Leg Sling 1/2" dia. 6x19 IWRC	MP-6
	Cattle Chute	12 Tons	4-12'x3/4" dia. Sling)Spreader 4-20'x3/4" dia. Sling)Frame	MP-9
	Shielded Personnel Work Basket	8,500 Lbs.	Redundant Lifting Rig Dryer/Separator Sling & Hook	MP-6
	Replacement Fuel Storage Racks	Later	Later	Later
	R.V. Head Stud	600 Lbs.	Stud Handling Tool	FH-3, MP-7
	Head Nut & Washer Rack	600 Lbs.	Handling Sling - 3,800 Lbs. 4 Leg 1/4" Spreader	FH-3, MP-7

TABLE 3-1

TABULATION OF HEAVY LOADS FOR BRUNSWICK STEAM ELECTRIC PLANT

CRANES	LOAD IDENTIFICATION	WEIGHT	LIFTING DEVICE	PROCEDURE
Reactor Building Crane - Continued				
	Head Stud Rack	3,000 Lbs.	4 Leg Sling 3/8" dia. 6x19 IWRC	FH-3, FH-5, MP-7
	Refueling and Service Tools	.4 Tons	Various	FH-10, FH-11, FH-11A, FH-15
	New Fuel	745 Lbs.	General Purpose Grapple	FH-9
	Debris Cask	11 Tons	Redundant Lifting Apparatus	MP-6
	Invessel Service Platform	85,629 Lbs. (2 PCS)	Strongback	MP-6 & Special Work Procedures
	Flux Monitor & Shipping Crate	5,000 Lbs.	Slings - 2-1/2" dia. 6x19 IWRC	MP-6
REFUELING PLATFORM	Reactor Vessel Servicing & Refueling			PT-18.1, MP-6, FH-11A
Traveling Bridge	BWR Dummy Fuel Assembly	600 Lbs.	Fuel Grapple	FH-4
Trolley & Aux. Hoist On Separate Monorail	BWR New Fuel Assembly	745 Lbs.	Fuel Grapple	FH-5, FH-9, FH-10, FH-11
	BWR Spent Fuel Assembly	745 Lbs.	Fuel Grapple	FH-5, FH-11, FH-15
	Refueling & Service Tools	.4 Ton	Various	FH-10, FH-11, FH-11A, FH-15
	PWR Fuel	1,439 Lbs.	Fuel Grapple	FH-13
REFUELING JIB CRANE Capacity 1,000 Lbs. @ 15'R	Refueling Tools			
Electric Hoist with Motorized Trolley & Boom	Reactor Components	.5 Ton	Various	MP-6, FH-4, FH-5
REACTOR BUILDING HOISTS		Heaviest Load		
MR-2 Chain Hoist[2]	RHR Pumps B & D	8,400 Lbs.	Slings 2 Leg 5/8" dia. 6x19 IWRC	MP-6
MR-4 Chain Hoist[2]	RHR Pumps A & C	8,400 Lbs.	Slings 2 Leg 5/8" dia. 6x19 IWRC	MP-6

TABLE 3-1

TABULATION OF HEAVY LOADS FOR BRUNSWICK STEAM ELECTRIC PLANT

CRANES	LOAD IDENTIFICATION	WEIGHT	LIFTING DEVICE	PROCEDURE
Reactor Building Hoists Continued				
MR-7 Elect. Motor Hoist & Trolley	HPCI Pump & Turbine	8,400 Lbs.	Slings 2 Leg 5/8" dia. 6x19 IWRC	MP-6
MR-10 Chain Hoist[2]	RHR Serv. Water Booster PumpA	6,465 Lbs.	Slings 2 Leg 3/4" dia. 6x19 IWRC	MP-6
MR-11 Chain Hoist[2]	RHR Serv. Water Booster PumpB	6,465 Lbs.	Slings 2 Leg 3/4" dia. 6x19 IWRC	MP-6
MR-12 Chain Hoist[2]	RHR Service Water & Booster Pump C	6,465 Lbs.	Slings 2 Leg 3/4" dia. 6x19 IWRC	MP-6
MR-13 Chain Hoist[2]	RHR Service Water & Booster Pump D	6,465 Lbs.	Slings 2 Leg 3/4" dia. 6x19 IWRC	MP-6
MR-20 Chain Hoist[2]	Recirc. Pump Motor A	34,000 Lbs.	Slings 2 or 3 Leg 1 1/4" dia. 6x37 IWRC	MP-6
MR-21 Chain Hoist[2]	Recirc. Pump Motor B	34,000 Lbs.	Slings 2 or 3 Leg 1 1/4" dia. 6x37 IWRC	MP-6
INTAKE STRUCTURE CRANE				
P & H Traveling Gantry	Service Water Motors	3,600 Lbs.	Sling 2 Leg 1/2" dia. 6x19 IWRC	MP-6
30 Ton Capacity	Circ. Water Pumps	56,000 Lbs.	Sling 2 Leg 1 1/2" dia. 6x37 IWRC OR	MP-6
		34,000 Lbs.	Sling 3 Leg 1 3/8" dia. 6x37 IWRC OR	
	Circ. Water Motors	45,000 Lbs.	Sling 4 Leg 1 1/8" dia. 6x37 IWRC	MP-6
	Traveling Screens			
	Circ. Water	54,000 Lbs.	Strongback (28 tons)	MP-6
	Service Water	21,100 Lbs.	Slings 2 Leg 1" dia. 6x19 IWRC or 4 Leg 3/4" dia. 6x19 IWRC	MP-6

TABLE 3-1

TABULATION OF HEAVY LOADS FOR BRUNSWICK STEAM ELECTRIC PLANT

CRANES	LOAD IDENTIFICATION	WEIGHT	LIFTING DEVICE	PROCEDURE
Intake Structure Crane Continued				
	Service Water Pumps	6,284 Lbs.	Sling 2 Leg 5/8 dia. 6x19 IWRC	MP-6
DIESEL BUILDING CRANES				
Single Bridge[3]	D/G 1 Components	3,300 Lbs.	Sling 1/2" dia. 6x19 IWRC	MP-6
Hand Operated[3]	D/G 2 Components	3,300 Lbs.	Sling 1/2" dia. 6x19 IWRC	MP-6
Chain Hoist & Trolley[3]	D/G 3 Components	3,300 Lbs.	Sling 1/2" dia. 6x19 IWRC	MP-6
[3]	D/G 4 Components	3,300 Lbs.	Sling 1/2" dia. 6x19 IWRC	MP-6

Notes:

1. Access Plug/Shielding- The current use of 2-8 part braided slings consisting of 7/8" dia. IWRC wire rope provides a safety factor of 5; however the method of connection does not allow for a failure of one lifting attachment. A four (4) leg matched sling assembly has been recommended consisting of 2" dia. 6x37 improved plow steel IWRC slings. This will provide a safety factor of 5.0 and allow for a failure of one (1) attachment point without resulting in a load drop. Failure of a single attachment point will result in shifting the load to two (2) point and a reduction of the safety factor to 2.5.
2. Hoist removed during plant operation - only installed during required maintenance periods.
3. Hoists are physically secured during nonuse periods.
4. Sling sizes given are considered minimum to be used for given configuration, i.e., vertical or basket hitch. Site personnel are permitted to use larger size slings or can vary rigging configuration.

TABLE 3-1

TABULATION OF HEAVY LOADS
FOR
BRUNSWICK STEAM ELECTRIC PLANT

CRANES	LOAD IDENTIFICATION	WEIGHT	LIFTING DEVICE	PROCEDURE
	5. Sling capacities are based on ANSI B30.9 tables; however, recommended capacities from sling/wire rope mfg. may be used provided a minimum safety factor of 5 is maintained. 6. All slings used are of IWRC improved plow steel construction or equal. 7. Unless specifically noted all slings have swagged fittings.			

TABLE 3-2 SAFETY FACTORS FOR LIFTING DEVICES USED
FOR HEAVY LOADS LIFTED BY REACTOR BUILDING MAIN CRANE

Load Identification and Weight (kips)	Lifting Device	Critical[2] Components Considered	Critical Stress Type	Computed Safety Factor[1]				Remarks
				Normal Operating Condition		Single Failure Condition		
				SF_y	SF_u	SF_y	SF_u	
Head strongback wt = 10.0	Main hook	Hook Pin	Bending	103.5	200.0	37.7	72.1	(3)
Reactor vessel head wt = 140.0	Head strongback	Turnbuckle Main beam Hook pin	Tension Bending Bending	--- 7.2 6.9	9.3 14.7 13.2	--- 4.7 2.5	5.9 9.5 4.8	(3)
Drywell head wt = 85.0	Head strongback	Turnbuckle Main beam Hook pin	Tension Bending Bending	--- 11.4 10.9	15.4 23.2 20.9	--- 7.5 4.0	9.7 15.2 7.6	(3)
Spent fuel pool gate wt = 4.5	2-1¼" x 6' 6 x 37 IWRC slings	Lifting lug Fillet weld Sling	Shear Shear Tension	13.8 11.1 ---	34.4 18.5 33.4	> 7.0 7.0 ---	>11.7 11.7 14.1	(3)

NOTES:
1. Safety Factor SF_y (or SF_u) is defined as the ratio of the capacity of the components at yield strength (or ultimate strength) over the load applied to the components.
2. Components of the lifting device not considered are less critical.
3. Loadings considered in the computation include weights of load to be lifted and lifting device used plus their dynamic effect.

TABLE 3-2 SAFETY FACTORS FOR LIFTING DEVICES USED
FOR HEAVY LOADS LIFTED BY REACTOR BUILDING MAIN CRANE (continued)

Load Identification and Weight (kips)	Lifting Device	Critical[2] Components Considered	Critical Stress Type	Computed Safety Factor[1]				Remarks
				Normal Operating Condition		Single Failure Condition		
				SF_y	SF_u	SF_y	SF_u	
Moisture separator wt = 102.0	Dryer & separator sling	Hook Box Socket pin Sling	Shear Bending Tension	6.7 4.5 ---	10.9 10.1 6.0	--- 2.9 ---	--- 6.4 3.8	(3)
Steam dryer wt = 75.0	Dryer & separator sling	Socket pin Sling	Bending Tension	6.1 ---	13.8 8.0	3.9 ---	8.7 5.0	(3)
In-vessel service platform wt = 85.63 (2 parts)	Platform lifting tool	Stud Main beam 3/4" hook plate Hook pin	Tension Bending Shear Bending	11.7 5.4 15.6 34.7	18.9 8.8 25.2 57.6	7.4 3.5 --- ---	11.9 5.6 --- ---	(3)

NOTES:
1. Safety Factor SF_y (or SF_u) is defined as the ratio of the capacity of the components at yield strength (or ultimate strength) over the load applied to the components.
2. Components of the lifting device not considered are less critical.
3. Loadings considered in the computation include weights of load to be lifted and lifting device used plus their dynamic effect.

TABLE 3-2 SAFETY FACTORS FOR LIFTING DEVICES USED
FOR HEAVY LOADS LIFTED BY REACTOR BUILDING MAIN CRANE (continued)

Load Identification and Weight (kips)	Lifting Device	Critical[2] Components Considered	Critical Stress Type	Computed Safety Factor[1]				Remarks
				Normal Operating Condition		Single Failure Condition		
				SF_y	SF_u	SF_y	SF_u	
Stud tensioner wt = 5200 lb	Stud tensioner handling frame	1/2" wire rope	Tension	---	14.7	---	10.7	
		3"x4" plate	Shear	9.9	18.1	---	---	(3)
		Main beam	Bending	5.3	9.6	4.1	7.3	
		Hook pin	Bending	14.5	39.7	---	---	
		3/8" dia. wire rope assembly (Incl. hook, stud, & rope)	Tension	---	16.9	---	---	
		Eyebolts (2)	Tension	---	20.0 ea. bolt	---	---	
		1/2" Round Pin	Bending	---	10.9	---	---	

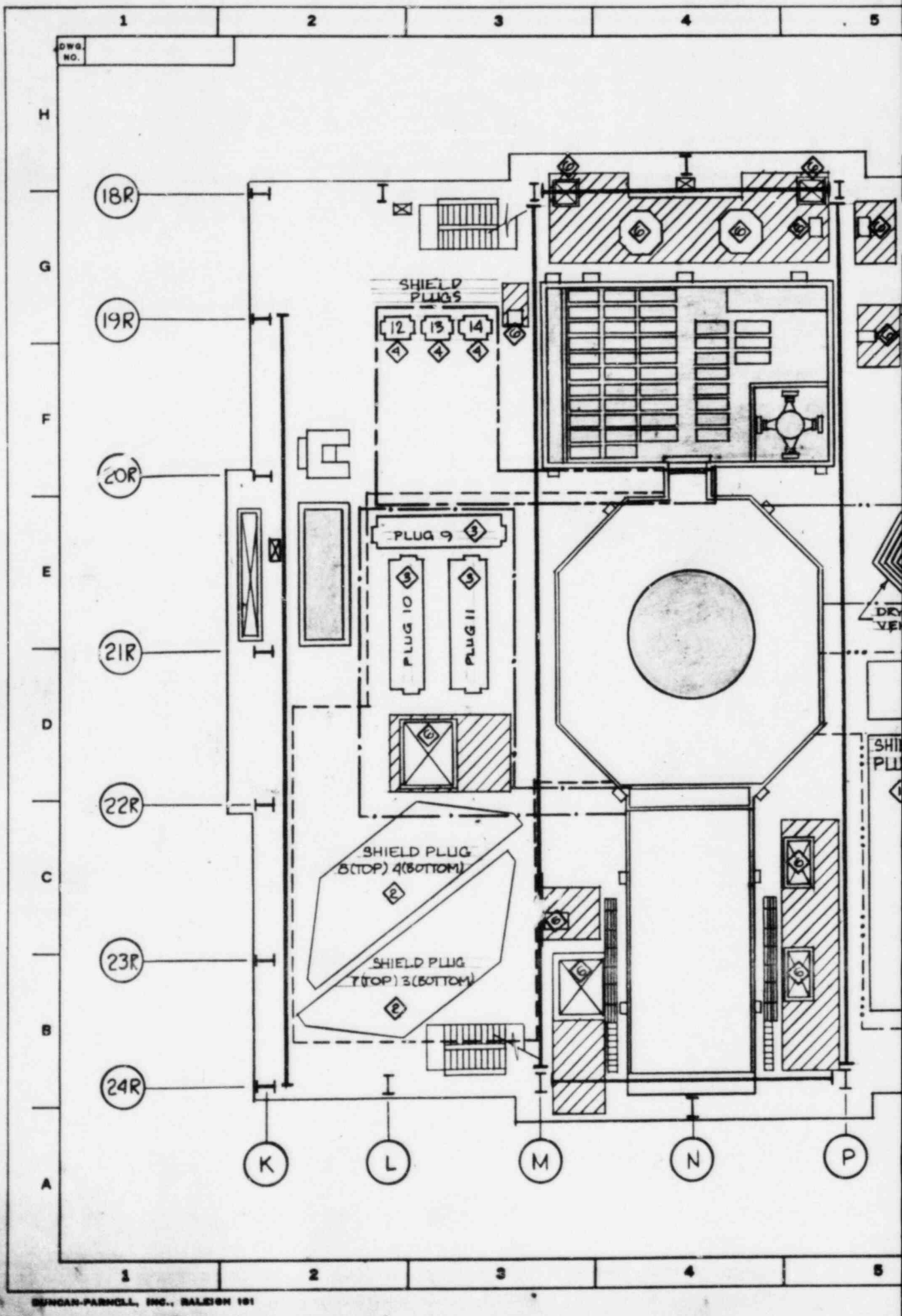
NOTES:
1. Safety Factor SF_y (or SF_u) is defined as the ratio of the capacity of the components at yield strength (or ultimate strength) over the load applied to the components.
2. Components of the lifting device not considered are less critical.
3. Loadings considered in the computation include weights of load to be lifted and lifting device used plus their dynamic effect.

TABLE 2.3-2
CONTROL OF HEAVY LOADS
HAZARD EVALUATION
CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT UNITS 1&2

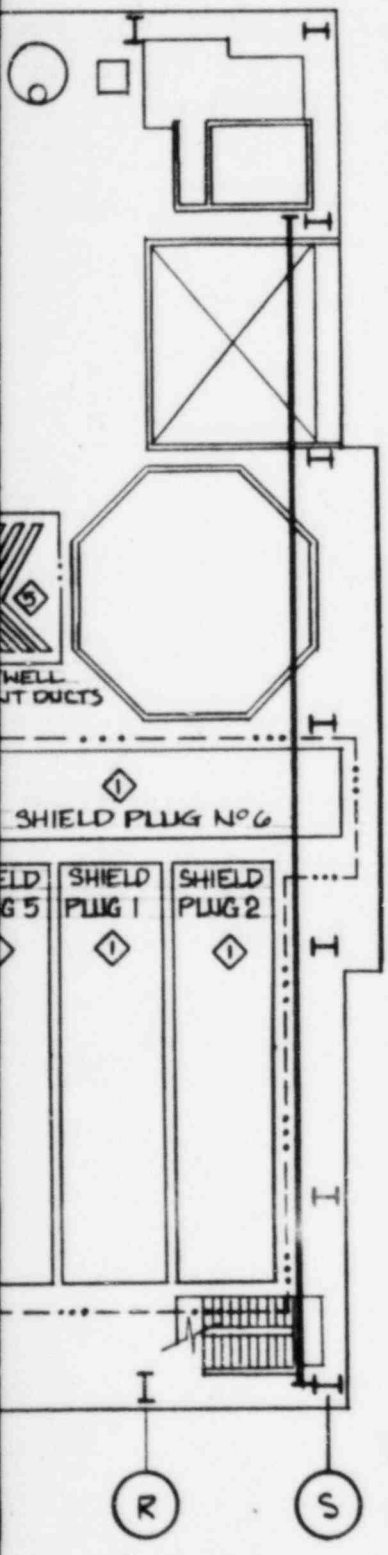
CRANE	LOCATION	ELEVATION	LOAD	HAZARD AREA	SAFETY RELATED EQUIPMENT	HAZARD ELIMINATION CATEGORY
MR-2	Cols. S-T 6R-7R	-17'0"	RHR Pumps B&D	Elev. 17'-0" Col. S-T 6R-7R	RHR Pumps	B
MR-4	Cols. S-T 3R-4R	-17'0"	RHR Pumps A&C	Elev. -17'0"	RHR Pumps	B
MR-7	Cols. S-T 4R-6R	-17'0"	HPCI Pump & Turbine	Elev. -17'0" Elev. 20' Cols. S-T 4R-6R	HPCI Pump & Turbine Motor Control Center No. 1 X C 480V AC	C, B
MR-10	Cols. P-S 4R-5R	50'0"	RHR Service Water Booster Pump A	Elev. 50'0" Cols. 4R-5R P-S	RHR Service Water Booster Pump A	B
MR-11	Cols. P-S 5R	50'0"	RHR Service Water Booster Pump B	Elev. 50'0" Cols. P-S, 5R	RHR Service Water Booster Pump B	B
MR-12	Cols. P-S 6R	50'0"	RHR Service Water Booster Pump C	Elev. 50'0" Cols. P-S, 6R	RHR Service Water Booster Pump C	B
MR-13	Cols. N-P 6R-7R	50'0"	RHR Service Water Booster Pump D	Elev. 50'0" Cols. P-S, 6R-7R	RHR Service Water Booster Pump D	B
MR-20	Cols. N-P 4R-6R	-17'0"	Recirc. Pump Motor A	Elev. -17'0"	Recirc. Pump A	B
MR-21	Cols. M-N 5R-6R	-17'0"	Recirc. Pump Motor B	Elev. -17'0"	Recirc. Pump B	B

TABLE 2.3-2
CONTROL OF HEAVY LOADS
HAZARD EVALUATION
CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT UNITS 1&2

CRANE	LOCATION	ELEVATION	LOAD	HAZARD AREA	SAFETY RELATED EQUIPMENT	HAZARD ELIMINATION CATEGORY
Intake Structure Crane	Service Water Intake Structure	20'0"	Service Water Pumps & Motors	Elev. 20 Service Water Structure	Service Water Pumps & Motors & Related Equipment	B
	Circ. Water Structure	6'7"	Circ. Water Pumps & Motors	N/A	None	C
	Circ. Water Structure	20'	C. W. Traveling Water Screens	N/A	None	C
	Service Water Structure	20'	S. W. Traveling Water Screens	N/A	None	C
Diesel Generator Building Cranes D/g CR. #1	D/g Bldg.	23'0"	Misc. D/g #1 Components	Elev. 23'0" Cols. 9D-10D V-X	D/g #1 & Excitation Cubical Gen. Control Panel MCC Cabinets	B
D/g CR. #2	D/g Bldg.	23'0"	Misc. D/g #2 Components	Elev. 23'0" Cols. 10D-11D V-X	D/g #2 & Excitation Cubical Gen. Control Panel MCC Cabinets	B
D/g CR. #3	D/g Bldg.	23'0"	Misc. D/g #2 Components	Elev. 23'0" Cols. 11D-12D V-X	D/g #3 & Excitation Cubical Gen. Control Panel MCC MCC Cabinets	B
D/g CR. #4	D/g Bldg.	23'0"	Misc. D/g #2 Components	Elev. 23'0" Cols. 12D-13D V-X	D/g #4 & Excitation Cubical Gen. Control Panel MCC Cabinets	B



REVISIONS					
REV NO.	DESCRIPTION	BY	CHK	APPROVAL BY	APPROVAL DATE
B	REDUCED SIZE OF REPRODUCIBLE AND INCREASED CLARITY OF DWG.	GEM	[illegible]	[illegible]	5 22 81



SAFE LOAD PATHS

N°	SYMBOL	LOAD
1	— — — • • • — — —	SHIELD PLUGS 1, 2, 5, & 6
2	— — — — — — — — —	SHIELD PLUGS 3, 7, 8, & 4
3	——— • ——— • ———	SHIELD PLUGS 9, 10, & 11
4	——— — ——— — —	SHIELD PLUGS 12, 13, & 14
5	——— •• ——— •• ———	DRYWELL VENT DUCTS
6	▨	VALVE & COVERED ACCESSES

NOTES:

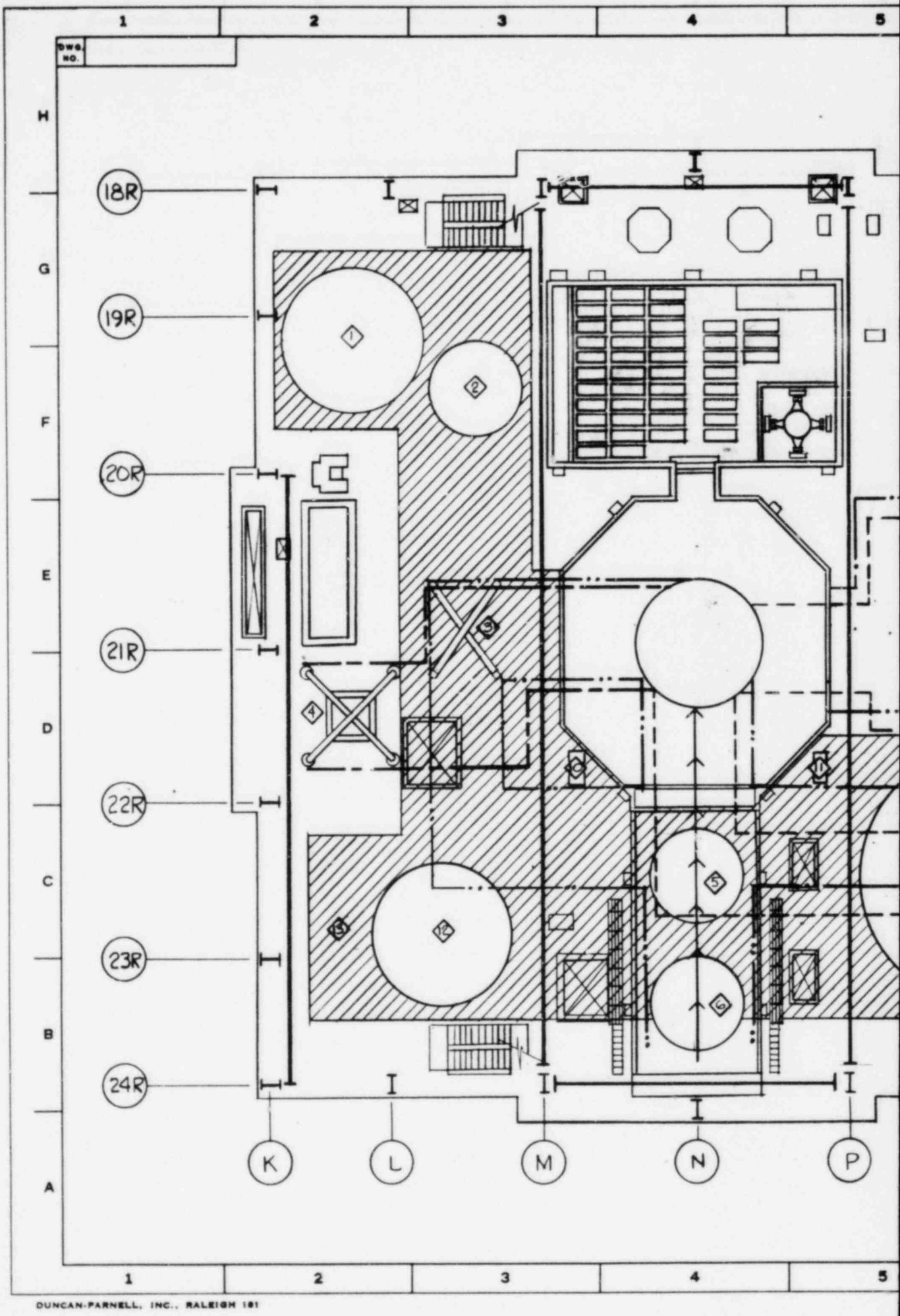
1. FUEL LOCATED IN SHADED AREAS
2. LOAD PATHS APPLICABLE TO UNITS 1 & 2
3. HOISTS MUST BE REMOVED OR PROPERLY SECURED WHEN NOT IN USE

CAROLINA POWER & LIGHT COMPANY
NUCLEAR PLANT ENGINEERING DEPARTMENT - RALEIGH, N. C.

PLANT: BRUNSWICK STEAM ELECTRIC PLANT

TITLE: CONTROL OF HEAVY LOADS
SAFE LOAD PATHS
REACTOR BUILDING ELEV. 117' - 0"

DRAWN BY	CHECK BY	A'SN'D. ENGR.	APPROVED BY	APPR. DATE	SCALE	SHEET	OF
GEM	[illegible]	[illegible]	[illegible]	5-14-81	DWG. NO. 81020-M-001		REV B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DWG. NO.
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22R
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24R
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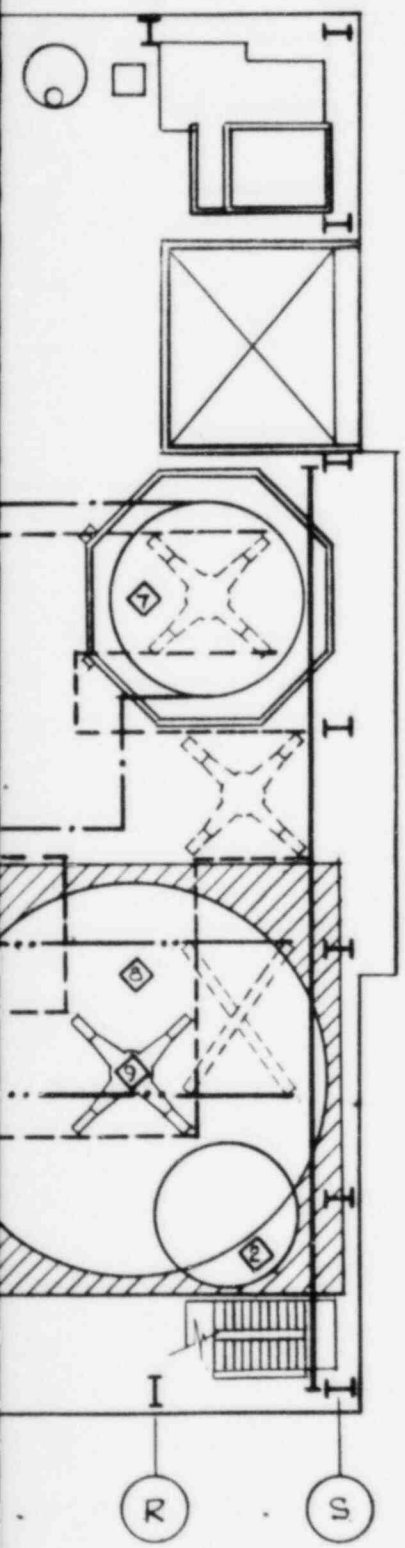
REVISIONS					
REV NO.	DESCRIPTION	BY	CHK	APPROVAL BY	APPROVAL DATE
B	REDUCED SIZE OF REPRODUCIBLE AND INCREASED CLARITY OF DWG.	GEM			5 22 84



NOTES

1. SHADED AREA SHOWS FUEL LOCATIONS
2. LOAD PATHS APPLICABLE TO UNITS 1 & 2
3. HOISTS MUST BE REMOVED OR PROPERLY SECURED WHEN NOT IN USE.

SAFE LOAD PATHS

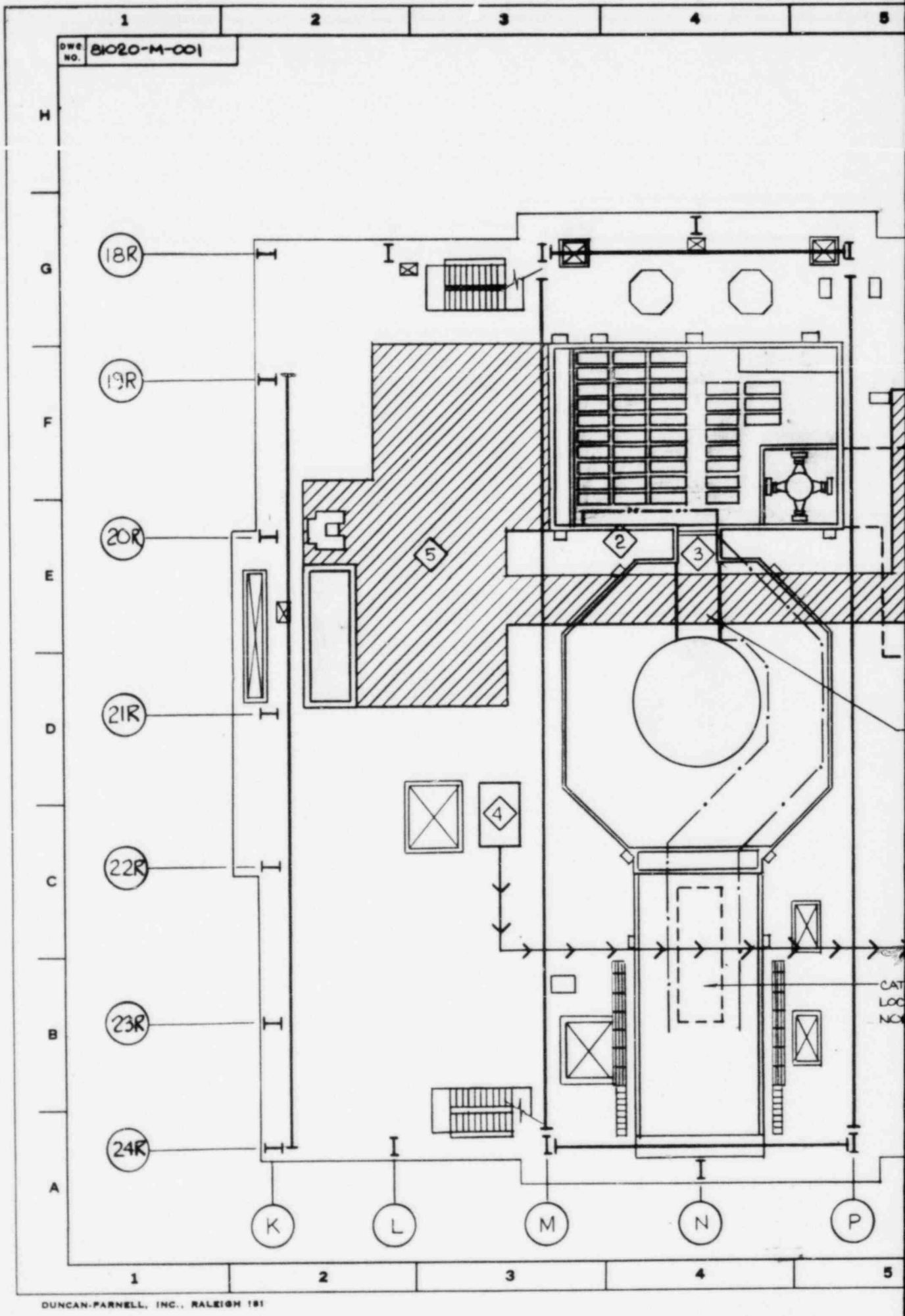
NO	SYMBOL	LOAD
1		RVP SERVICE PLATFORM & SUPPORT
2		INVESSEL SHIELDED PLATFORM
3		DRYER & SEPARATOR SLING
4		STUD TENSIONER
5		STEAM SEPARATOR
6		STEAM DRYER
7		RPV HEAD
8		DRYWELL HEAD
9		HEAD STRONGBACK
10		NUT RACKS
11		STUD RACKS
12		HEAD INSULATION
13		VESSEL PIPING SPOOLS

CAROLINA POWER & LIGHT COMPANY
NUCLEAR PLANT ENGINEERING DEPARTMENT - RALEIGH, N. C.

PLANT: BRUNSWICK STEAM ELECTRIC PLANT

TITLE: CONTROL OF HEAVY LOADS
SAFE LOAD PATHS
REACTOR BUILDING ELEV. 117'-0"

DRAWN BY	CHECK BY	A&N'D ENGR.	APPROVED BY	APPR. DATE	SCALE	SHEET 2 OF 3
GEM	JRW	JRW	[illegible]	5-14-84	DWG NO. 81020-M-001	REV B


DWG NO. 81020-M-001
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18R
19R
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21R
22R
23R
24R
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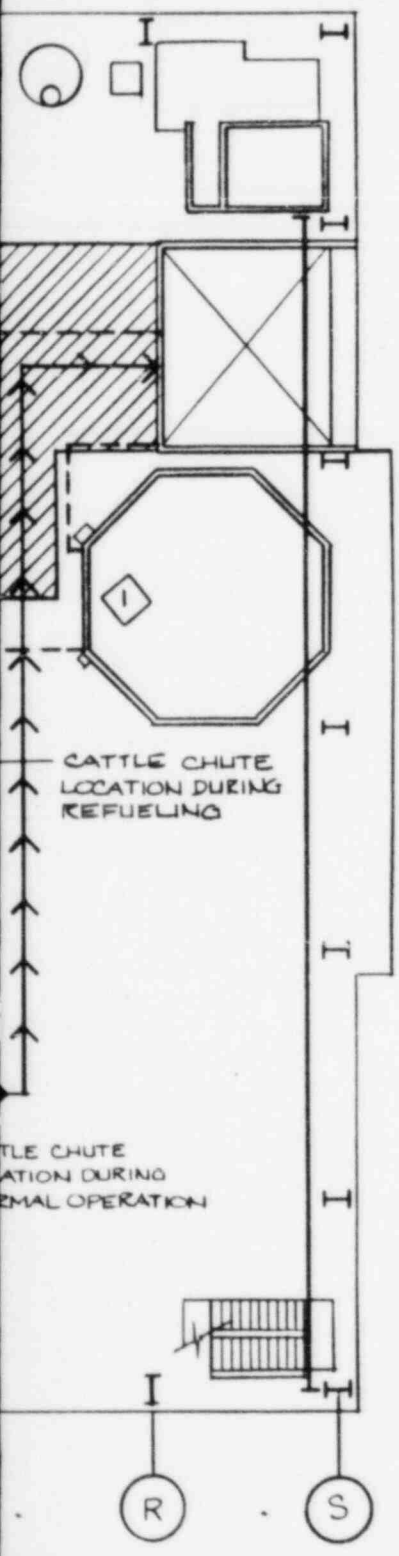
REV NO.	DESCRIPTION	BY	CHK	APPROVAL BY	APPROVAL DATE
B	REDUCED SIZE OF REPRODUIBLE AND INCREASED CLARITY OF DWG.	CEM			8 22 81



NOTE

1. FUEL LOCATED IN SHADED AREAS
2. LOAD PATHS APPLICABLE TO UNITS 1 & 2
3. HOISTS MUST BE REMOVED OR PROPERLY SECURED WHEN NOT IN USE

SAFE LOAD PATHS

Nº	SYMBOL	LOAD
1	– – – – – –	SHIPPING CASK
2	— ·· — ·· —	SPENT FUEL POOL GATES
3	— · — · —	CATTLE CHUTE
4	→ → →	HEPA FILTER
5	▨	NEW FUEL

CAROLINA POWER & LIGHT COMPANY

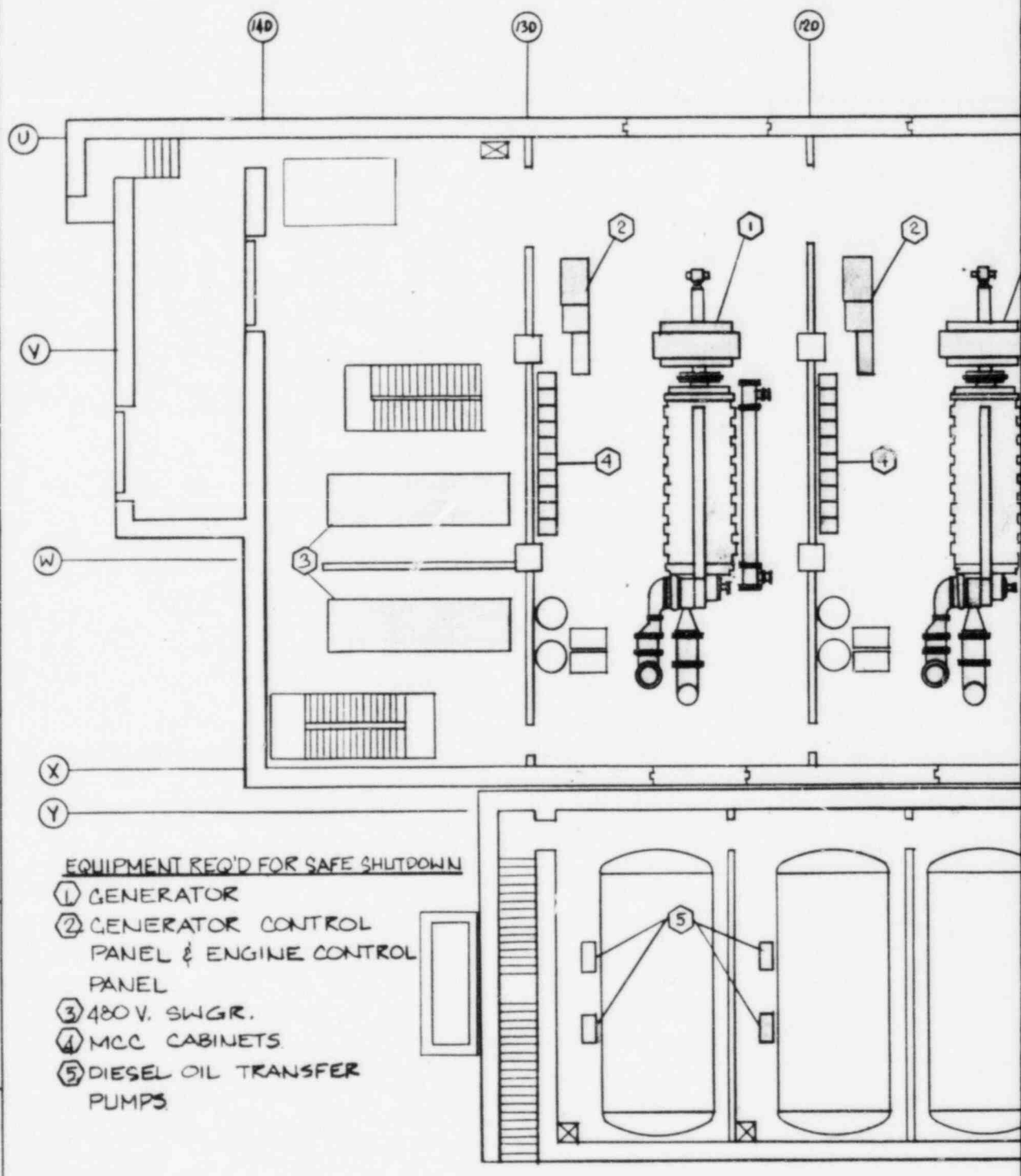
NUCLEAR PLANT ENGINEERING DEPARTMENT - RALEIGH, N. C.

PLANT: BRUNSWICK STEAM ELECTRIC PLANT

TITLE: CONTROL OF HEAVY LOADS
SAFE LOAD PATHS
REACTOR BUILDING ELEV. 117'-0"

DRAWN BY	CHECK BY	A'SN'D. ENGR.	APPROVED BY	APPVL DATE	SCALE	SHEET 3 OF 3
CEM				5-14-81	DWG NO. 81020-M-001	REV 8

DWG. NO. 81020-M-002



EQUIPMENT REQ'D FOR SAFE SHUTDOWN

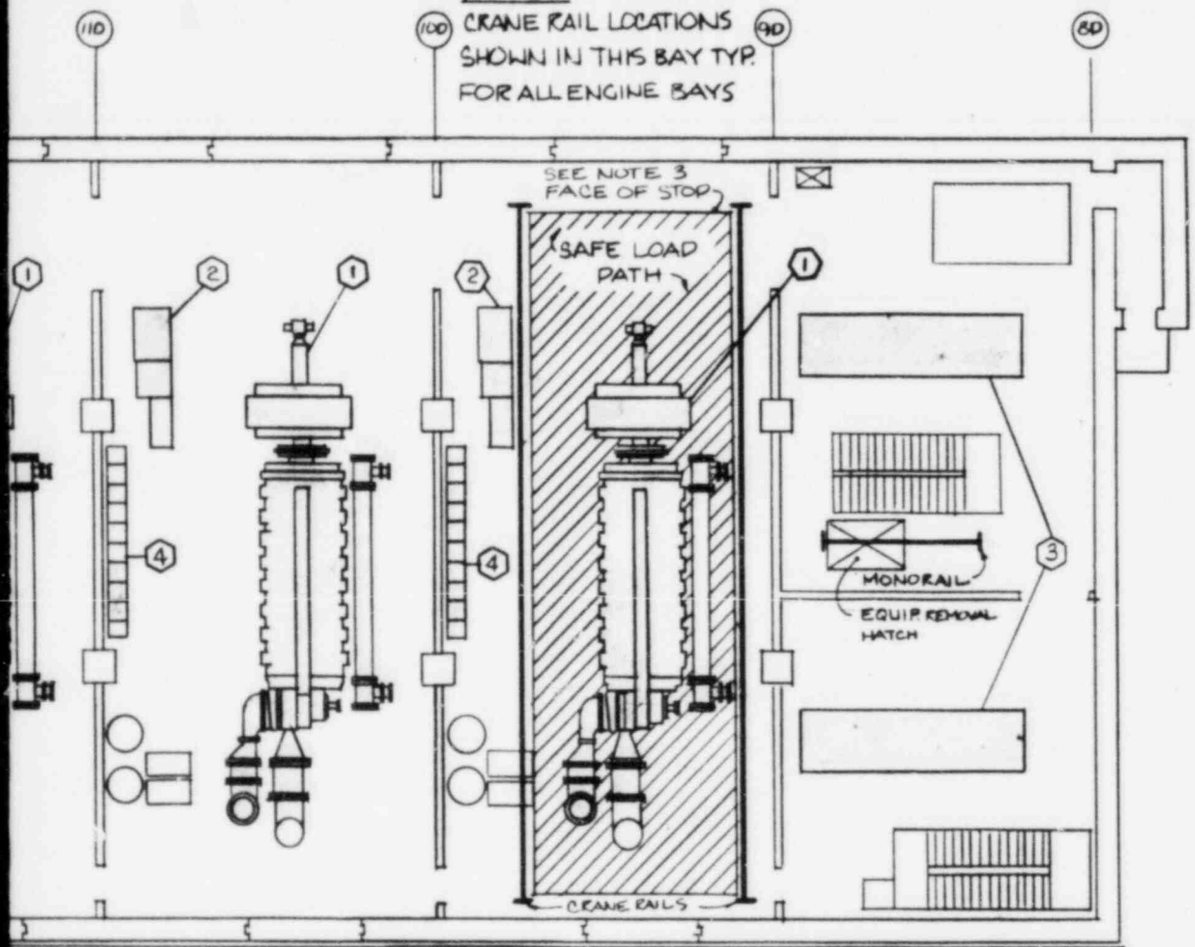
1. GENERATOR
2. GENERATOR CONTROL PANEL & ENGINE CONTROL PANEL
3. 480 V. SWGR.
4. MCC CABINETS
5. DIESEL OIL TRANSFER PUMPS

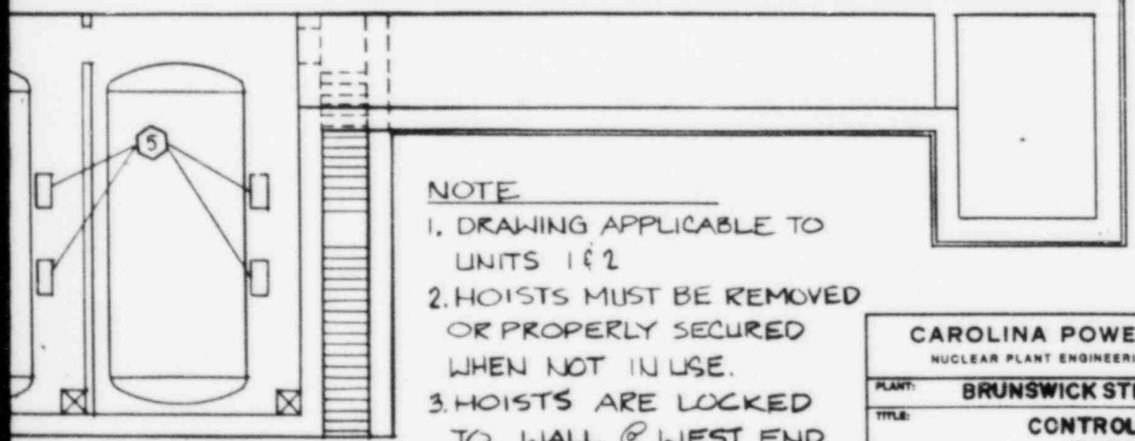
5. WHEN EQUI
SAFE SHUTD
EXTREME CA

REV NO.	DESCRIPTION	BY	CHK	APPROVED BY	APPROVED DATE
B	REDUCED SIZE OF REPRODUCIBLE AND INCREASED CLARITY OF DWG. ADDED SHEET 2	G E M			5 22 81

PLANT NORTH → N

NOTE:
CRANE RAIL LOCATIONS SHOWN IN THIS BAY TYP. FOR ALL ENGINE BAYS





PMENT IS HANDLED OVER
OWN COMPONENTS
UTION MUST BE TAKEN

NOTE
1. DRAWING APPLICABLE TO UNITS 1 & 2
2. HOISTS MUST BE REMOVED OR PROPERLY SECURED WHEN NOT IN USE.
3. HOISTS ARE LOCKED TO WALL @ WEST END
4. SHADED EQUIPMENT REQUIRED FOR SAFE SHUTDOWN.

CAROLINA POWER & LIGHT COMPANY
NUCLEAR PLANT ENGINEERING DEPARTMENT - RALEIGH, N. C.

PLANT: BRUNSWICK STEAM ELECTRIC PLANT

TITLE: CONTROL OF HEAVY LOADS
SAFE LOAD PATHS
DIESEL GENERATOR BUILDING

DRAWN BY	CHECK BY	A'BN'D. ENGR.	APPROVED BY	APPVL DATE	SCALE	SHEET	OF
SEM				5-14-81			2

DWG NO. 81020-M-002 REV B

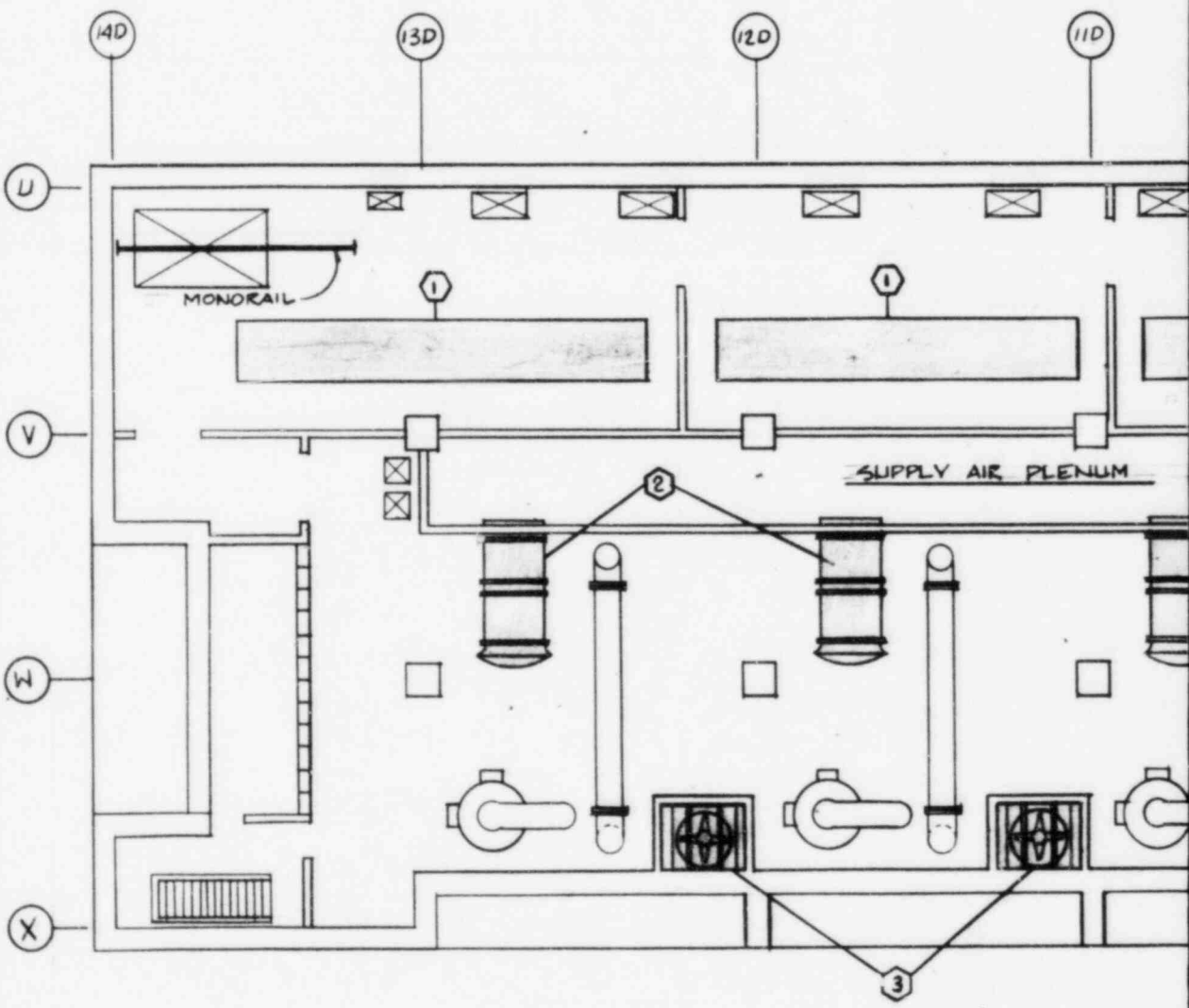
DWG NO. 8102D-M-002

EQUIPMENT REQUIRED FOR SAFE SHUTDOWN

(1) 4160 SWGR

(2) SUPPLY AIR FANS

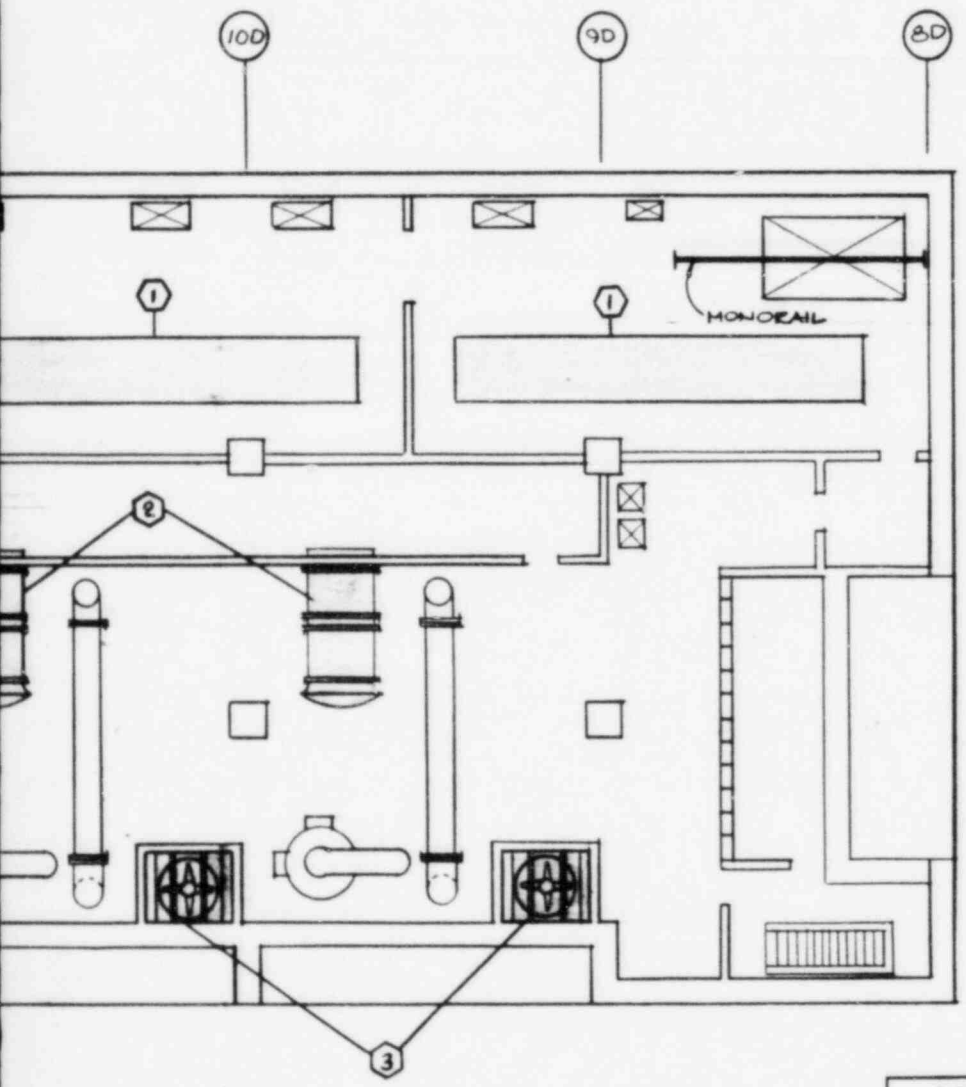
(3) EXHAUST FANS



REVISION(S)					
REV NO.	DESCRIPTION	BY	CHK	APPROVAL BY	APPROVAL DATE
B	REDUCED SIZE OF REDUCIBLE AND INCREASED CLARITY OF DWG ADDED SHEET 2	G E M	[illegible]	[illegible]	5 22 81

NOTE:

1. DRAWING APPLICABLE TO UNITS 1 & 2
2. HOISTS MUST BE REMOVED OR PROPERLY SECURED WHEN NOT IN USE.
3. SHADED EQUIPMENT REQUIRED FOR SAFE SHUTDOWN.
4. NO EQUIPMENT IS TO BE LIFTED OVER SAFE SHUTDOWN EQUIPMENT UNLESS NECESSARY AND THEN W/EXTREME CAUTION.



CAROLINA POWER & LIGHT COMPANY

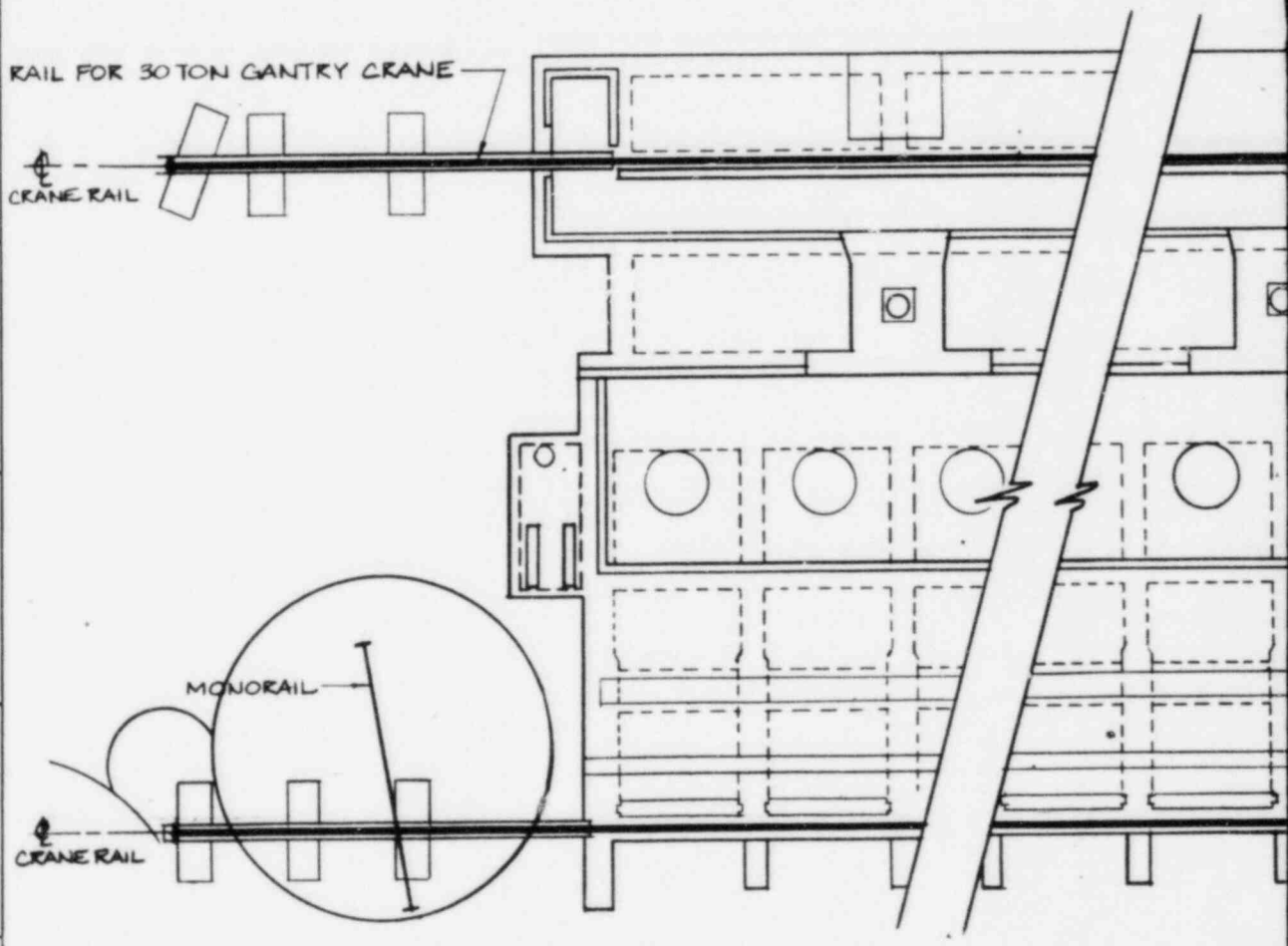
NUCLEAR PLANT ENGINEERING DEPARTMENT - RALEIGH, N. C.

PLANT: BRUNSWICK STEAM ELECTRIC PLANT

TITLE: CONTROL OF HEAVY LOADS
SAFE LOAD PATHS
DIESEL GENERATOR BUILDING

DRAWN BY	CHECK BY	A&N'D ENGR.	APPROVED BY	APPVL DATE	SCALE	SHEET 2 OF 2
GEM	[illegible]	[illegible]	[illegible]	5-14-81	DWG NO. 81020-M-002	REV B

DWG. NO. B1020-M-003



EQUIPMENT REQUIRED FOR SAFE SHUTDOWN

(1) NUCLEAR SERVICE WATER PUMPS

NOTE

1. DRAWING APPLICABLE TO UNITS 1 & 2
2. NO EQUIPMENT IS TO BE LIFTED OVER SAFE SHUTDOWN EQUIPMENT UNLESS NECESSARY AND THEN W/EXTREME CAUTION.

3. HOIST
SECUR
4. OTHER
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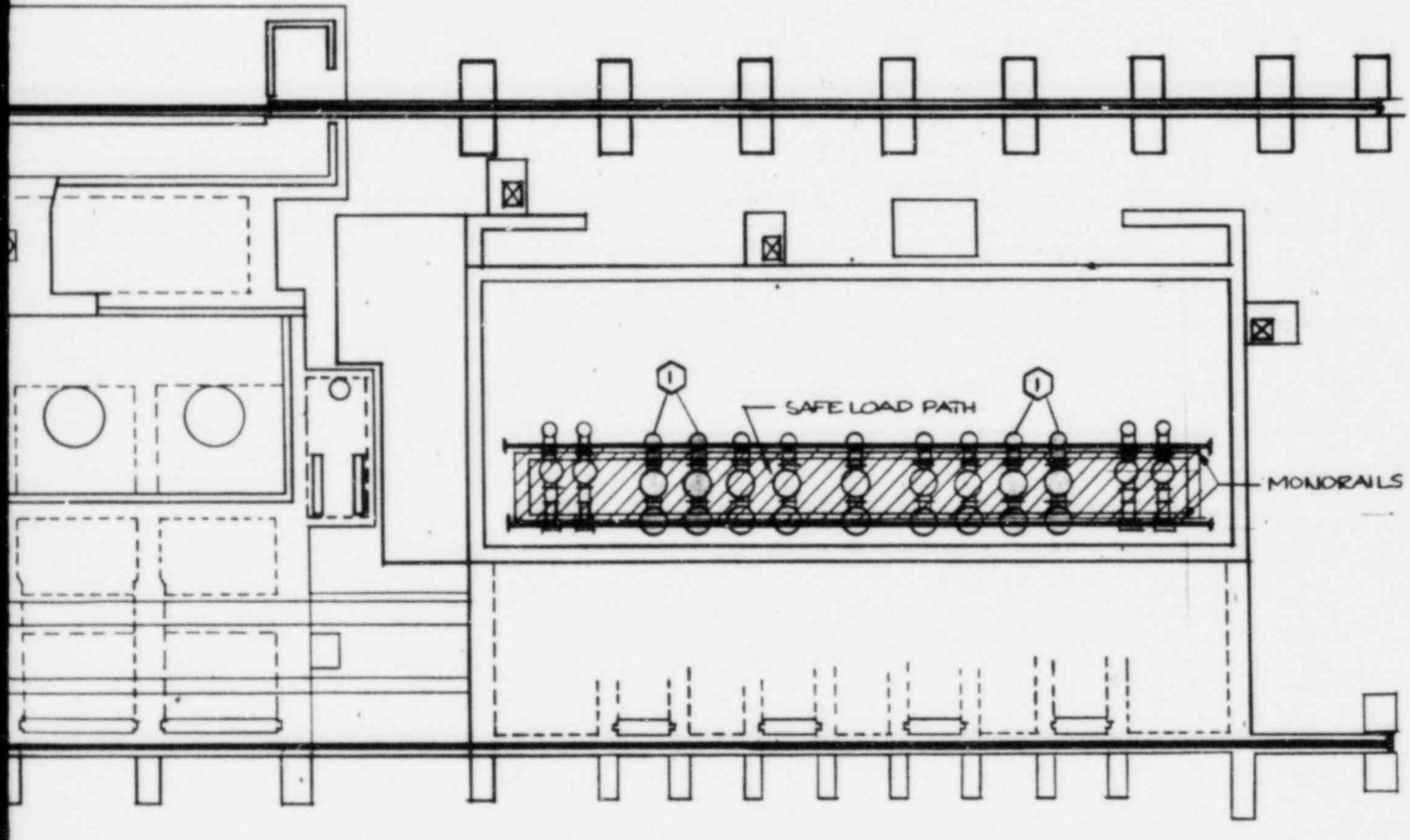
SHOWN

DUNCAN-PARNELL, INC., RALEIGH 101

REVISIONS					
REV NO.	DESCRIPTION	BY	CHK	APPROVAL BY	APPROVAL DATE
B	REDUCED SIZE OF REPRODUCIBLE AND INCREASED CLARITY OF DRAWING EXPANDED DRAWING TO INCLUDE WHOLE STRUCTURE INCLUDED MONORAILS	G E M			5 22 81



S MUST BE REMOVED OR PROPERLY
ED WHEN NOT IN USE
EQUIPMENT NOT AFFECTING SAFE
OWN EQUIPMENT MAY NOT BE
N IN THIS DRAWING

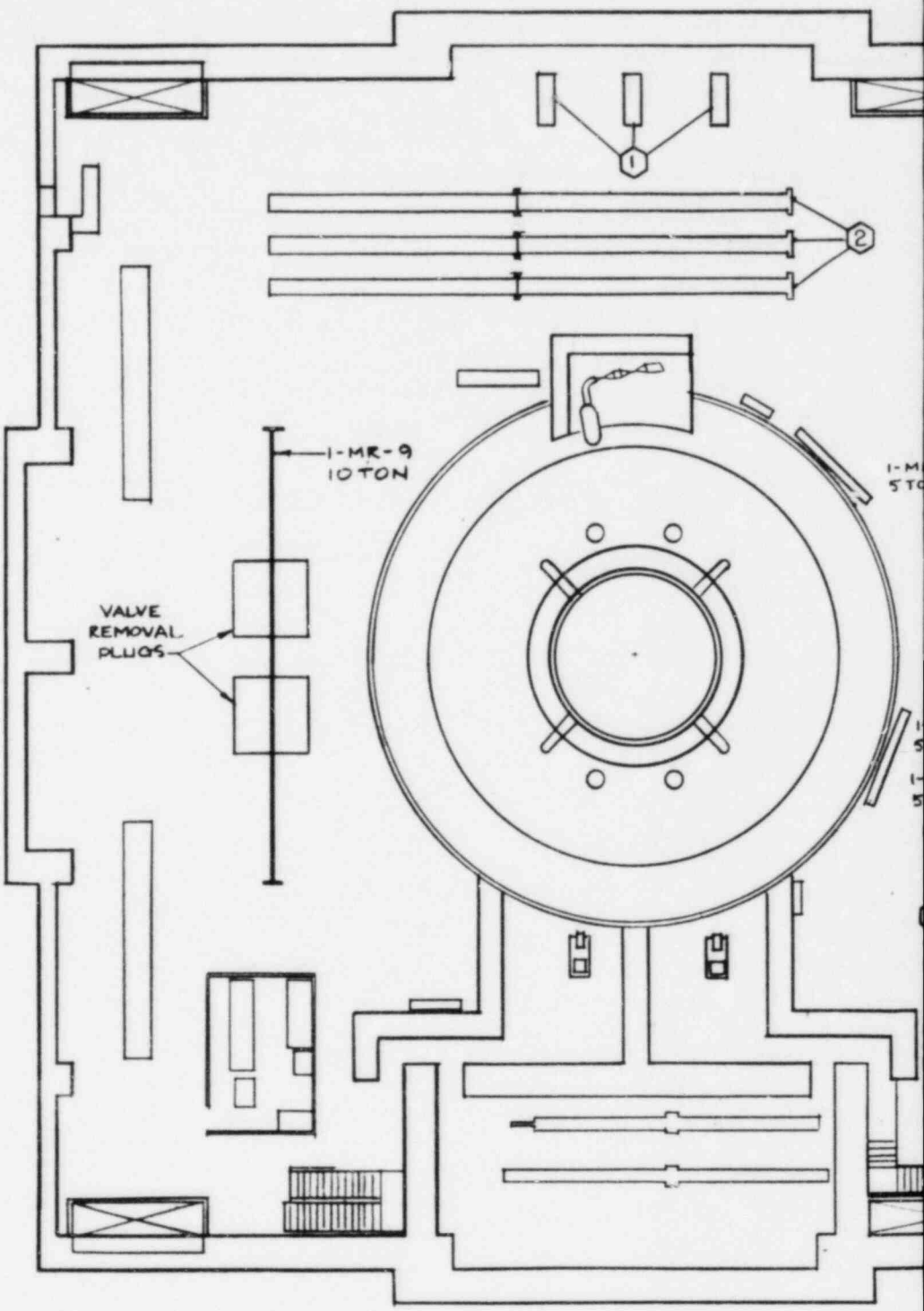
CAROLINA POWER & LIGHT COMPANY
NUCLEAR PLANT ENGINEERING DEPARTMENT - RALEIGH, N. C.

PLANT: BRUNSWICK STEAM ELECTRIC PLANT

TITLE: CONTROL OF HEAVY LOADS
SAFE LOAD PATHS
INTAKE SERVICE WATER STRUCTURE

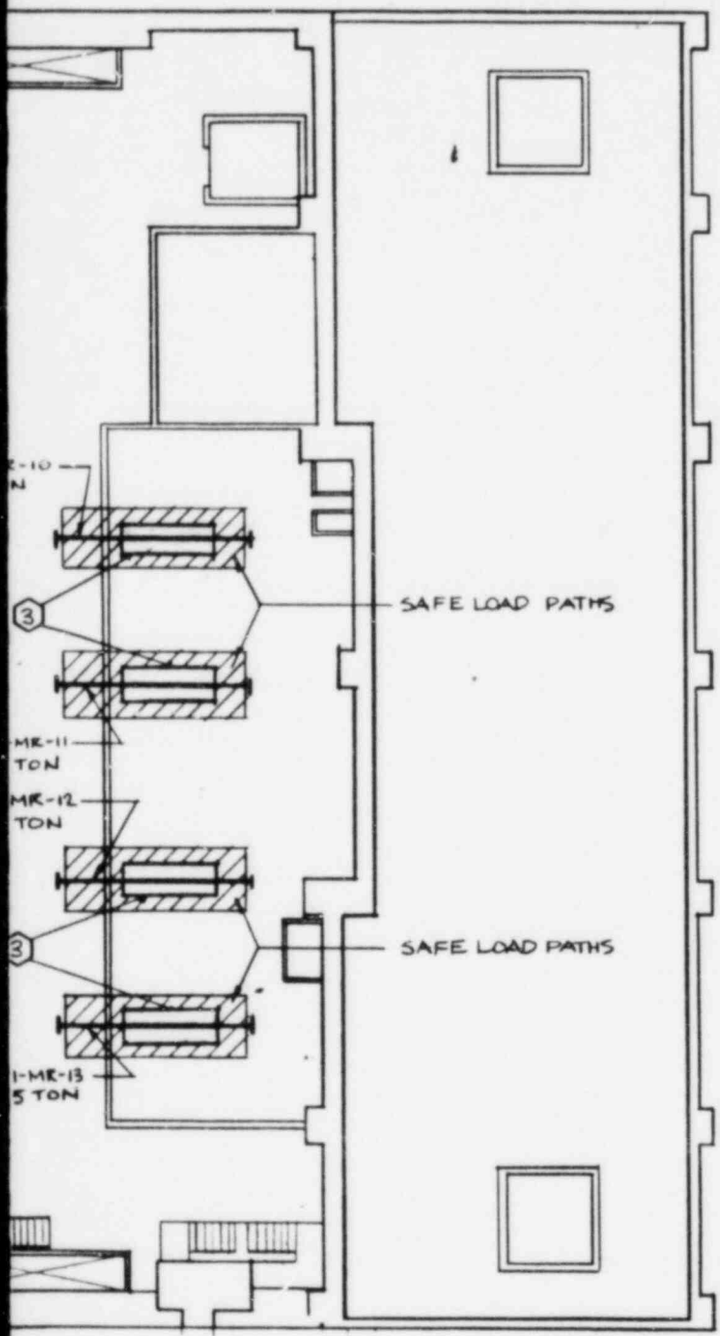
DRAWN BY	CHECK BY	ASS'T ENGR.	APPROVED BY	APPR. DATE	SCALE	SHEET OF
G.E.M.				5-14-81	DWG. NO. 81020-M-003	REV B

DWG. NO. 81020-M-004



DUNCAN-PARNELL, INC., RALEIGH 181

REVISIONS					
REV NO.	DESCRIPTION	BY	CHK	APPROVAL BY	APPROVAL DATE
B	REDUCED SIZE OF REPRODUIBLE AND INCREASED CLARITY OF DWG	GEM	[illegible]	[illegible]	5/22/81



NOTE:

1. SHADED EQUIPMENT REQUIRED FOR SAFE SHUTDOWN
2. DRAWING APPLICABLE TO UNITS 1 & 2
3. HOISTS MUST BE REMOVED OR PROPERLY SECURED WHEN NOT IN USE
4. OTHER EQUIPMENT IN REACTOR BUILDING NOT AFFECTING THE CONTROL OF HEAVY LOADS OR SAFE SHUTDOWN EQUIPMENT MAY NOT BE SHOWN IN THIS DRAWING

EQUIPMENT REQ'D FOR SAFE SHUTDOWN

(1) R.B.C.C.W PUMP

(2) R.B.C.C.W. HEAT EXCHANGERS

(3) R.H.R.S. SERVICE WATER BOOSTER PUMP & MTR.

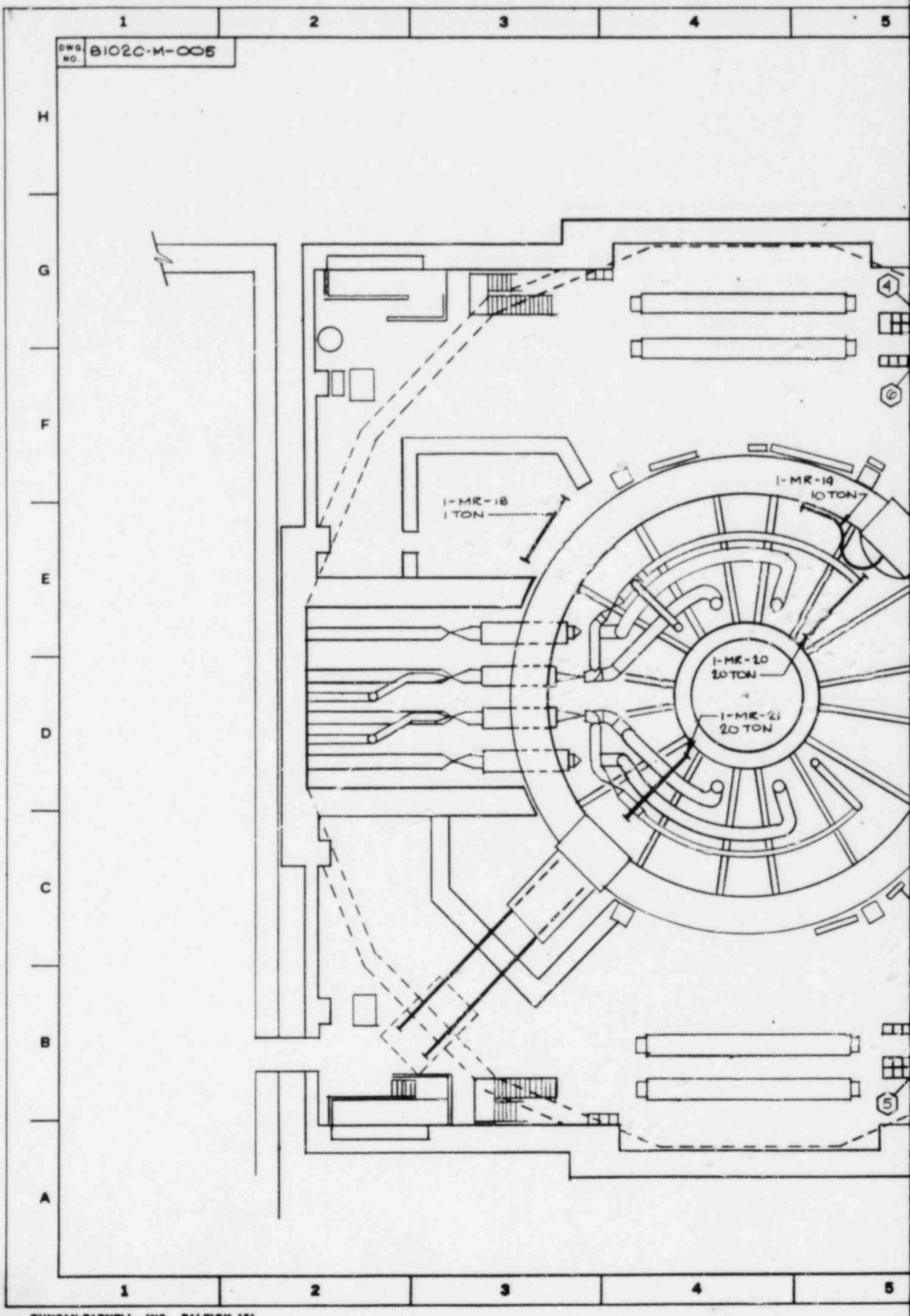
CAROLINA POWER & LIGHT COMPANY
NUCLEAR PLANT ENGINEERING DEPARTMENT - RALEIGH, N. C.

PLANT: BRUNSWICK STEAM ELECTRIC PLANT

TITLE: CONTROL OF HEAVY LOADS
SAFE LOAD PATHS
REACTOR BUILDING ELEV. 50'-0"

DRAWN BY	CHECK BY	ASS'D ENGR	APPROVED BY	APPR. DATE	SCALE	SHEET OF
GEM	[illegible]	[illegible]	[illegible]	5/14/81	DWG NO. 81020-M-004	REV B

ELE 50'0"


DWG. NO. B102C-M-005
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1-MR-19
10 TON
1-MR-20
20 TON
1-MR-21
20 TON
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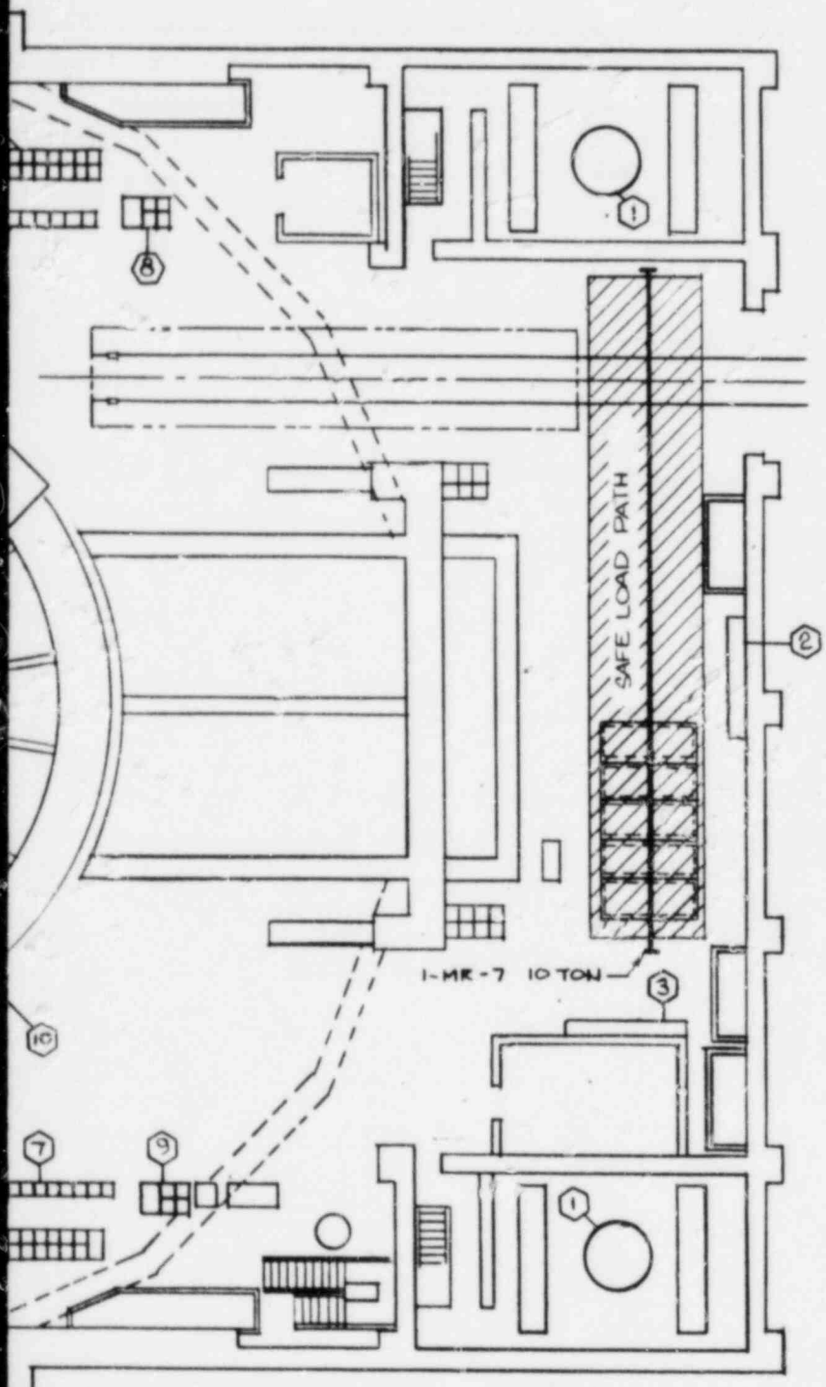
REVISIONS					
REV NO.	DESCRIPTION	BY	CHK	APPROVAL BY	APPROVAL DATE
B	REDUCED SIZE OF REPRODUCIBLE AND INCREASED CLARITY OF DWG	GEM			5 22 81



NOTE:

1. SHADED EQUIPMENT REQUIRED FOR SAFE SHUTDOWN
2. DRAWING APPLICABLE TO UNITS 1 & 2
3. HOISTS MUST BE REMOVED OR PROPERLY SECURED WHEN NOT IN USE
4. OTHER EQUIPMENT IN THE REACTOR BUILDING NOT AFFECTING THE CONTROL OF HEAVY LOADS OR EQUIPMENT REQ'D FOR SAFE SHUTDOWN MAY NOT BE SHOWN IN THIS DRAWING

EQUIPMENT REQ'D FOR SAFE SHUTDOWN

1. R.H.R. HEAT EXCHANGER
2. MOTOR CONTROL CENTER Nº 1XC 480V A.C.
3. MOTOR CONTROL CENTER Nº 1XD 480V A.C.
4. MOTOR CONTROL CENTER Nº 1XA 480V A.C.
5. MOTOR CONTROL CENTER Nº 1XB 480V A.C.
6. MOTOR CONTROL CENTER Nº 1XDA 250V D.C.
7. MOTOR CONTROL CENTER Nº 1XDB 250V D.C.
8. MOTOR CONTROL CENTER Nº 1XA2
9. MOTOR CONTROL CENTER Nº 1XB2
10. H.P.C.I. LEAK DETECTOR INTR RACK 3

CAROLINA POWER & LIGHT COMPANY
NUCLEAR PLANT ENGINEERING DEPARTMENT - RALEIGH, N. C.

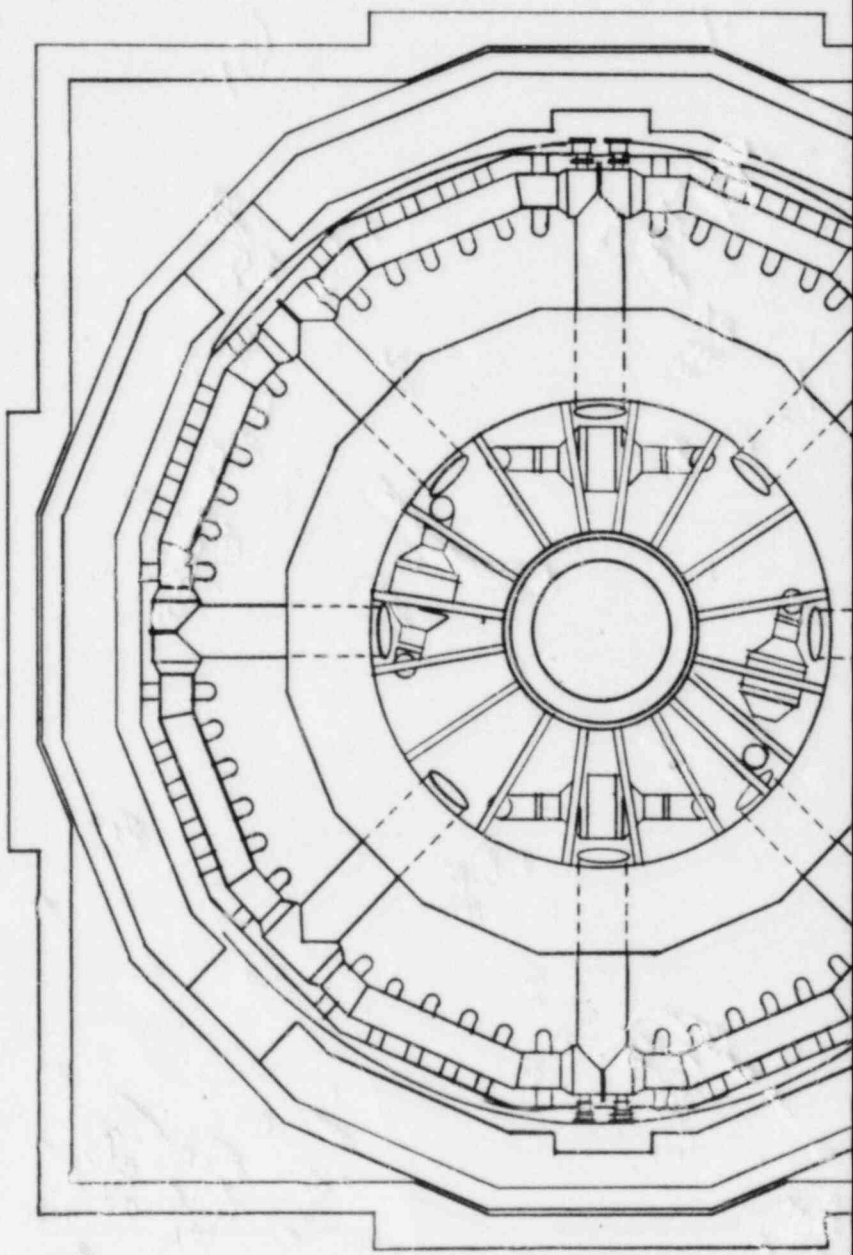
PLANT: BRUNSWICK STEAM ELECTRIC PLANT

TITLE: CONTROL OF HEAVY LOADS
SAFE LOAD PATHS
REACTOR BUILDING ELEV. 20'-0"

DRAWN BY	CHECK BY	A&N'D ENGR.	APPROVED BY	APPVL. DATE	SCALE	SHEET OF
GEM	ADK	HHO		5-14-81	DWG NO. 81020-M-005	REV B

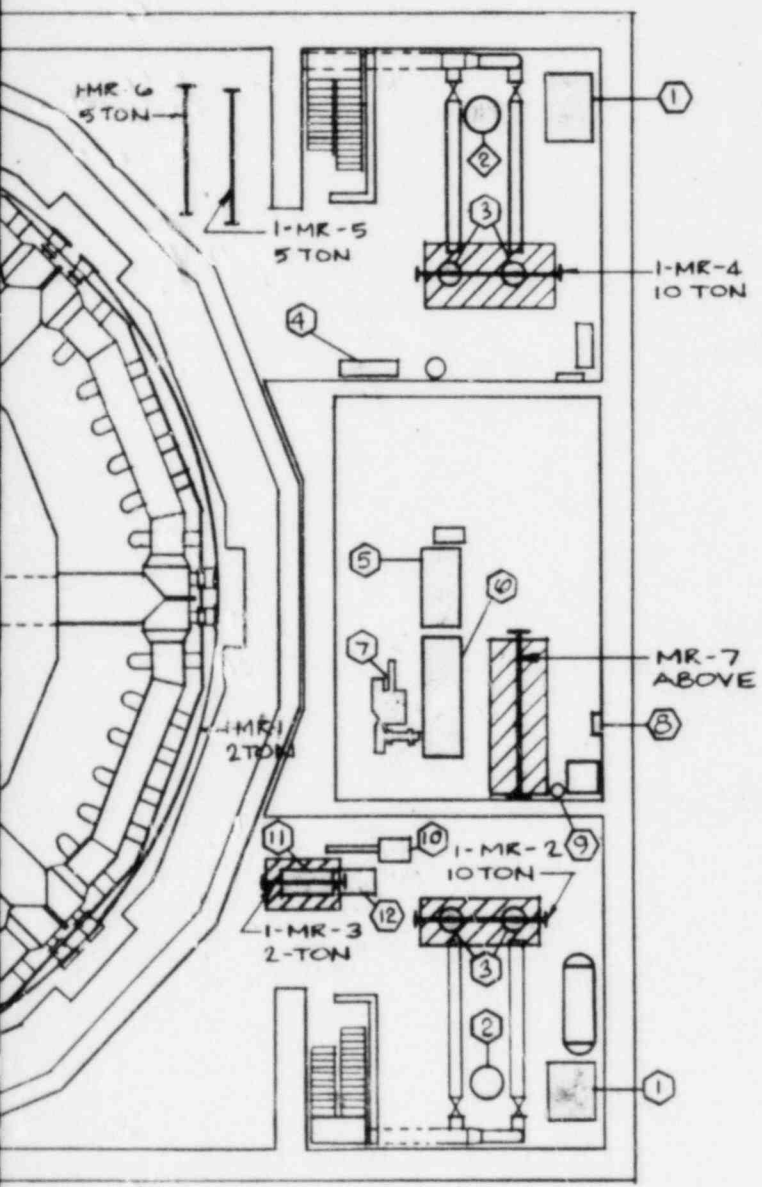
20'-0"

DWG. NO. 81020-M-006



DUNCAN-PARNELL, INC., RALEIGH 101

REVISIONS					
REV NO.	DESCRIPTION	BY	CHK	APPROVAL BY	APPROVAL DATE
B	REDUCED SIZE REPRODUCIBLE AND INCREASED CLARITY OF DWG	GEM			5 22 81



NOTE:

1. SHADED EQUIPMENT REQ'D FOR SAFE SHUTDOWN
2. DRAWING APPLICABLE TO UNITS 1 & 2
3. HOISTS MUST BE REMOVED OR PROPERLY SECURED WHEN NOT IN USE
4. OTHER EQUIPMENT IN THE REACTOR BUILDING NOT AFFECTING THE CONTROL OF HEAVY LOADS OR EQUIPMENT FOR SAFE SHUTDOWN MAY NOT BE SHOWN IN THIS DRAWING

EQUIPMENT REQUIRED FOR SAFE SHUTDOWN

1. FAN COOLING UNIT
2. R.H.R.S. HEAT EXCHANGER
3. R.H.R. PUMP
4. H.P.C.I.S. PUMP & TURBINE INSTRUMENT RACK
5. H.P.C.I.S. TURBINE
6. H.P.C.I.S. PUMP
7. H.P.C.I GLAND EXHAUST PUMP W/ BAROMETRIC COND.
8. H.P.C.I. LEAK DETECTOR INST. RACK A
9. H.P.C.I. LEVEL SWITCH 1-X-LSHH-4238
10. R.C.I.C GLAND EXHAUST PUMP W/ BAROMETRIC COND.
11. R.C.I.C. TURBINE
12. R.C.I.C PUMP

▨ DEPICTS SAFE LOAD AREA

CAROLINA POWER & LIGHT COMPANY
NUCLEAR PLANT ENGINEERING DEPARTMENT - RALEIGH, N. C.

PLANT: BRUNSWICK STEAM ELECTRIC PLANT

TITLE: CONTROL OF HEAVY LOADS
SAFE LOAD PATHS
REACTOR BUILDING ELEV.(-) 17'-0"

DRAWN BY	CHECK BY	A&N'D ENGR.	APPROVED BY	APPR. DATE	SCALE	SHEET OF
GEM				5/14/81	DWG NO. 81020-M-006	REV B

-17'-0"