TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS

CAROLINA POWER AND LIGHT COMPANY

BRUNSWICK UNITS 1 AND 2

NRC DOCKET NO. 50-324, 50-325

NRC TAC NO. 07976, 07977

NRC CONTRACT NO. NRC-03-81-130

FRC PROJECT C5506

FRC ASSIGNMENT 13

FRC TASKS 340, 341

Prepared by

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Prepared for

Nuclear Regulatory Commission
Washington, D.C. 20555

Lead NRC Engineer: A. Singh

April 23, 1984

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CONTENTS

FOREWORD

This Technical Evaluation Report was prepared by Franklin Research Center under a contract with the U.S. Nuclear Regulatory Commission (Office of Nuclear Reactor Regulation, Division of Operating Reactors) for technical assistance in support of NRC operating reactor licensing actions. The technical evaluation was conducted in accordance with criteria established by the NRC.

Mr. C. Bomberger and Mr. I. H. Sargent contributed to the technical preparation of this report through a subcontract with WESTEC Services, Inc.

1. INTRODUCTION

1.1 PURPOSE OF REVIEW

This technical evaluation report documents an independent review of general load handling policy and procedures at the Carolina Power and Light Company's (CP&L) Brunswick Steam Electric Plant Units 1 and 2 Plant. This evaluation was performed with the following objectives:

- to assess conformance to the general load handling guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants" [1], Section 5.1.1
- to assess conformance to the interim protection measures of NUREG-0612, Section 5.3.

1.2 GENERIC BACKGROUND

Generic Technical Activity Task A-36 was established by the Nuclear Regulatory Commission (NRC) staff to systematically examine staff licensing criteria and the adequacy of measures in effect at operating nuclear power plants to assure the safe handling of heavy loads and to recommend necessary changes in these measures. This activity was initiated by a letter issued by the NRC staff on May 17, 1978 [2] to all power reactor licensees, requesting information concerning the control of heavy loads near spent fuel.

The results of Task A-36 were reported in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." The staff's conclusion from this evaluation was that existing measures to control the handling of heavy loads at operating plants, although providing protection from certain potential problems, do not adequately cover the major causes of load handling accidents and should be upgraded.

In order to upgrade measures provided to control the handling of heavy loads, the staff developed a series of guidelines designed to achieve a two-part objective using an accepted approach or protection philosophy. The first part of the objective, achieved through a set of general guidelines identified in NUREG-0612, Section 5.1.1, is to ensure that all load handling

systems at nuclear power plants are designed and operated so that their probability of failure is uniformly small and appropriate for the critical tasks in which they are employed. The second part of the staff's objective, achieved through guidelines identified in NUREG-0612, Sections 5.1.2 through 5.1.5, is to ensure that, for load handling systems in areas where their failure might result in significant consequences, either (1) features are provided, in addition to those required for all load handling systems, to ensure that the potential for a load drop is extremely small (e.g., a single-failure-proof crane) or (2) conservative evaluations of load handling accidents indicate that the potential consequences of any load drop are acceptably small. Acceptability of accident consequences is quantified in NUREG-0612 into four accident analysis evaluation criteria.

A defense-in-depth approach was used to develop the staff guidelines so as to ensure that all load handling systems are designed and operated so that their probability of failure is appropriately small. The intent of the guidelines is to ensure that licensees of all operating nuclear power plants perform the following:

- o define safe load travel paths, through procedures and operator training, so that, to the extent practical, heavy loads are not carried over or near irradiated fuel or safe shutdown equipment
- o provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to assure reliable operation of the handling system.

Staff guidelines resulting from the foregoing are tabulated in Section 5 of NUREG-0612. Section 6 of NUREG-0612 recommended that a program be initiated to ensure that these guidelines are implemented at operating plants.

1.3 PLANT-SPECIFIC BACKGROUND

On December 22, 1980, the NRC issued a letter [3] to CP&L, the Licensee for Brunswick Steam Electric Plant, requesting that the Licensee review provisions for the handling and control of heavy loads at the Brunswick plant, evaluate there provisions with respect to the guidelines of NUREG-0612, and provide certain additional information to be used for an independent

determination of conformance to these guidelines. CP&L responses to this request were submitted on September 22, 1981 [4], November 16, 1982 [5], February 3, 1984 [6], and February 6, 1984 [7]. Clarifications to Licensee statements were identified in a conference call conducted on February 21, 1984 [8] and in an additional submittal dated March 20, 1984 [9]. All information submitted has been incorporated into this technical evaluation.

2. EVALUATION AND RECOMMENDATIONS

This section presents a point-by-point evaluation of load handling provisions at Brunswick Steam Electric Plant Units 1 and 2 with respect to NRC staff guidelines provided in NUREG-0612. Separate subsections are provided for both the general guidelines of NUREG-0612, Section 5.1.1 and the interim measures of NUREG-0612, Section 5.3. In each case, the guideline or interim measure is presented, Licensee-provided information is summarized and evaluated, and a conclusion as to the extent of compliance, including recommended additional action where appropriate, is presented. These conclusions are summarized in Table 2.1.

2.1 GENERAL GUIDELINES

The NRC has established seven general guidelines which must be met in order to provide the defense-in-depth approach for the handling of heavy loads. These guidelines consist of the following criteria from Section 5.1.1 of NUREG-0612:

Guideline 1 - Safe Load Paths
Guideline 2 - Load Handling Procedures
Guideline 3 - Crane Operator Training
Guideline 4 - Special Lifting Devices
Guideline 5 - Lifting Devices (Not Specially Designed)
Guideline 6 - Cranes (Inspection, Testing, and Maintenance)
Guideline 7 - Crane Design.

These seven guidelines should be satisfied by all overhead handling systems and procedures used to handle heavy loads in the vicinity of the reactor vessel, near spent fuel in the spent fuel pool, or in other areas where a load drop may damage safe shutdown systems. The Licensee's verification of the extent to which these guidelines have been satisfied, and evaluations of this verification are contained in the succeeding paragraphs.

Table 2.1. Brunswick Nuclear Power Plant/NUREG-0612 Compliance Matrix

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
1. Reactor Building Crane	120/5	--	--	C	--	--	C	C	C	C
Shielding/ Access Plug	110	C	C	--	--	C	--	--	--	C
Drywell Head and Strongback	43	C	C	--	C	--	--	--	--	C
Reactor Vessel Head and Strongback	70	C	C	--	C	--	--	--	--	C
Steam Dryer and Sling Assembly	37.5	C	C	--	--	C	--	--	--	C
Moisture Separator and Sling Assembly	51	C	C	--	--	C	--	--	--	C
R.P.V. Service Platform and Sling Assembly	7	C	C	--	--	C	--	--	--	C
Head Strongback	5	C	C	--	C	--	--	--	--	C
R.V. Head Insulation and Strongback	2	C	C	--	R	--	--	--	--	C
Stud Tensioner	3.5	C	C	--	R	--	--	--	--	C
HEPA Filter and Sling Assembly	2	C	C	--	--	C	--	--	--	--
Spent Fuel Pool Gates and Sling Assembly	4	C	C	--	--	C	--	--	C	--

C = Licensee action complies with NUREG-0612 Guideline.
R = Licensee has proposed revisions or modifications which, when implemented, will be in compliance with NUREG-0612.
-- = Not applicable.

Table 2.1 (Cont.)

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
Spent Fuel Shipping Cask	80	C	C	--	C	--	--	--	C	--
Fuel Rack and Sling Assembly	4.3	C	C	--	--	C	--	--	C	--
Cattle Chute	12	C	C	--	--	C	--	--	C	--
Shielded Personnel Work Basket	4.3	C	C	--	C	--	--	--	--	C
Replacement Fuel Storage Racks	--	C		--	--	--	--	--	C	--
R.V. Head Stud	0.3	C	C	--	R	--	--	--	--	C
Head Nut and Washer Rack	0.3	C	C	--	--	C	--	--	--	C
Head Stud Rack	1.5	C	C	--	--	C	--	--	--	C
Refueling and Service Tools	0.4	C	C	--	--	--	--	--	C	--
New Fuel	0.3	C	C	--	--	--	--	--	C	--
Debris Cask	11	C	C	--	--	C	--	--	--	C
Invessel Service Platform and Strongback	43	C	C	--	R	--	--	--	--	C
Flux Monitor and Shipping Crate	2.5	C	C	--	--	C	--	--	C	--

Table 2.1 (Cont.)

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
2. Refueling Platform	0.8	--	--	C	--	--	C	C	C	C
BWR Fuel Assemblies	0.4	C	C	--	--	--	--	--	C	--
PWR Fuel	0.7	C	C	--	--	--	--	--	C	--
Refueling and Service Tools	0.4	C	C	--	--	--	--	--	C	--
3. Refueling Jib Crane	0.5	--	--	C	--	--	C	C	C	C
Refueling Tools	--	C	C	--	--	C	--	--	C	--
Reactor Components	0.5	C	C	--	--	C	--	--	C	--
4. Reactor Building Hoists	20	--	--	C	--	--	C	C	--	--
RHR Pumps and Sling Assembly	4.2	C	C	--	--	C	--	--	--	--
RCIC Pump and Turbine with Sling Assembly	0.3	C	C	--	--	C	--	--	--	--
HPCI Pump and Turbine with Sling Assembly	4.2	C	C	--	--	C	--	--	--	--
RHR Service Water and Booster Pumps with Sling Assembly	5	C	C	--	--	C	--	--	--	--
Recirculation Pumps and Sling Assembly	17	C	C	--	--	C	--	--	--	--

Table 2.1 (Cont.)

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
5. Diesel Generator Building Cranes	5.0	--	--	C	--	--	C	C	--	--
Diesel Generator Components with Sling Assembly	1.7	C	C	--	--	C	--	--	--	--
6. Diesel Generator Building Hoist	5.0	--	--	C	--	--	C	C	--	--
Switchgear with Sling Assembly	5	C	C	--	--	C	--	--	--	--
7. Intake Structure Crane	30	--	--	C	--	--	C	C	--	--
Service Water Pumps and Sling Assembly	3.1	C	C	--	--	C	--	--	--	--
Service Water Motors and Sling Assembly	1.8	C	C	--	--	C	--	--	--	--
Circulation Water Pumps and Sling Assembly	28	C	C	--	--	C	--	--	--	--
Circulation Water Motors and Sling Assembly	22.5	C	C	--	--	C	--	--	--	--
Traveling Screen Circulation Water and Strongback	27	C	C	--	--	C	--	--	--	--
Traveling Screen Service Water and Sling Assembly	10.6	C	C	--	--	C	--	--	--	--

2.1.1 Overhead Heavy Load Handling Systems

a. Summary of Licensee Statements and Conclusions

The Licensee's review of overhead handling systems identified the following overhead handling systems to be subject to the criteria of NUREG-0612:

Reactor Building

- o reactor building crane
- o refueling platform
- o refueling jib crane
- o hand-operated chain hoists (MR-2,-3,-4,-7,-10,-11,-12,-13,-20,-21)

Diesel Generator Building

- o 5-ton single bridge cranes (4)
- o 5-ton hand operated chain hoist

Intake Structure:

- o intake structure crane.

Numerous handling devices identified by the Licensee have been excluded from compliance with NUREG-0612. The following handling systems were excluded on the basis that no safety-related equipment or irradiated fuel is located in close proximity:

Reactor Building

- o vacuum breakers hoist
- o CRD and RCIC pumps hoists
- o valve removal hoist and trolley
- o contamination equipment room hoist and trolley
- o gamma scan lead plug hoist
- o access and hatch covers hoists and trolley
- o removable platform hoist
- o neutron monitoring equipment hoist
- o relief valves hoist and davit

Intake Structure

- o intake structure hoist

Radwaste Building

- o HVAC equipment hoists and trolley
- o demineralizer tank hoists and trolley
- o fuel pool and waste collector filter hoist and trolley
- o floor drain filters hoist and trolley
- o centrifuge hoists.

The following handling systems were excluded on the basis that no system or components required for plant shutdown or decay heat removal are located in the areas where the handling systems are located:

Turbine Building

- o turbine building overhead traveling bridge
- o auxiliary bay semi-gantry crane
- o recirculation pumps hoists
- o condensate booster pumps hoist
- o air compressor hoist

Shop Cranes and Miscellaneous Hoists

- o hot machine shop crane
- o clean machine shop crane
- o floor plug and offgas filter hoist and trolley
- o pumps and valves hoist
- o HVAC equipment hoist
- o AOG equipment hoist.

b. Evaluation and Conclusion

The Licensee's exclusion of listed handling systems from compliance with NUREG-0612 is acceptable on the basis of the Licensee's justification that either (1) physical separation exists between the handling system and any safety-related system or irradiated fuel or (2) no systems or components required for plant shutdown or decay heat removal are located in the areas where the handling systems are located.

2.1.2 Safe Load Paths [Guideline 1, NUREG-0612, Section 5.1.1(1)]

"Safe load paths should be defined for the movement of heavy loads to minimize the potential for heavy loads, if dropped, to impact irradiated fuel in the reactor vessel and in the spent fuel pool, or to impact safe shutdown equipment. The path should follow, to the extent practical,

structural floor members, beams, etc., such that if the load is dropped, the structure is more likely to withstand the impact. These load paths should be defined in procedures, shown on equipment layout drawings, and clearly marked on the floor in the area where the load is to be handled. Deviations from defined load paths should require written alternative procedures approved by the plant safety review committee."

a. Summary of Licensee Statements and Conclusions

All heavy loads have been tabulated with their respective written procedures (except for replacement of fuel racks). Safe load paths have been developed, identified in plant drawings, and included in plant procedures. The Licensee noted that loads are moved by the safest and shortest paths in accordance with the above procedures and drawings, and with due consideration to the avoidance of irradiated fuel and safety-related equipment. The procedures refer operational personnel to the applicable load path drawings which, with electrical interlocks, should prevent loads from being carried over the spent fuel and the reactor except during specific operations.

In lieu of marking the load path, the Licensee stated that Procedure MP-06 will be revised to require the signalman and crane operator to review and walk the path to the extent possible prior to load movement. In addition, deviations to approved load paths are reviewed in accordance with Technical Specification 6.5, and procedures will be revised to caution users that deviations must be performed in accordance with special procedures prepared by the Brunswick engineering staff.

b. Evaluation

The Licensee's response clearly states that load paths have been developed, defined in procedures (except for replacement of fuel storage racks), and incorporated into drawings which are in turn, included in appropriate procedures. Load paths have not been marked on the floors; however, the Licensee's decision to require the presence of a signalman who checks the path prior to movement is consistent with the intent of load path marking to provide visual aids for the crane operator.

In addition, the Licensee has provided information which verifies that deviations from established load paths will require written alternatives which must be reviewed and approved by the plant engineeering staff. Such an approach is consistent with the criteria of NUREG-0612.

c. Conclusion

Development and implementation of safe load paths at the Brunswick plant are consistent with Guideline 1 of NUREG-0612.

2.1.3 Load Handling Procedures [Guideline 2, NUREG-0612, Section 5.1.1(2)]

> "Procedures should be developed to cover load handling operations for heavy loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment. At a minimum, procedures should cover handling of those loads listed in Table 3-1 of NUREG-0612. These procedures should include: identification of required equipment; inspections and acceptance criteria required before movement of load; the steps and proper sequence to be followed in handling the load; defining the safe path; and other special precautions."

a. Summary of Licensee Statements and Conclusions

A detailed list of heavy loads and procedures governing the handling of each load has been supplied by the Licensee, who states that these procedures meet the intent of Section 5.1.1(2) of NUREG-0612 and generally include sections concerning purpose, responsibility, precautions, special equipment and descriptions, references, safe load paths, and step-by-step instructions.

b. Evaluation and Conclusion

Specific procedures identified by the Licensee for load handling in the reactor building have been developed in a manner consistent with Guideline 2.

2.1.4 Crane Operator Training [Guideline 3, NUREG-0612, Section 5.1.1(3)]

> "Crane operators should be trained, qualified, and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, 'Overhead and Gantry Cranes' [10]."

a. Summary of Licensee Statements and Conclusions

The Licensee stated that all crane operators are trained in accordance with the requirements of ANSI B30.2-1976 without exception, and that Brunswick plant crane operators are required to requalify annually. To qualify initially, crane operators are required to receive classroom instructions, gain practical operating experience, and pass a written and physical examination. In addition, the immediate supervisor of the crane operator and signalman is tasked with the responsibility of ensuring that these individuals conduct themselves in a manner consistent with applicable standards and procedures.

b. Evaluation

Programs for crane operators at the Brunswick plant satisfy the requirements of this guideline on the basis of the Licensee's verification that existing programs comply with ANSI B30.2-1976. In addition, programs exist to monitor operator conduct following qualification.

c. Conclusion

Training and qualification of crane operators at the Brunswick plant are conducted in accordance with the provisions of ANSI B30.2-1976 and Guideline 3 of NUREG-0612.

2.1.5 Special Lifting Devices [Guideline 4, NUREG-0612, Section 5.1.1(4)]

> "Special lifting devices should satisfy the guidelines of ANSI N14.6-1978, 'Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials' [11]. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants, certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is stress design factor on only the weight (static load) of the load and of the intervening components of the special handling device [NUREG-0612, Guideline 5.1.1(4)]."

a. Summary of Licensee Statements and Conclusions

The following special lifting devices have been identified by the Licensee for review in accordance with this guideline:

- o spent fuel cask yoke
- o shielded personnel work basket lifting apparatus
- o head strongback
- o dryer/separator sling
- o stud tensioner frame
- o invessel service platform strongback

These special lifting devices are handled by the reactor building crane and the intake structure crane, which have maximum speeds of 3 and 13 feet per minute, respectively. Therefore, based upon guidance contained in CMAA-70, maximum dynamic loads may be considered to be 1.5% and 6.5% and may be disregarded.

The special lifting devices that have been identified were designed with a minimum safety factor of 4.5 (yield strength) and 6 (ultimate strength). Values of design safety factors of the critical components of each device have been provided for review. Based upon present design, no modifications to accommodate current standards are planned.

The Licensee stated that the spent fuel cask yoke and the shielded personnel lifting apparatus are of redundant design and are lifted by a single-failure-proof crane; therefore, a load drop of equipment handled by these devices is not considered credible.

All special lifting devices have been load tested; the head strongback has been load tested to 142% (100 tons) of rated load, whereas the dryer/separator sling and the spent fuel cask yoke have been load tested to 200% of rated load. Remaining special lifting devices will be load tested in compliance with ANSI N.14.6-1978.

Regarding programs for assuring continuing compliance, the Licensee stated that programs are currently in place or will be fully implemented which satisfy Section 5 of ANSI N14.6-1978 with the following exception:

- For the spent fuel cask yoke and the shield personnel lifting apparatus, visual inspections required by Section 5.3.7 are performed prior to use due to infrequent usage.

b. Evaluation

Sufficient information has been provided by the Licensee to provide reasonable assurances of the design adequacy of the special lifting devices subject to compliance with NUREG-0612. It is agreed that dynamic loads are reasonably small and may be disregarded. Design safety factors identified in the Licensee's submittal are well in excess of those required by ANSI N14.6-1978.

Regarding load tests, the performance of load tests of all lifting devices substantially in excess of 100% of rated load is or will be sufficient to demonstrate fabrication practices and proof of workmanship of the assembled devices.

Programs that ensure continued compliance are also satisfactory based upon the Licensee's statements that programs are in place or will be developed which comply with Section 5 of ANSI N14.6-1978. The Licensee's proposal to perform inspections required by Section 5.3.7 on a prior-to-use basis is also consistent with this guideline.

c. Conclusion

Design of special lifting devices and programs to ensure their continued compliance at the Brunswick plant is consistent with the criteria of ANSI N14.6-1978 and NUREG-0612, Guideline 4.

2.1.6 Lifting Devices (Not Specially Designed) [Guideline 5, NUREG-0612, Section 5.1.1(5)]

"Lifting devices that are not specially designed should be installed and used in accordance with the guidelines of ANSI B30.9-1971, 'Slings' [12]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in terms of the 'static load' that produces the

maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

a. Summary of Licensee Statements and Conclusions

The Licensee stated that "non-special" lifting devices are in compliance with ANSI B30.9-1971 or other applicable standards; however, components were sized to maintain a minimum safety factor of 5, based on ultimate strength and with consideration for static load only.

In addition, the safe working load of all slings will be reduced by 15% to account for maximum dynamic loading and will be appropriately marked to so indicate. No other restrictions exist on crane use.

b. Evaluation and Conclusion

Selection and use of slings, including consideration of dynamic loading, are performed in a manner consistent with Guideline 5 of NUREG-0612.

2.1.7 Cranes (Inspection, Testing, and Maintenance) [Guideline 6, NUREG-0612, Section 5.1.1(6)]

"The crane should be inspected, tested and maintained in accordance with Chapter 2-2 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' with the exception that tests and inspections should be performed prior to use when it is not practical to meet the frequencies of ANSI B30.2 for periodic inspection and test, or where frequency of crane use is less than the specified inspection and test frequency (e.g., the polar crane inside a PWR containment may only be used every 12 to 18 months during refueling operations and is generally not accessible during power operation. ANSI B30.2, however, calls for certain inspections to be performed daily or monthly. For such cranes having limited usage, the inspections, tests, and maintenance should be performed prior to their use)."

a. Summary of Licensee Statements and Conclusions

CP&L stated that crane inspection, testing, and maintenance programs at the Brunswick plant comply with Chapter 2-2 of ANSI B30.2-1976, and with the Occupational Safety and Health Standards, Section 179, 29CFR, Part 1910.

b. Evaluation and Conclusion

The Brunswick plant satisfies the criteria of this guideline on the basis of the Licensee's verification that the crane inspection, testing, and maintenance programs comply with ANSI B30.2-1976.

2.1.8 Crane Design [Guideline 7, NUREG-0612, Section 5.1.(7)]

> "The crane should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, 'Overhead and Gantry Cranes, and of CMAA-70, 'Specifications for Electric Overhead Traveling Cranes' [13]. An alternative to a specification in ANSI B30.2 or CMAA-70 may be accepted in lieu of specific compliance if the intent of the specification is satisfied."

a. Summary of Licensee Statements and Conclusions

CP&L stated that all cranes and hoists used at the Brunswick plant (except the refueling bridge) were purchased in accordance with United Engineers specifications as follows:

1. The reactor building overhead cranes' 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 reactor building crane is of single-failure-proof design. The Licensee states that details of crane design were provided to the NRC by letters dated June 18, 1976 [14] and July 26, 1976 [15].

3. The intake structure crane's 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."

4. The refueling jib crane's specification requires 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 will not result in a loss of control of load."

5. The remainder of cranes and hoists (except the refueling bridge) were purchased in accordance with specifications which require that the hoist 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. All equipment shall be secured in such a manner as not to fall during a seismic reaction while in an unloaded condition."

b. Evaluation

Cranes and hoists at the Brunswick plant satisfy the criteria of Guideline 7 on the basis that they were specified to conform to ANSI B30.2, CMAA-70, and other equivalent standards (refueling jib crane).

c. Conclusion

Design of cranes at the Brunswick plant is consistent with Guideline 7 on the basis of the Licensee's stated compliance with CMAA-70 and equivalent standards.

2.2 INTERIM PROTECTION MEASURES

The NRC has established six interim protection measures to be implemented at operating nuclear power plants to provide reasonable assurance that no heavy loads will be handled over the spent fuel pool and that measures exist to reduce the potential for accidental load drops to impact on fuel in the core or spent fuel pool. Four of the six interim measures of the report consist of Guideline 1, Safe Load Paths; Guideline 2, Load Handling Procedures; Guideline 3, Crane Operator Training; and Guideline 6, Cranes (Inspection, Testing, and Maintenance). The two remaining interim measures cover the following criteria:

1. Heavy load technical specifications
2. Special review for heavy loads handled over the core.

Licensee implementation and evaluation of these interim protection measures are contained in the succeeding paragraphs of this section.

2.2.1 Technical Specifications [Interim Protection Measure 1, NUREG-0612, Section 5.3(1)]

"Licenses for all operating reactors not having a single-failure-proof overhead crane in the fuel storage pool area should be revised to include a specification comparable to Standard Technical Specification 3.9.7, 'Crane Travel - Spent Fuel Storage Building,' for PWR's and Standard Technical Specification 3.9.6.2, 'Crane Travel,' for BWR's, to prohibit handling of heavy loads over fuel in the storage pool until implementation of measures which satisfy the guidelines of Section 5.1."

b. Evaluation, Conclusions, and Recommendations

The Brunswick plant complies with Interim Protection Measure 1 on the basis that the reactor building crane is an approved single-failure-proof crane.

2.2.2 Administrative Controls [Interim Protection Measures 2, 3, 4, and 5, NUREG-0612, Sections 5.3(2)-5.3(5)]

"Procedural or administrative measures [including safe load paths, load handling procedures, crane operator training, and crane inspection]... can be accomplished in a short time period and need not be delayed for completion of evaluations and modifications to satisfy the guidelines of Section 5.1 [of NUREG-0612]."

a. Evaluation

The specific requirements for load handling administrative controls are contained in NUREG-0612, Section 5.1.1, Guidelines 1, 2, 3, and 6. The Licensee's compliance with these guidelines has been evaluated in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7, respectively, of this report.

b. Conclusions and Recommendations

Conclusions and recommendations concerning the Licensee's compliance with these administrative controls are contained in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7 of this report.

2.2.3 Special Review for Heavy Loads Handled Over the Core [Interim Protection Measure 6, NUREG-0612, Section 5.3(6)]

"...special attention should be given to procedures, equipment, and personnel for the handling of heavy loads over the core, such as vessel internals or vessel inspection tools. This special review should include the following for these loads: (1) review of procedures for installation of rigging or lifting devices and movement of the load to assure that sufficient detail is provided and that instructions are clear and concise; (2) visual inspections of load bearing components of cranes, slings, and special lifting devices to identify flaws or deficiencies that could lead to failure of the component; (3) appropriate repair and replacement of defective components; and (4) verify that the crane operators have been properly trained and are familiar with specific procedures used in handling these loads, e.g., hand signals, conduct of operation, and content of procedures."

a. Summary of Licensee Statements and Conclusions

Interim actions identified in Reference 3 were implemented at the Brunswick plant in May 1981. A review of procedures was performed and the results were documented. Minor revisions were made for inclusion of and/or reference to load paths, lifting device inspections, training and qualification of operators, and repair and replacement of defective components.

b. Evaluation and Conclusion

Interim measures performed by the Licensee are in accordance with Interim Protection Measure 6.

3. CONCLUSION

This summary is provided to consolidate the results of the evaluation contained in Section 2 concerning individual NRC staff guidelines into an overall evaluation of heavy load handling at Brunswick Steam Electric Plant Units 1 and 2. Overall conclusions and recommended Licensee actions, where appropriate, are provided with respect to both general provisions for load handling (NUREG-0612, Section 5.1.1) and completion of the staff recommendations for interim protection (NUREG-0612, Section 5.3).

3.1 GENERAL PROVISIONS FOR LOAD HANDLING

The NRC staff has established seven guidelines concerning provisions for handling heavy loads in the area of the reactor vessel, near stored spent fuel, or in other areas where an accidental load drop could damage equipment required for safe shutdown or decay heat removal. The intent of these guidelines is twofold. A plant conforming to these guidelines will have developed and implemented, through procedures and operator training, safe load travel paths such that, to the maximum extent practical, heavy loads are not carried over or near irradiated fuel or safe shutdown equipment. A plant conforming to these guidelines will also have provided sufficient operator training, handling system design, load handling instructions, and equipment inspection to ensure reliable operation of the handling system. As detailed in Section 2, it has been found that load handling operations at Brunswick Units 1 and 2 can be expected to be conducted in a highly reliable manner consistent with the staff's objectives as expressed in these guidelines.

3.2 INTERIM PROTECTION

The NRC staff has established (NUREG-0612, Section 5.3) certain measures that should be initiated to provide reasonable assurance that handling of heavy loads will be performed in a safe manner until final implementation of the general guidelines of NUREG-0612, Section 5.1 is complete. Specified measures include the implementation of a technical specification to prohibit the

handling of heavy loads over fuel in the storage pool; compliance with Guidelines 1, 2, 3, and 6 of NUREG-0612, Section 5.1.1; a review of load handling procedures and operator training; and a visual inspection program, including component repair or replacement as necessary of cranes, slings, and special lifting devices to eliminate deficiencies that could lead to component failure. Evaluation of information provided indicates that the Licensee has satisfactorily complied with the interim protection measures at the Brunswick plant.

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