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TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

ROCHESTER GAS AND ELECTRIC CORPORATION
ROBERT E. GINNA NUCLEAR POWER PLANT

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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. T. Hofkin 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 Rochester Gas and Electric Corporation's (RG&E) Robert E. Ginna Nuclear Power 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 ensure 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.

The approach used to develop the staff guidelines for minimizing the potential for a load drop was based on defense-in-depth, and the intent of the guidelines is to ensure that licensees of all operating nuclear power plants perform the following:

1. provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to ensure reliable operation of the handling system

2. 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

3. provide mechanical stops or electrical interlocks to prevent movement of heavy loads over irradiated fuel or in proximity to equipment associated with redundant shutdown paths.

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 RG&E, the Licensee for R. E. Ginna Nuclear Power Plant, requesting that the Licensee review provisions for handling and control of heavy loads at the Ginna plant, evaluate

these 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. On February 1, 1982, RG&E responded [4] to this request.

2. EVALUATION AND RECOMMENDATIONS

The evaluation of load handling at the Ginna plant is divided into two categories. These categories deal separately with the general guidelines of Section 5.1.1 and the recommended interim measures of Section 5.3 of NUREG-0612. Applicable guidelines are referenced in each category. Conclusions and recommendations are provided in the summary for each guideline.

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:

- o Guideline 1 - Safe Load Paths
- o Guideline 2 - Load Handling Procedures
- o Guideline 3 - Crane Operator Training
- o Guideline 4 - Special Lifting Devices
- o Guideline 5 - Lifting Devices (Not Specially Designed)
- o Guideline 6 - Cranes (Inspection, Testing, and Maintenance)
- o 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 evaluation of this verification, are contained in the succeeding paragraphs.

2.1.1 Overhead Heavy Load Handling Systems

a. Summary of Licensee Statements and Conclusions

The Licensee stated in the review of overhead handling systems that all cranes, jibs, and monorails are subject to the criteria of NUREG-0612, with the exception of those excluded from compliance by the existence of a redundant system and administrative procedures.

b. Evaluation

As discussed in Section 1.2, the NRC objective is to achieve a defense-in-depth approach for the handling of heavy loads, which is to be accomplished in two distinct phases:

> First phase: Overall improvement of procedures, training, maintenance of cranes and lifting devices, as well as establishment of safe travel paths which avoid irradiated fuel and safe shutdown equipment, as means to assure reliable operation of handling systems.
>
> Second phase: Implementation of additional safeguards by satisfying single-failure-proof crane criteria; or installation of mechanical or electrical interlocks; or performance of analyses that substantiate the Licensee's contention that damage to irradiated fuel will not exceed limits for criticality or release of radioactivity, or that damage to dual safe shutdown systems will not result in a loss of required safety functions.

The intent of the first phase of NUREG-0612 implementation is to ensure that all handling devices operating with heavy loads in the vicinity of irradiated fuel or safe shutdown equipment meet the requirements of the general guidelines, including satisfying the criteria for lifting device and crane design, operation, and maintenance, and development of safe load pathways. Section 5.1.1 of NUREG-0612 provides general guidelines for safe load handling to reduce the potential for load drops. These guidelines must be satisfied even if a single-failure-proof crane is provided or evaluations show that the consequences of postulated load drops are within established limits. In addition, these guidelines must be satisfied for the load-handling systems identified by the Licensee regardless of the fact that detailed structural analyses, interlocks, operating procedures, technical specifications, or physical separation of redundant equipment may indicate that a system safety function could continue following a load-handling accident. The only load-handling systems that can be excluded from the general guidelines of NUREG-0612 are those for which it can be demonstrated that (1) adequate physical separation is provided between the load path and safety-related equipment or irradiated fuel; (2) the capacity of the crane is not sufficient to lift a NUREG-0612-defined heavy load and thus the crane could not be used to lift a heavy load; or (3) the handling device has a sole-purpose lift function and a load drop would damage only the lifted equipment.

c. Conclusions and Recommendations

The Licensee should identify overhead handling systems excluded from compliance with NUREG-0612 and verify that such exclusion was based on one or more of the following:

1. No safety-related equipment or irradiated fuel is located in close proximity or sufficient physical separation exists.

2. The systems are sole-purpose systems and are used only when the equipment is out of service.

3. Heavy loads are not carried by the excluded system.

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

The Licensee stated that, for all monorail and jib overhead handling systems, safe load paths are limited by the physical capabilities of the system itself. For the 100/20-ton containment crane, the 40/5-ton auxiliary building crane, and the 7.5-ton screenhouse crane, plant operating procedure A-1305 addresses safe lifting procedures. In addition, the Licensee stated that some systems are eliminated from the scope of Guideline 1 by the existence of one or more redundant safety trains.

b. Evaluation

The Licensee's response regarding monorails and jib cranes is satisfactory, since these devices are limited by the physical capabilities of the respective

systems. Elimination of handling systems due to redundant safety trains, however, does not meet the intent of Guideline 1.

Review of operating procedure A-1305 indicates that safe load paths have not been marked on the floors, although some paths have been sketched on equipment layout drawings and several are defined in procedures. In lieu of permanent markings on the floor, the Licensee may consider alternatives which meet the intent of NRC criteria by providing suitable visual aids, such as tape, temporary stanchions or markers, or other equivalent measures to assist the operator.

No information has been provided by the Licensee to verify that deviations from established load paths require written alternatives that must be approved by the plant safety review committee.

c. Conclusion and Recommendations

The Licensee partially complies with Guideline 1 for the Ginna plant. In order to comply fully with the criteria of this guideline, the Licensee should perform the following:

1. Provide suitable visual aids to assist the crane operator in the areas where loads are handled by all equipment that is not excluded from compliance with NUREG-0612, as specified in 2.1.1.c.

2. Define all safe load paths in procedures.

3. Incorporate safe load paths into equipment layout drawings.

4. Verify that deviations from established load paths require written alternatives to be approved by the plant safety review committee.

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 loads and procedures governing the handling of each load, as well as a list of the required equipment for each load movement, has been supplied by the Licensee.

b. Evaluation

The procedures supplied by the Licensee are very general and do not include the necessary information specified by this guideline, such as inspection and acceptance criteria required before movement of a load, the steps and proper sequence to be followed in handling the load, and a full description of the safe load path.

c. Conclusion and Recommendation

The Ginna plant does not comply with Guideline 2. Load-handling procedures should clearly identify inspection and acceptance criteria, steps, and proper sequence, and clearly define the safe load paths for the various heavy loads listed.

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' [5]."

a. Summary of Licensee Statements and Conclusions

The Licensee stated that operators are trained and qualified in accordance with ANSI B30.2-1976 without exception.

b. Evaluation

Since the Licensee will train operators in accordance with ANSI B30.2-1976, Chapter 2-3, it can be expected that they will conduct operations in accordance with the requirements of that chapter.

c. Conclusion and Recommendation

RG&E complies with this guideline.

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' [6]. 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 Licensee stated that special lifting devices are to undergo a comparison analysis to determine the extent of compliance with ANSI N14.6-1978.

b. Evaluation

Insufficient information has been provided by RG&E to determine compliance with Guideline 4. Since it is difficult to strictly interpret compliance of existing special lifting device design with the criteria of ANSI N14.6-1978, the information in the succeeding paragraphs is provided to assist the Licensee in detemining the extent of compliance.

Since several sections of ANSI 14.6-1978 do not contain requirements concerning load-handling reliability, it is necessary to address only those sections of ANSI N14.6-1978 that are directly related to load-handling reliability of the lifting devices. Therefore, the following sections need not be addressed by the Licensee: Scope (Section 1), Definitions (2), Design Considerations to Minimize Decontamination Efforts (3.4), Coatings (3.5), Lubrication (3.6), Inspector's Responsibilities (4.2), and Fabrication Considerations (4.3).

c. Conclusion and Recommendation

RG&E complies with this guideline.

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' [6]. 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 Licensee stated that special lifting devices are to undergo a comparison analysis to determine the extent of compliance with ANSI N14.6-1978.

b. Evaluation

Insufficient information has been provided by RG&E to determine compliance with Guideline 4. Since it is difficult to strictly interpret compliance of existing special lifting device design with the criteria of ANSI N14.6-1978, the information in the succeeding paragraphs is provided to assist the Licensee in detemining the extent of compliance.

Since several sections of ANSI 14.6-1978 do not contain requirements concerning load-handling reliability, it is necessary to address only those sections of ANSI N14.6-1978 that are directly related to load-handling reliability of the lifting devices. Therefore, the following sections need not be addressed by the Licensee: Scope (Section 1), Definitions (2), Design Considerations to Minimize Decontamination Efforts (3.4), Coatings (3.5), Lubrication (3.6), Inspector's Responsibilities (4.2), and Fabrication Considerations (4.3).

Other sections, however, identify important information that should be readily available or requirements to which the Licensee should adhere in order to adequately substantiate the load-handling reliability of the special lifting devices. Although this standard did not exist when lifting devices were designed and manufactured, it is not anticipated that obtaining information or complying with the standard's requirements will create undue hardship, since the criteria of the standard are akin to established industry practices; this standard merely codifies such practices for special lifting devices. These special lifting devices are used for infrequent lifts of the plant's largest components, generally in the direct vicinity of irradiated fuel; this makes the reliability of design, fabrication, and continued testing of those special lifting devices a relatively sensitive concern for both the Licensee and the NRC.

A determination of compliance with Guideline 4 requires that the following specific sections of ANSI N14.6 be addressed:

Section 3.1:
- a. limitations on the use of the lifting devices (3.1.1)
- b. identification of critical components and definition of critical characteristics (3.1.2)
- c. signed stress analyses which demonstrate appropriate margins of safety (3.1.3)
- d. indication of permissible repair procedures (3.1.4)

Section 3.2:
- a. use of stress design factors of 3 for minimum yield strength and 5 for ultimate strength (3.2.1)
- b. similar stress design factors for load bearing pins, links, and adapters (3.2.4)
- c. slings used comply with ANSI B30.9-1971 (3.2.5)
- d. subjecting materials to dead weight testing or Charpy impact testing (3.2.6)

Section 3.3:
- a. consideration of problems related to possible lamellar tearing (3.3.1)
- b. design shall assure even distribution of the load (3.3.4)
- c. retainers fitted for load carrying components which may become inadvertently disengaged (3.3.5)
- d. verification that remote actuating mechanisms securely engage or disengage (3.3.6)

Section 4.1:

a. verify selection and use of material (4.1.3)
b. compliance with fabrication practices (4.1.4)
c. qualification of welders, procedures, and operators (4.1.5)
d. provisions for a quality assurance program (4.1.6)
e. provisions for identification and certification of equipment (4.1.7).
f. verification that materials or services are produced under appropriate controls and qualifications (4.1.9).

Section 5.1:

a. implementation of a periodic testing schedule and a system to indicate the date of expiration (5.1.3)
b. provisions for establishing operating procedures (5.1.4)
c. identification of subassemblies which may be exchanged (5.1.5)
d. suitable markings (5.1.6)
e. maintaining a full record of history (5.1.7)
f. conditions for removal from service (5.1.8)

Section 5.2:

a. load test to 150% and appropriate inspections prior to initial use (5.2.1)
b. qualification of replacement parts (5.2.2)

Section 5.3:

a. satisfying annual load test or inspection requirements (5.3.1)
b. testing following major maintenance (5.3.2)
c. testing after application of substantial stresses (5.3.4)
d. inspections by operating (5.3.6) and non-operating or maintenance personnel (5.3.7).

c. Conclusion and Recommendation

A conclusion regarding compliance with this guideline must be deferred until the Licensee completes the analysis of their special lifting devices. However, this analysis should address the specific items identified in this independent evaluation.

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' [7]. 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 inspection of wire rope and nylon slings is governed by RG&E operating procedure MHE-1000-1. This procedure defines proper sling use and the inspection requirements which determine when slings are to be removed from service.

b. Evaluation

Insufficient information has been provided by RG&E to determine compliance with Guideline 5. No information has been provided to verify that sling use will comply with the guidelines of ANSI B30.9-1971. No information is available to determine whether dynamic loads have been considered as noted in the guideline.

c. Conclusion and Recommendations

Determination of compliance with Guideline 6 must be deferred until RG&E provides specific information concerning:

1. Installation and use of slings (in accordance with ANSI B30.9-1971)
2. Selection of slings (based upon the sum of the static and maximum dynamic loads)
3. Sling marking and sling restrictions, where appropriate.

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

The Licensee stated that procedures for inspection, testing, and maintenance of certain jibs and cranes meet the intent of Chapter 2-2 of ANSI B30.2-1976, with the exception of 1) operational testing, 2) rated load test and documentation, 3) written maintenance procedures, and 4) written procedures for adjustments and repairs. The Licensee has stated that procedures will be developed and incorporated into the inspection, testing, and maintenance programs to satisfy ANSI B30.2-1976 for exceptions 1, 3, and 4.

Regarding exception 2 (rate load tests and documentation), the Licensee stated that the auxiliary building crane was not load-tested prior to initial use. It was, however, load-tested prior to a spent fuel cask lift in 1973. This crane has not been significantly altered or repaired.

The containment crane was significantly altered during construction. After the modifications were complete, the crane was tested; however, no documentation of this test is available. The crane has safely lifted the lower internals (approximately 98 tons).

b. Evaluation

The requirements of this guideline will be substantially satisfied at the Ginna plant when operational tests, written maintenance procedures, and a written procedure for adjustments and repairs are developed and incorporated into plant procedures to comply with criteria of ANSI B30.2-1976, Chapter 2-2 for all equipment that was not excluded from compliance with NUREG-0612.

It is noted that a rated load test is not required by ANSI B30.2-1976, although it is recommended. In the case of the containment crane, the fact that it has been used to lift the lower internals provides a degree of assurance equivalent to that provided by the rated load test for the routine lifts of less than 40 tons. The upper internals lift can be considered, on the basis of frequency, to be similar to a special lift as outlined in ANSI B30.2-1776, Section 2-3.2.1.1, for which a rated load test is not required. In the case of the auxiliary building crane, a rated load test has been

conducted although the Licensee has not specified the test load or the relationsnip of the current rating to that test load. Considering the foregoing, no further action is considered necessary with respect to rated load testing.

c. Conclusion and Recommendations

The Ginna plant will comply with Guideline 6 upon implementation of proposed revisions to inspection, testing, and maintenance programs.

2.1.8 Crane Design [Guideline 7, NUREG-0612, Section 5.1.1(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 Travelling Cranes' [8]. 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

The Licensee stated that both the containment building and the auxiliary building cranes were designed and built prior to the issuance of CMAA-70. Both cranes have undergone a mechanical and structural design comparison between their original design specification, EOC1-61, and CMAA-70. The results of this comparison, performed by the Whiting Corporation, identified the following as the only items associated with the containment building crane that are not in compliance with CMAA-70:

1. The sheave material is currently ASTM Grade A48-41 Class 35 cast iron, while CMAA-70 requires that sheaves be made of steel or ASTM grade A48-64 Class 40 cast iron.
2. Tne extra reduction gear durability rating is exceeded by 30%.
3. The auxiliary hoist motor horsepower and torque rating is exceeded by 4.3%.
4. The allowable wheel load is exceeded by 1%.
5. The longitudinal stiffener is not properly located and does not meet moment of inertia requirement.

6. The bridge end truck drop due to axle failure is 1.875 inches while the maximum drop allowed by CMAA-70 is 1 inch.

Regarding the auxiliary building crane, the Whiting comparison stated that, in general, the crane meets the present CMAA-70 specifications, with the following exceptions:

1. The platform requires reinforcement of the toe plate to satisfy CMAA-70.

2. The sheaves and shaft couplings are made of Class 30 cast iron, while CMAA-70 requires use of Class 40 cast iron.

In addition, several other discrepancies were noted between the requirements of ANSI B30.2-1976 and the actual design of the auxiliary building crane, including lubricating points, footwalks, clearances, resistors, hooks, and warning devices.

b. Evaluation

The cranes at the Ginna plant substantially satisfy the criteria of this guideline on the basis that they were procured to EOCI-61 specifications, and a subsequent comparison with requirements of CMAA-70 has identified few discrepancies.

For the sheaves and shaft couplings of both cranes, CMAA-70 specifies that the material should be steel or ASTM Grade A48-64 or later, Class 40 cast iron or its equivalent. The specification in CMAA-70 of a later, higher tensile strength material for the sheaves and coupling is similar to the specification of ASTM A-36 in lieu of A-7 structural material and represents recognition of industrial progress in the area of material properties. The use of a similar but lower tensile strength material, of composition based on ASTM standards and with appropriate properties used for design calculations, is judged to result in crane components or structures with overall factors-of-safety and consequent load-handling reliability equivalent to that produced with higher tensile strength material.

Current design of the containment building crane's auxiliary hoist motor, and allowable wheel loading meet the intent of this guideline since variations

associated with these items are nominal. In addition, present design of the bridge end truck meets the intent of CMAA-70 and EOC1-61 to prevent an excessive drop of the crane, thereby minimizing the effects of a drop due to axle failure.

Although not in verbatim compliance with CMAA-70 requirements concerning location and moment of inertia, the use of longitudinal stiffeners in the containment building crane is judged to meet the intent of this guideline. Longitudinal stiffeners are used, in conjunction with transverse stiffeners or diaphragms, to allow the use of thin web plates (i.e., web plates with large h/t ratios where h = web depth, and t = web thickness.) CMAA-70 allows for h/t ratios of up to 188 for girders with no longitudinal stiffener, and of up to 376 for girders with a single longitudinal stiffener. Were such a single stiffener used in the Ginna containment crane, a moment of inertia about the web face of approximately 1.8 in^4 would be required. The Ginna design employs two longitudinal stiffeners, each with a moment of inertia of approximately 0.46 in^4 about the web face, in conjunction with a web h/t ratio of 236. Although judged to meet the intent of this guideline, the Licensee should provide suitable documentation to justify the location and moment of inertia of the installed stiffeners.

In the case of the reduction gear durability rating, it appears that, although identified as a deficiency by the Licensee, the requirements of CMAA-70 may also be satisfied. As noted in the Licensee's submittal, the current gear durability is rated at 37.3 hp. Informal discussions conducted with the Licensee indicate that the main hoist motor has been replaced with a 5-hp motor. According to CMAA-70, Section 4.5.3, the actual horsepower imposed on the gearing should be considered to be the rated horsepower of the hoist motor (5-hp) multiplied by a factor of 0.75 (assuming Service Class A-1). This value (3.75-hp) is considerably less than the allowed durability calculated by the Licensee (37.3-hp) and therefore satisfies the requirements of this guideline.

The auxiliary building crane satisfies the criteria of this guideline on the basis of the satisfactory comparison by Whiting Corporation. Discrepan-

cies noted with ANSI B30.2-1976 are not of consequence to the load-handling reliability of this crane.

c. Conclusion

The Ginna auxiliary building crane complies with Guideline 7. The reactor building crane substantially complies with this guideline; however, the Licensee should be ready to provide suitable documentation to justify the location and moment of inertia of the actual longitudinal stiffeners.

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 [of NUREG-0612]."

a. Evaluation

A review of the Licensee's technical specifications indicates that two specifications currently restrict movements of loads and handling systems over the spent fuel pool. Technical Specification 3.11.3 prohibits movement of the auxiliary building crane trolley over spent fuel in the spent fuel pool storage racks. Technical Specification 3.11.6 prohibits movement of the spent fuel shipping cask by the auxiliary building crane pending completion of the spent fuel cask drop analysis and a review of crane design to determine single-failure-proofness. Although it appears that these specifications prohibit the movement of loads over irradiated fuel in the spent fuel pool, the Licensee should verify this fact or modify the current specifications to prohibit movement of all heavy loads over irradiated fuel in the spent fuel area.

b. Conclusion and Recommendations

Insufficient information has been provided to clearly determine compliance with this interim measure. The Licensee should review and determine whether current technical specifications meet the intent of this guideline.

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. Evaluation, Conclusion, and Recommendations

The Licensee has made no statements or conclusions regarding this interim protection measure. The Licensee should report the completion of the special review identified in this interim measure.

3. CONCLUDING SUMMARY

This summary is provided to consolidate the conclusions and recommendations of Section 2 and to document the overall evaluation of the nandling of heavy loads at the Robert E. Ginna Nuclear Power Plant. It is divided into two sections, one dealing with general provisions for load handling at nuclear power plants (NUREG-0612, Section 5.1.1) and the other with staff recommendations for interim protection, pending complete implementation of the guidelines of NUREG-0612 (NUREG-0612, Section 5.3). In each case, recommendations are made for additional Licensee action and, where appropriate, for additional NRC staff action.

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 safe shutdown systems. Compliance with these guidelines is necessary to ensure that load-handling system design, administrative controls, and operator training and qualification are such that the possibility of a load drop is appropriately small for the critical functions and potential consequences of failures of cranes at nuclear power plants. These guidelines are partially satisfied at the Ginna Nuclear Power Plant. This conclusion is presented in tabular form as Table 3.1. Specific recommendations for achieving full compliance with these guidelines are provided as follows:

Guideline	Recommendations
1	a. Clearly mark safe load paths using suitable visual aids.
	b. Define safe load paths in procedures.
	c. Clearly show safe load paths on equipment layout drawings.
	d. Verify that deviations from established load paths require written alternatives that are approved by the plant safety review committee.

Table 3.1 Ginna 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. CTMT Building Jib	10	--	--	C	--	--	R	R	--	I
PZR Hatch Covers and Sling Assembly	4.8	P	N	--	I	N	--	--	--	I
2. CTMT Building Crane	100/20	--	--	C	--	--	R	R	--	I
RCP Parts and Sling Assembly	7.1	P	N	--	I	N	--	--	--	I
Upper Intervals and Lifting Fixture	27.5	P	N	--	I	N	--	--	--	I
RPV Head and Lifting Fixture	37.5	P	N	--	I	N	--	--	--	I
Lower Internals and Lifting Fixture	94.5	P	N	--	I	N	--	--	--	I
Floor Sections and Sling Assembly	9.8	P	N	--	I	N	--	--	--	I
RCP Motor and Lifting Fixture	30	P	N	--	I	N	--	--	--	I

C = Licensee actions comply with NUREG-0612 Guidelines.
N = Licensee actions do not comply with NUREG-0612 Guidelines.
R = Licensee has proposed revisions/modifications designed to comply with NUREG-0612 Guidelines.
I = Insufficient information provided by the Licensee.
P = Licensee information indicates partial compliance.
-- = Not applicable.

Table 3.1 (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
3. Auxiliary Building Crane	40/5	--	--	C	--	--	R	C	I	--
RHR Pumps and Sling Assembly	2.3	P	N	--	I	N	--	--	--	--
Component Cooling Pumps and Sling Assembly	1.2	P	N	--	I	N	--	--	--	--
Removable Floor and Sling Assembly	2.4	P	N	--	I	N	--	--	I	--
New Fuel Shipping Cask and Sling Assembly	3.25	P	N	--	I	N	--	--	I	--
Transfer Canal Gate and Sling Assembly	0.9	P	N	--	I	N	--	--	I	--
4. Screenhouse Crane	7.5	--	--	C	--	--	R	C	--	--
Service Water Pump	2.2	P	N	--	--	N	--	--	--	--
SW Pump Motor	1.2	P	N	--	--	N	--	--	--	--
Fire Pump Motor	1.2	P	N	--	--	N	--	--	--	--
SWP Check Valves	1.3	P	N	--	--	N	--	--	--	--
SWP Isolation Valves	0.5	P	N	--	--	N	--	--	--	--

Guideline		Recommendations
2		Verify compliance with guideline requirements.
3		(The Ginna plant complies with this guideline.)
4	a.	Review actual design and fabrication of all special lifting devices and evaluate all differences with respect to the requirements of ANSI N14.6-1978 and the stress design factor of this guideline.
	b.	Verify the existence of programs that satisfy the requirements of Section 5 of ANSI N14.6-1978 for all special lifting devices.
5	a.	Verify that slings are installed and used in accordance with the guidelines of ANSI B30.9-1971.
	b.	Verify that selection of slings includes consideration of the maximum dynamic loads, including suitable markings; slings restricted to use on only certain cranes should be marked to so indicate.
6		The Ginna plant will comply with this guideline when appropriate revisions have been implemented.
7		(The Ginna plant complies with this guideline.)

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. Specific 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 by the Licensee indicates that

the following actions are necessary to ensure that the staff's measures for interim protection at the Ginna plant are taken:

Interim Measure	Recommendation
1	Verify that plant technical specifications prohibit movement of heavy loads over the spent fuel pool or implement the technical specification identified in the interim protection measure.
2,3,5	Implement the recommendations concerning Guidelines 1, 2, and 6 identified in Section 3.1.
4	(The Ginna plant complies with this interim protection measure.)
6	Complete the special review of procedures, equipment, and personnel qualifications for the handling of heavy loads over the core.

3.3 SUMMARY

The NRC's general guidelines and interim protection measures established in NUREG-0612 have not been fully satisfied at RG&E's Ginna plant. The Licensee's response indicates compliance with crane operator training and qualification requirements, and crane design. Guidelines for safe load paths, and crane inspection, testing and maintenance require few items to be resolved for full compliance. Several items, however, must be resolved before compliance can be determined for load-handling procedures, and for special and non-special lifting devices. Licensee action is also required for compliance with the interim protection measures.

4. REFERENCES

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