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TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

CAROLINA POWER AND LIGHT COMPANY

H. B. ROBINSON UNIT 2

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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. 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) H. B. Robinson Unit 2. 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 USNRC 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 USNRC 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 for the control 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 portion 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 portion 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 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 ensure 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 Carolina Power and Light Company (CP&L), the Licensee for H. B. Robinson Unit 2, requesting that the Licensee review provisions for handling and control of heavy loads at Robinson Unit 2, 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 August 12, 1981, CP&L responded to this request [4]. Based on this information, a draft technical evaluation report (TER) was prepared and informally transmitted to the Licensee for review and comment. On July 1, 1982, a telephone conference call was held between the NRC and CP&L to discuss the draft TER. In response to this telephone call, CP&L provided additional information on December 15, 1982 [5], which has been incorporated into this final technical evaluation.

2. EVALUATION

This section presents a point-by-point evaluation of load handling provisions at H. B. Robinson Unit 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:

- 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 for all overhead handling systems and programs in order 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 the evaluation of that verification are contained in the succeeding paragraphs.

Table 2.1. Robinson Unit 2/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. Containment Polar Crane	115	--	--	C	--	--	C	C	--	--
a. Reactor Vessel Head	57.4	C	C	--	C	--	--	--	--	C
b. Upper Internals	42.7	C	C	--	C	--	--	--	--	C
c. ISI Tool	5	C	C	--	C	--	--	--	--	C
d. RCP Motor	34.3	C	C	--	--	C	--	--	--	--
e. RCP Internals	21	C	C	--	--	C	--	--	--	--
f. Stud Tensioners	1	C	C	--	--	C	--	--	--	--
g. Studs	0.4	C	C	--	--	C	--	--	--	--
h. Studs and Stud Rack	2.5	C	C	--	--	C	--	--	--	--
i. Head Storage Hatch Cover	25	C	C	--	--	C	--	--	--	--
j. Pump Bay Hatch Cover	42.5	C	C	--	--	C	--	--	--	--

C = Licensee action complies with NUREG-0612 Guideline.
P = Licensee action partially complies with NUREG-0612 Guidelines.
-- = 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
k. Pzr. Cover	40	C	C	--	--	C	--	--	--	--
l. Seal Table	11	C	C	--	--	C	--	--	--	--
m. Missile Shield	46.5	C	C	--	--	C	--	--	--	--
n. Missile Shield Frame	28.5	C	C	--	--	C	--	--	--	--
o. Guide Studs	0.75	C	C	--	--	C	--	--	--	--
p. Air Recir. Fan Motor	1.9	C	C	--	--	C	--	--	--	--
2. Spent Fuel Cask Handling Crane (FHB)	125	--	--	C	--	--	C	C	--	--
a. Spent Fuel Cask	7.0	C	C	--	C	--	--	--	C	--
b. Fuel Gates	5.25	C	C	--	--	C	--	--	C	--
c. Removable Siding	1.5	C	C	--	--	C	--	--	C	--
d. Fuel Storage Racks	13	C	C	--	--	C	--	--	C	--
3. Residual Heat Removal Monorail Hoist	6	--	--	C	--	--	C	--	--	--
a. RHR Pumps	1.2	C	C	--	--	C	--	--	--	--
b. RHR Motors	1.2	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
4. Monorail Hoist (Boric Acid Batch Room)	2	--	--	C	--	--	C	--	--	--
a. Bulk Boric Acid and Misc. Equip.	1.5	C	C	--	--	C	--	--	--	--
5. Solid Waste Handling Crane	5	--	--	C	--	--	C	P	--	--
a. Drummed Waste	<5	C	C	--	--	C	--	--	--	--
6. Turbine Building Crane	145	--	--	C	--	--	C	C	--	--
a. HP Turbine Cover	85	C	C	--	P	C	--	--	--	--
b. HP Rotor	55	C	C	--	P	C	--	--	--	--
c. Nos. 1 & 2 LP Turbine Outer Cover	70	C	C	--	P	C	--	--	--	--
d. LP Inner Cover #2	57.5	C	C	--	P	C	--	--	--	--
e. LP Inner Cover #1	28	C	C	--	P	C	--	--	--	--
f. LP Rotor	100	C	C	--	P	C	--	--	--	--
g. Generator Rotor	144	C	C	--	P	C	--	--	--	--

2.1.1 NUREG-0612, Heavy Load Overhead Handling System

a. Summary of Licensee Statements and Conclusions

The Licensee's review of overhead handling systems from which a load drop may result in damage to any system required for plant shutdown or decay heat removal identified the following load handling systems to be subject to the general guidelines of NUREG-0612:

- o containment polar crane
- o spent fuel cask handling crane (fuel handling building)
- o residual heat removal monorail and hoist (auxiliary building)
- o boric acid batch room monorail and hoist (auxiliary building)
- o solid waste handling crane (auxiliary building)
- o turbine building crane.

The following load handling systems have been excluded from the general guidelines of NUREG-0612 by verification that there is sufficient physical separation between any load impact point and 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:

- o new fuel handling crane
- o hot machine shop bridge crane.

In addition, the following load handling systems have been excluded from the general guidelines of NUREG-0612 because system capacity/load weight is less than the defined heavy load weight according to Section 1.1 of NUREG-0612:

- o containment manipulator crane
- o monorail and three hoist assembly (underside of head lift rig)
- o spent fuel pool movable bridge
- o new fuel element monorail and hoist
- o spent fuel pool filter monorail and hoist.

The Licensee provided additional information to support the exclusion of the 2-ton, manually operated, spent fuel pool filter monorail and hoist located directly over the filter it services, on the basis that: (1) it handles no

heavy load; (2) its failure would not result in damage to other safety-related equipment; and (3) it is not required to maintain fuel pool cooling. Therefore, the spent fuel monorail and hoist has been excluded from further consideration.

b. Evaluation and Conclusion

The Licensee's identification of load handling systems subject to the general guidelines of NUREG-0612 is acceptable. Exclusion of the remaining handling systems is consistent with the guidance of NUREG-0612 based on the justification provided by the Licensee.

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 safe load paths for the movement of heavy loads in the reactor containment building, fuel handling building, new fuel and residual heat removal (RHR) area, and turbine building are detailed in the following plant drawings:

81022-M-001 Rev A
81022-M-002 Rev A
81022-M-003 Rev A
81022-M-004 Rev B
81022-M-005 Rev A.

Load paths follow the safest and shortest routes with consideration given to avoidance of fuel and safety-related equipment.

Subsequently, the Licensee stated that difficulty was being experienced in adhering to the load paths in the containment, resulting in the need for numerous load path revisions to facilitate movement of the loads. CP&L has reevaluated the containment load paths due to the severe space limitations and the multitude of variations and combinations required to conduct movement of components during maintenance and refueling outages. Revised safe load paths/handling areas have been developed to accommodate the above factors and have been incorporated into revised drawings. These drawings have safe load paths marked and identify nearby equipment required for safe shutdown or new/spent fuel.

The Licensee has further stated that, due to the severe space limitations and multitude of load variations and combinations, it is absolutely necessary to handle heavy loads over spent fuel or safety-related equipment. This is done only when there is no other alternative available.

The safe load paths at Robinson Unit 2 are referenced in appropriate plant operating procedures required for each specific heavy load. These procedures refer maintenance and operations personnel to the applicable load path drawing(s). Copies of these drawings will be available on the operating floor/area for reference and use by the signalman. In addition, reference copies of the load path drawings will be located in the polar crane operator's cab. During crane operation training and qualification, operators are instructed regarding the above procedure, including the proper and safe handling of heavy loads and identification of safe load paths. The signalman will "walk down" the load path prior to each lift or, in cases where walking the load paths is not possible, review the load path with the crane operator prior to signaling the crane operator to lift and move the load. A telephone communication system between the polar crane operator and signalman will be available to provide a voice communication link and to provide more precise control of load movement. The telephone system will be installed during the next refueling outage.

In addition, reference to safe load paths is made in procedure MP-1-5, "Operation, Testing and Inspection of Cranes and Material Handling Equipment."

The Licensee has also stated that, due to the number of paths and their configurations, marked load paths could possibly cause confusion during maintenance operations and therefore do not contribute to safe load handling.

In response to the question of deviation from defined load paths, the Licensee stated that the maintenance supervisor will be delegated the authority to approve alternate load paths and laydown areas in the containment from the load paths and load handling areas identified on the containment load path drawings. In his absence, the maintenance supervisor's designated alternate will have the authority to approve alternate load paths and laydown areas in the containment. If heavy loads not identified on the current containment load path drawings must be carried over the open reactor vessel when (1) the missile shield has been removed and (2) when the vessel contains fuel, prior Plant Nuclear Safety Committee (PNSC) review must be obtained. Approval of heavy load movement over the open reactor vessel is contingent upon meeting the following minimum conditions:

a. use lifting equipment (lifting apparatus and crane) with a rated capacity at least twice the load to be handled.

b. use a four-point or redundant lifting arrangement to preclude a load drop in the event of a single lift point failure.

b. <u>Evaluation</u>

The Licensee's approach to the designation of specific safe load paths and the definition and depiction of such load paths in procedures and drawings is consistent with the guidance in Section 5.1.1(1) of NUREG-0612.

It is recognized that certain cases may exist for which there are no alternatives to handling heavy loads over spent fuel or safety-related equipment; additionally, it is apparent from the Licensee's response to Guideline 2 that procedures involving such cases will contain adequate precautions and a step-by-step procedure to minimize the potential hazard to fuel and equipment.

The use of a signalman as a visual aid to the crane operator in lieu of permanent load path markings is acceptable provided that the designated

signalman is knowledgeable about the safe load paths and that his duties are clearly defined in appropriate procedures.

Telephone communication between the signalman and the crane operator is an added improvement. A head set is preferred over the hand set type in order to minimize interference with the load control movements of the operator.

Delegation of authority to a maintenance supervisor or his designated alternate for the approval of alternate load paths and laydown areas is an acceptable equivalent to the plant safety review committee provided that such personnel are limited in number and officially designated by this committee. Deviations from these load paths should be subsequently reviewed in accordance with plant guidelines for changes to plant procedures.

c. Conclusion

Robinson Unit 2 complies with Guideline 1.

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

The Licensee has stated that procedures generally include sections for purpose, responsibility, precautions, special equipment and descriptions, references, and step-by-step instructions. The procedures in use at Robinson Unit 2 meet the intent of NUREG-0612, Section 5.1.1(2). In addition, the Licensee has provided a tabular listing of heavy loads and the applicable procedures for each.

b. Evaluation

Robinson Unit 2 meets the intent of Guideline 2 based on the Licensee's certification that the requirements of Section 5.1.1(2) of NUREG-0612 are met.

c. Conclusion

Robinson Unit 2 complies with Guideline 2 of NUREG-0612.

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' [6]."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that all crane operators and signalmen are trained, qualified, and conduct themselves in accordance with the requirements of ANSI B30.2-1976 with no exceptions.

b. Evaluation

Robinson Unit 2 satisfies the requirements of Section 5.1.1(3) of NUREG-0612 based on the Licensee's certification of conformance to ANSI B30.2-1976 for operator training, qualification, and conduct, with no exceptions.

c. Conclusion and Recommendations

Robinson Unit 2 complies with 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' [7]. 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 in lieu of the guideline in Section 3.2.1.1 of ANSI N14.6 which bases the stress design factor on only the weight (static load) of the load and of the intervening components of the special handling device."

a. Summary of Licensee Statements and Conclusions

The Licensee identified the following special lifting devices:

1. reactor vessel (RV) head lifting rig
2. internals lifting rig
3. reactor coolant pump (RCP) motor lift sling
4. spent fuel cask redundant lifting yoke
5. fuel storage rack lifting frame and slings (to be sized later)
6. in-service inspection/removable lifting tool handling tool
7. turbine lifting beam.

The spent fuel cask redundant lifting yoke is of a redundant design and the crane on which it is used is single-failure proof. Therefore, a load drop with regard to the handling of the cask is not considered credible. The cask redundant lifting yoke meets the intent of ANSI N14.6-1978.

The in-service inspection/removable lifting tool has been designed in accordance with and meets the requirements of ANSI N14.6-1978. Westinghouse has confirmed this in writing to CP&L: "The weakest link of the rig has a safety factor of 10.24 based on ultimate tensile strength and 6.65 based on yield strength of the materials used. The safety factors of all other components are greater than those stated for the weakest link. The computations were performed assuming max load (static) 10,500 pounds." This special lifting tool is supplied by Westinghouse during in-service inspection. Procedures for use, inspection, and testing provided by Westinghouse during in-service inspection, will be incorporated into plant procedures prior to performing the inspection.

The Licensee is excluding the turbine lifting beam from the requirements of ANSI N14.6 since the turbine crane heavy loads will be excluded in the

plant's Phase II Report. Load exclusion will be based on redundancy of the 480V and 4160V power supplies located at elevations below the turbine operating deck.

The Licensee has stated that the remaining special lifting devices at Robinsion Unit 2 were designed, constructed, and delivered prior to the existence of ANSI N14.6-1978. Their design met the accepted industry standards and engineering practices of that time. Information relative to compliance with the design and construction requirements of ANSI N14.6 is not available from the suppliers in some cases. CP&L considers the existing special lifting devices to be of adequate design; the performance record during the past 11 years provides substantial verification of their design adequacy. However, as a result of necessity to handle loads the reevaluation of safe load paths and the over the reactor and safe shutdown equipment in the containment, implementation of the inspection, testing, and maintenance requirements discussed herein will provide satisfactory assurance that design integrity does not deteriorate and that the probability for a load drop continues to remain at acceptable limits.

CP&L stated that plant operating and maintenance procedures, which address the inspection, testing, and maintenance of special lifting devices, will be implemented. Special lifting devices will be nondestructively examined in accordance with ANSI N14.6. In addition, prior to use each outage, a visual examination will be made and documented. A nondocumented visual examination will be made by the crane operator or signalman in accordance with ANSI B30.2 prior to each use.

The Licensee has provided in tabular form a comparison of special lifting rig design to the requirements of Sections 3, 4, and 5 of ANSI N14.6-1978. This comparison indicates that the spent fuel cask redundant lift yoke, reactor coolant pump motor lift sling, internals lifting rig, and reactor vessel lifting rigs were subjected to initial load tests of at least 125%.

b. Evaluation

The continuing compliance testing, inspection, and maintenance program for special lifting devices at Robinson Unit 2 meets the intent of NUREG-0612 on the basis of the Licensee's commitment to Section 5 of ANSI N14.6-1978. Further, the initial load testing of 150% for the spent fuel cask redundant lift yoke and 125% for RCP motor lift sling, internals lifting rig, and RV head lifting rig, respectively, sufficiently stressed the special lifting devices to provide an adequate guarantee of the device's structural integrity. Although it cannot be determined if the specific requirements of ANSI N14.6-1978 for component design and fabrication have been satisfied for these lifting devices, performance of load tests and implementation of a rigorous program for inspection and maintenance aid in the assurance that these devices will provide a high degree of load handling reliability.

A review of design information provided indicates that the lifting devices evaluated by the Licensee satisfy the design criteria of ANSI N14.6-1978 in that all stress design factors are greater than 3 for yield stress and greater than 5 for ultimate strength. The Licensee has also indicated that the effect of dynamic loading imposed by cranes is negligible due to slow hook speeds. Therefore, these lifting devices satisfactorily accommodate dynamic loads while maintaining an acceptable stress design margin.

The Licensee's exclusion of the turbine lifting beam from the requirements of ANSI N14.6 based on the plant's Phase II report is not consistent with the guidance of NUREG-0612. Phase II analyses may be used to preclude the need for further hardware modifications, but should not be used as a basis for exclusion from Phase I requirements. The general guidelines of NUREG-0612 should be satisfied for all load handling systems that carry heavy loads in the vicinity of safe shutdown equipment regardless of the fact that detailed analyses, interlocks, technical specifications, and operating procedure may indicate that a system safety function could continue following a load handling accident.

c. Conclusion

H. B. Robinsion Unit 2 complies with Guideline 4 of NUREG-0612 for all lifting devices except the turbine lifting beam. To fully comply, the Licensee should evaluate the turbine lifting beam for compliance with ANSI N14.6-1978.

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' [8]. 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' which 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 has stated that all nonspecial lifting devices subject to NUREG-0612 are installed and used in accordance with ANSI B30.9-1971. Selection of nonspecial lifting devices will be based on the sum of the static load plus at least 15% for unanticipated dynamic loading and other unknowns. Slings will be tagged to indicate their maximum capacity. With the exception of several slings (i.e., turbine components, etc.), CP&L does not limit the use of slings to specific cranes or loads. Slings which are restricted for specific uses such as the above will be clearly marked and personnel will be instructed accordingly. When loads must be handled over spent fuel or equipment required to maintain safe shutdown, personnel will be instructed by a plant procedure and by attached load path drawings to use increased safety factors and four-point or redundant lifting arrangements. Safety factors will be increased by doubling the static load and adding a 15% dynamic load allowance. The resultant load will be used to select proper sling size from standard sling charts. Where it is impossible to obtain a safety factor of 10, the lifts will be considered on a case-by-case basis and will be described in a written procedure properly approved by plant management.

Lifting devices are inspected and maintained in accordance with ANSI B30.9 and ANSI B30.10.

b. Evaluation

Sling usage at Robinson Unit 2 satisfies the requirements of Section 5.1.1(5) of NUREG-0612 based on the Licensee's certification of compliance with the requirements of ANSI B30.9-1971.

c. Conclusion

Robinson Unit 2 complies 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 where 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, test, and maintenance should be performed prior to their use)."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that the crane inspection, testing, and maintenance program now in effect at Robinson Unit 2 is in compliance with ANSI B30.2-1976, Chapter 2-2, and the Occupational Safety and Health Standards, Section 176 of 29CFR1910.

b. Evaluation

Robinson Unit 2 satisfies the criteria of Section 5.1.1(6) of NUREG-0612 based on the Licensee's certification of compliance with ANSI B30.2-1976 for crane inspection, testing, and maintenance.

c. Conclusion

Robinson Unit 2 complies with Guideline 6 of NUREG-0612.

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 Traveling Cranes' [9]. 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 has stated that the spent fuel cask handling crane is a single-failure-proof crane designed in accordance with CMAA-70, ANSI B30.2, and OSHA 1910.179. Detailed information regarding design of this crane was transmitted to the NRC via CP&L letter No. N6-74-1246 dated October 17, 1974.

CP&L performed a detailed technical evaluation of the containment polar, turbine building, and solid waste handling cranes to determine whether the design and safety features are comparable with the current requirements of ANSI B30.9-1976 and CMAA-70 and to identify areas of variance.

Based on this evaluation, the Licensee stated that the design of the cranes identified above substantially meets the current requirements of CMAA-70 and Chapter 2-1 of ANSI B30.2.

The 5-ton bridge crane and monorail used for the solid waste handling complies with EOCI-61 for the bridge and HMI-100 for the electric wire rope hoist. The design information of this crane, and vendor information as available, did not provide any specific information on other codes and standards. CP&L intends to exclude this crane and monorail in the Phase II response based on structural analyses which will demonstrate the ability of the 3-ft-thick reinforced slab floor to withstand a 10,000-lb load drop without resulting in failure of the slab or generation of unacceptable secondary missiles.

b. Evaluation

The spent fuel cask handling crane at Robinson Unit 2 satisfies Section 5.1.1(7) of NUREG-0612 based on the Licensee's certification that the crane was designed in accordance with CMAA-70 and ANSI B30.2. The containment polar crane and turbine building crane substantially comply with Guideline 7 of NUREG-0612 based on the detailed technical evaluation performed by the Licensee. The intended exclusion of the bridge crane and monorail used for solid waste handling based on structural analyses in Phase II is not consistent with NUREG-0612 guidance. Although the detailed structural analyses may exclude this crane and monorail from Phase II of NUREG-0612, the rationale is not suitable for exclusion from the Phase I general guidelines and interim actions.

c. Conclusion and Recommendation

Robinson Unit 2 substantially complies with Guideline 7 of NUREG-0612. To comply fully, the Licensee must evaluate the solid waste handling crane for compliance with CMAA-70 and ANSI B30.2-1976 or other appropriate 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 the evaluation of these last two 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 Pool 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."

a. Summary of Licensee Statements and Conclusions

The Licensee has noted that the spent fuel cask handling crane is a single-failure-proof crane. Information detailing this fact was transmitted to the NRC via CP&L letter No. NG-74-1246 dated October 17, 1974 and is documented in 3.2-1 of NUREG-0612..

b. Evaluation and Conclusion

The Licensee satisfies the requirements of Interim Protection Measure 1 on the basis of certification that the spent fuel pool cask handling crane is a 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. Summary of Licensee Statements and Conclusions

Summaries of Licensee statements and conclusions are contained in discussions of the respective general guidelines in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7, respectively.

b. Evaluations, Conclusions, and Recommendations

The evaluations, conclusions, and recommendations of this review are contained in discussions of the respective general guidelines in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7.

2.2.3 Special Reviews for Heavy Loads 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 operations, and content of procedures."

a. Summary of Licensee Statements and Conclusions

The Licensee stated that a review of plant procedures was performed and a checklist used to record the results. Recommended changes were implemented and are included in the plant Interim Action Report. The recommended changes include inclusion of and/or guideline instructions for load path identification, inspection of lifting devices, use of qualified operators, replacement or repair of defective lifting components and use of only approved repair parts and approved repair procedures.

b. Evaluation

H. B. Robinson Unit 2 satisfies the requirements of this interim measure. Procedures and operator training have been reviewed and upgraded as appropriate. Inspection of lifting devices and approved repair procedures have been implemented.

c. Conclusion

H. B. Robinson Unit 2 complies 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 H. B. Robinson Unit 2. Overall conclusions and recommended Licensee actions, where appropriate, are provided with respect to both general provisions for load handling (NUREG-0612, Section 5.1.5) 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 H. B. Robinson Unit 2 can be expected to be conducted in a highly reliable manner consistent with the staff's objectives as expressed in these guidelines. A need for further Licensee action, however, was identified in the following areas:

- o Evaluate the turbine lifting beam for compliance with ANSI N14.6-1978.
- o Evaluate the solid waste handling crane for compliance with CMAA-70 and ANSI B30.2-1976.

3.2 INTERIM PROTECTION MEASURES

The NRC staff has established (NUREG-0612, Article 5.3) that certain measures 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, Article 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 by the Licensee indicates that measures have been properly implemented which ensure compliance with the staff's measures for interim protection at the H. B. Robinson Unit 2.

4. REFERENCES

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2. V. Stello, Jr. (NRC)
   Letter to all Licensees
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   NRC, 17 May 1978

3. NRC
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5. S. R. Zimmerman (CP&L)
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6. "Overhead and Gantry Cranes"
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7. "Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials"
   New York: American National Standards Institute, Inc., 15 February 1972
   ANSI N14.6-1978

8. "Slings"
   American Society of Mechanical Engineers, 1972
   ANSI B30.9-1971

9. "Specifications for Electric Overhead Traveling Cranes"
   Crane Manufacturers Association of America, Inc., 1975
   CMAA-70

Exception 1

In the opinion of the licensee, development of individual load paths is impractical since there are a significant number of loads for which the pickup and laydown areas vary from outage to outage. Further, in some cases the location of safety related equipment combined with the design of the floor over which heavy loads are carried indicates that for a number of lifts there is no preferred load path.

Discussion

The purpose of this portion of Guideline 1 is to ensure that the paths over which heavy loads are carried have been developed and approved in advance of the lift and are based on considerations of safety. In particular it is provided to avoid the ad hoc selection of load paths by maintenance personnel since such a situation could result in the use of a load path which has been established by a process wherein considerations other than safety have taken precedence.

It is recognized that there are a class of loads which, although in excess of the weight specified for classification as a heavy load, are actually miscellaneous or maintenance related loads for which it is impractical to identify a specific laydown area which can be fixed from outage to outage. Conversely there are a number of loads for which specific laydown areas have been allocated in the original plant design and which should reasonably be expected to be carried over the same load paths during every outage. A tabulation of loads in this latter category, generally applicable to PWR's and BWR's, was provided in NUREG 0612 as Table 3-1.

A fundamental principal of NUREG 0612 is protection through defense in depth. Specifically, the first line of protection from an accident which could result in damage to spent fuel or equipment required for safe shutdown or decay heat removal is to avoid or minimize the exposure of such equipment to crane borne loads overhead. Where such exposure is minimized, rather than avoided, a second line of defense can then be provided by intervening barriers such as floors or the provision of additional lifting device redundancy or safety factors. Considering the foregoing, the use of exclusion areas, rather than safe load paths, is consistent with this guideline only under circumstances where there is no safety related equipment located beneath the area accessible to the crane hook but outside of the exclusion area. This situation has been found in buildings such as the turbine hall or screen house where safety related equipment is concentrated in a specific area within the crane path. It is unlikely to occur within containment due to the numerous safety related piping and electrical systems provided to support decay heat removal.

Approaches Consistent With This Guideline

Specific safe load paths are prepared and approved for major components for which hazardous areas are well established. For miscellaneous lifts load corridors are established such that any movement within that corridor cannot result in carrying a heavy load over spent fuel or systems required for safe shutdown or decay heat removal (regardless of intervening floors). Movement within these corridors is at the discretion of the load handling party.

Specific safe load paths are prepared and approved for major components for which hazardous areas are well established. For miscellaneous lifts detailed directions are prepared and approved for developing safe load paths which include floor plans showing the location of safety related equipment and instructions to avoid such equipment. Specific safe load paths are then prepared each time a miscellaneous lift qualifying as a heavy load is made. These individual load paths are temporary and may change from outage to outage.

Approaches Inconsistent With this Guideline.

Use of limited exclusion areas in containment which merely prohibited the carrying of heavy loads directly over the core or specific components and allow full load handling party discretion in other areas.

Exception 2

In the opinion of the licensee marking of load paths on the floor is impractical. This may be caused by the general use of temporary floor coverings which would cover the load path markings, or, due to the number of loads involved, a requirement for multiple markings which could confuse the crane operator.

Discussion

The purpose of this feature of Guideline 1 is to provide visual aids to assist the operator and supervisor in ensuring that designated safe load paths are actually followed. In the case of the operator it has the additional function of avoiding undesirable distractions while handling suspended loads (e.g., trying to read procedural steps or drawings while controlling the crane). This feature should also be seen as a provision necessary to complete a plan for the implementation of safe load paths. Specifically it provides some additional assurance that, having spent the time and effort to develop safe load paths, those paths will be followed.

Approaches Consistent With this Guideline

Rather than mark load paths a second member of the load handling party (that is, other than the crane operator) is made responsible for assuring that the designated safe load path is followed. This second person, a signalman is typically used on cab operated cranes, checks out the safe load path prior to the lift to ensure that it is clear, refers to the safe load path guidance during the lift and provides direction to the operator and that the load path is followed. To support this approach the duties and responsibilities of each member of the load handling party should be clearly defined.

Prior to a lift the appropriate load path is temporarily marked (rope, pylons, etc.) to provide a visual reference for the crane operator. In cases where the load path cannot be marked (e.g., transfer of the upper internals in a PWR) temporary or permanent match marks can be employed to assist in positioning the bridge and/or trolley during the lift.

In either case reasonable engineering judgement would indicate that in certain specific lifts marking of safe load paths is unnecessary due to physical constraints on the load handling operation (e.g., simple hoists, monorails, or very short lifts where movement is limited to one coordinate axis in addition to the vertical).

Approaches Inconsistent With this Guideline

Positions which in effect do not recognize the need for realistically providing visual aids to the crane operator and imply that, for all lifts, the operator will remember the load path from review of procedures or by reference to a drawing.

Exception 3

Obtaining written alternative procedures approved by the plant safety review committee for any deviations from a safe load path is considered too cumbersome to accommodate the handling of maintenance loads where laydown areas may have to change or load paths altered as a result of unanticipated maintenance requirements.

Discussion

The purpose of this portion of this guideline is to ensure that deviations from established safe load paths receive a level of review appropriate to their safety significance. In general it is highly desirable that once safe load paths are established they are retained and kept clear of interference rather than routinely deviated from. It is recognized, however, that issues associated with plant safety are the responsibility of an individual licensee plant safety review committee (or equivalent) and the details of their excercizing this responsibility should be within their jurisdiction.

Approach Consistent With this Guideline

A plant safety review committee (or equivalent) delegates the responsibility for approving temporary changes to safe load paths to a person, who may or may not be a member of that committee, with appropriate training and education in the area of plant safety. Such changes are reviewed by the safety review committee in the normal course of events. Any permanent alteration to a safe load path is approved by the plant safety review committee.

Approach Inconsistent With this Guideline

Activities which in effect allow decisions as to deviations from safe load paths to be made by persons not specifically designated by the plant safety review committee.

GUIDELINE 2 LOAD HANDLING PROCEDURES

No significant exceptions to this guideline have been encountered. Occasionally a question arises concerning the need for individual procedures for each lift. In general, it was not the purpose of this guideline to require separate procedures for each lift. A reasonable approach is to provide separate procedures for each major lift (e.g., RV head, core internals, fuel cask) and use a general procedure for handling other heavy loads as long as load specific details (e.g., load paths, equipment requirements) are provided in an attachments or enclosures.

Exception

The only exception occassionally encountered with respect to this Guideline other than fairly minor, site unique, exceptions has been a desire to deviate from the requirement of ANSI B30.2-3.1.7.o for testing of all controls before beginning a new shift. In some cases a licensee has qualified a commitment in this area by noting that only crane controls "necessary for crane operation" will be tested at the start of a shift.

Discussion

This requirement (ie. not a recommendation) of ANSI B30.2 is important since crane control system failures are relatively significant contributors to load handling incidents. The only reason that can be seen for an exception in this area is a general aversion to the word "all". Specifically, it appears that some licensees fear that a commitment to this requirement will force them to test all control type devices (eg. motor overloads, load cells, emergency brakes) rather than just those features generally known as controls (ie. hoist, bridge, and trolley motion controllers).

Approaches Consistent With this Guideline

Exceptions that clearly indicate that all normal controls (hoist, bridge, and trolley motion controllers) will be tested at the start of each shift and that the purpose of not committing to "all" controls is to avoid a misunderstanding concerning other control devices.

Approaches Inconsistent With This Guideline

A response that implies that a decision to test or not test a normal control will be made by the crane operator on the basis of what type of lift or direction of motion he expects for the forthcoming shift.

Exception 1

Some licensees have indicated that their special lifting devices were designed and procured prior to the publication of ANSI N14.6 and therefore are not designed in accordance with that standard. This fact is sometimes combined with a reference to the title of that standard to reach a conclusion that the standard is not applicable.

Discussion

The purpose of this section is to ensure that special lifting devices were designed and constructed under controlled conditions and that sufficient documentation is available to establish existing design stress margins and support future maintenance and repair requirements. ANSI N14.6 is an existing standard that provides requirements supporting this goal for lifting device applications where the consequence of a failure could be similar to that which could be expected in the event of the failure of a special lifting device carrying a load within the jurisdiction of NUREG 0612. Consequently it seems appropriate that for special lifting devices subject to NUREG 0612 it should be able to be demonstrated that, from a design standpoint, they are as reliable as a device for which ANSI N14.6 was developed.

Approaches Consistent With This Guideline

Although not originally specified to be designed in accordance with ANSI N14.6 the special lifting device in question was provided by a reactor vendor, in accordance with appropriate quality assurance and quality control procedures, for a specific application associated with power plant components provided by that vendor. Based on either the review of the original stress report or, if such a stress report is unavailable, the preparation of a new stress report, the licensee has determined that margins to material yield and ultimate strength are comparable to those specified in ANSI N14.6. Although not required of the lifting device vendor, the licensee has reviewed the design of the lifting device and prepared a list of critical components whose repair or replacement should be performed under controlled conditions.

Approaches Inconsistent With This Guideline

No information is available concerning the original design but it is probably allright because the device has been used for ten years and never failed.

The device was built before the publication of ANSI N14.6, does not carry shipping containers of nuclear material weighing more than 10,000 pounds, and thus need not comply with ANSI N14.6.

Exception 2

No 150% overload test has been performed and, in the opinion of the licensee, such a test is impractical.

Discussion

The performance of a load test in excess of the load subject to NUREG 0612 is an important contributor to the ability to assess the overall reliability of a device. Such a test supplements design reliability by demonstrating that the device was properly fabricated or assembled and that a portion of the design safety margin has been demonstrated. Such proof of workmanship is particularly important for a fairly complicated device. It is recognized, however, that the specification of a 150% overload test is somewhat arbitrary and that, in some cases, the nature of the device is such that the liklihood of workmanship shortcomings is remote.

Approaches Consistent With This Guideline

The licensee has evaluated the lifting device in question and has determined that design stress margins are substantial. Further it has been established that the device itself is uncomplicated and principally put together with mechanical joints such that an assembly error is highly unlikely. The use of welded joints is severly limited and where employed were performed in accordance with substantial quality controls (eg AWS D1.1) including NDE. The device has been tested to 100% of rated load.

Although a 150% overload test has not been performed the lifting device has been subjected to a manufacturer recommended overload to demonstrate proof of workmanship (typically 120-125%).

Approaches Inconsistent With This Guideline

See this topic for Exception 1 above.

Exception 3

The requirement of ANSI N14.6 for an annual 150% load test or full NDE is excessive. Both the load test (due to the inability to make the test lift within containment) and the NDE (due to the need to remove protective coatings) are impractical and not justified by the infrequent use of these devices.

Discussion

A continuing inspection program to assure the continued maintenance of safety margins incorporated in the original design of the device is important to demonstrate the reliability of special lifting devices. It is recognized, however, that some devices employed in a nuclear power plant, particularly those associated with refueling, are used under conditions of control and at frequencies of use that are substantially less severe than that possible for the type of lifting device for which ANSI N14.6 was originally prepared. Consequently a reasonable relaxation of the inspection interval seems appropriate.

Approaches Consistent With This Guideline

Overload tests will be conducted but at a longer interval, 5 years, between tests to be consistent with the number of operational lifts required.

NDE of load bearing welds will be conducted at 5 year intervals or, alternatively, load bearing welds will be examined through a program that ensures that all welds will be examined over a normal inservice inspection interval of 10 years in a manner similar to that specified in the B&PV Code for Class 2 Component Supports.

Approach Inconsistent With This Guideline

Continuing inspection will be limited to an annual visual examination of the device.

Exception

Licensees have taken exception to the requirement to select slings in accordance with the maximum working load tables of ANSI B30.9 considering the sum of static and dynamic loads. Most commonly it is the licensees position that the approximate factor of safety of five on rope breaking strength inherent in these tables adequately accomodates dynamic loading.

Discussion

The intent of this portion of this Guideline, which also applies to special lifting devices under Guideline 4, is to reserve the ANSI B30.9 safety factors for accomodating sling wear and unanticipated overloads and avoid a reduction of this safety factor as a result of the routine dynamic loads inherent in hook/load acceleration and deceleration. While it is acknowledged that, for operating characteristics typical of cranes employed at nuclear power plants, these dynamic loads are unlikely to be substantial, such a determination cannot be made generically. Typically the actual dynamic load due to hook/load acceleration or deceleration is a function of design hook speeds and the type of hoist control system employed. It should also be recalled that ANSI B30.9 is a general industrial standard which applies to all load handling devices and does not in itself provide for any additional conservatism in consideration of the potential consequences of a load handling accident at a nuclear power plant. Based on this, it is considered reasonable that individual licensees evaluate the potential contribution of dynamic loading in their operations and if such dynamic loading is indeed significant accomodate it in their procedures for sling selection.

Approach Consistent With This Guideline

The licensee has evaluated the potential routine dynamic loading for lifting devices not specially designed and found them to be a relatively small fraction (typically 5-15%) of static load. This estimate has been made on the basis of either calculated acceleration and deceleration rates or through use of the industrial standard for impact loading of cranes specified in CMAA-70. In either case having verified that routine dynamic loading of a specific hoist is indeed small the licensee has drawn the conclusion that revised selection criteria to accomodate such minor additional loads will not have a substantial effect on overall load handling reliability.

Approach Inconsistent With This Guideline

Statement to the effect that dynamic loads are accomodated in the tables of ANSI B30.9 with no indication that the licensee has assessed the actual dynamic loading imposed on cranes subject to NUREG 0612.

Exception

The only exception occasionally encountered with respect to this Guideline other than fairly minor and site-unique exceptions has been a desire to deviate from the requirement of ANSI B30.2-1.1.2.a.2 and 3.2.4 for testing of hoist limit devices before beginning a new shift. In some cases a licensee has qualified a commitment in this area by noting that this limit switch will be tested only if operations in the vicinity of the limit switch are anticipated.

Discussion

While this issue is treated somewhat ambigously in ANSI B30.2 (it is a recommendation in article 1.1.2 and a requirement in article 3.2.4) it is important since two-blocking incidents are relatively significant contributors to load handling incidents. Further it should be noted that this test has been incorporated as a requirement of OSHA in 29 CFR 1910.179.(n).(4).(i). It is recognized, however, that there may be circumstances where such a test is not prudent. First, such a test clearly should not be made with the hook under load. Consequently if a shift change is made with the hook loaded (this, by the way, is not a desireable practice and could be precluded through strict compliance with ANSI B30.2-3.2.3.j) a hoist limit switch test should not be performed. Second, there may be circumstances where the nature of forthcoming load handling operations indicates that the time (and minor risk) associated with this test is not justified. In particular if it is known that a hoist will not be used or used only in an area substantially removed from the upper travel limit, it would seem reasonable to defer the limit switch test until the start of the next shift. If such an approach is taken, however, it should be approached with care. Requirements for deferring an upper limit switch test should accomodate the uncertainty associated with maintenance plans and establish unambiguous criteria concerning what operations can be determined to be remote from upper travel limits. Such criteria should recognize that the need for upper travel limit switch protection may be preceeded by a control system failure and consequently should conservatively allow for operater response time and potential delays associated with emergency shutdown of the crane.

Approach Consistent With This Guideline

General compliance with this requirement. Certain specific provisions made for deferring upper limit switch testing under conditions that are not subject to operater interpretation.

Approaches Inconsistent With This Guideline

An approach that implies that a decision to test or not is left to the discretion of the operator or implies that such a test will be required only if operations are planned in close proximity to the hook upper travel limit.

Exception

Occasionally a licensee has indicated that the overhead electric travelling cranes employed at a site were purchased prior to the publication of CMAA-70 or ANSI B30.2-1976 and thus these standards should not be applied.

Discussion

The purpose of this Guideline is to ensure that all cranes carrying heavy loads in nuclear power plants meet certain minimum criteria in their design and, consequently, can be assumed to provide an acceptable standard of mechanical, electrical, and structural reliability. It is also recognized, however, that cranes in operating plants may have been designed and procured prior to the publication of current standards and, thus, not strictly comply with some details of these standards. In general, though, current standards have evolved from predecesor standards in existence at the time of crane procurement (EOCI 61, ANSI B30.2-1967) and, since the later standards are not revolutionary, it is likely that cranes at nuclear power plants will provide a degree of reliability equivalent to that provided by the current standards. Such a general determination canot be made, however, by the staff since nuclear power plant cranes are usually unique and provided with site specific design features. It is up to the licensee then to make a systematic comparison of their crane design with the requirements of current standards and determine if additional design features are appropriate.

Approach Consistent With This Guideline

The licensee has compared original crane procurement specifications or existing crane designs with the requirements of the referenced standards in areas effecting load handling reliability. In instances where the current standard provides additional protection against the consequences of operater error or component failure the licensee has proposed modifications which will result in a degree of load handling reliability similar to that provided in the current standard.

Approach Inconsistent With This Guideline

Positions to the effect that the cranes satisfied standards in existence at the time of procurement and what was good enough then is good enough now.