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TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

WISCONSUN PUBLIC SERVICE CORPORATION
KEWAUNEE 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.

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1. INTRODUCTION

1.1 PURPOSE OF REVIEW

This technical evaluation report documents an independent review of general load handling policy and procedures at the Wisconsin Public Service Corporation's (WPSC) Kewaunee 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.

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:

- 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
- 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 WPSC, the Licensee for the Kewaunee Nuclear Power Plant, requesting that the Licensee review provisions for handling and control of heavy loads at the Kewaunee 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. WPSC responded to this request on June 22, 1981 [4], August 17, 1981 [5], October 9, 1981 [6], December 23, 1982 [7], and March 9, 1983 [8]. On the basis of this information, a draft technical evaluation report (TER) was prepared.

2. EVALUATION

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

2.1 GENERAL GUIDELINES

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

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

These seven guidelines should be satisfied by all overhead handling systems and 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 this verification are contained in the succeeding paragraphs.

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Table 2.1. Kewaunee 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. Containment Polar Crane	Main	230	--	--	C	--	--	C	C	--	--
	Aux	20	--	--	C	--	--	C	C	--	--
Reactor Vessel Head		80	P	R	--	P	--	--	--	--	P
Reactor Vessel Upper Internals		28	P	R	--	P	--	--	--	--	P
Reactor Vessel Lower Internals		I	P	R	--	P	--	--	--	--	--
In-service Inspection Tool		4.5	P	R	--	--	I	--	--	--	--
Reactor Coolant Pump Motor		32	P	R	--	P	--	--	--	--	--
Flywheel		6.6	P	R	--	--	I	--	--	--	--
Shaft and Impeller		4	P	R	--	P	--	--	--	--	P
Reactor Vessel Missile Shield		20	P	R	--	P	--	--	--	--	--
Pressurizer Missile Shield		18	P	R	--	P	--	--	--	--	--
Reactor Vessel Studs in Handling Box		I	P	R	--	--	I	--	--	--	--

C = Licensee action complies with NUREG-0612 Guideline.
P = Licensee action partially complies with NUREG-0612 Guideline.
R = Licensee has proposed revisions/modifications designed to comply with NUREG-0612 Guideline.
I = Insufficient information supplied by the Licensee.
-- = Not applicable.

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Table 2.1 (Cont.)

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
2. Auxiliary Building Crane Main	125	--	--	C	--	--	C	C	C	--
Aux	10	--	--	C	--	--	C	C	C	--
Spent Fuel Shipping Cask	30	P	R	--	P	--	--	--	--	--
Pool Divider Gates	2	P	R	--	--	I	--	--	--	--
Radwaste Drums	3.5	P	R	--	--	I	--	--	--	--
Missile Shields										
a. Shield Wall Airlock	7.5	P	R	--	--	I	--	--	--	--
b. Drumming Station	16	P	R	--	--	I	--	--	--	--
c. Waste Evaporator	20	P	R	--	--	I	--	--	--	--
d. Demineralizer Removable Slabs	206 105 104	P	R	--	--	I	--	--	--	--
New Fuel Shipping Containers	2.5	P	R	--	--	I	--	--	--	--
Radwaste Cask Lid	4.2	P	R	--	--	I	--	--	--	--
Test Weights/ Fuel Handling Bridge Cranes	1.5/2	P	R	--	--	I	--	--	--	--
Irradiated Specimen Shipping Cask	7	P	R	--	--	I	--	--	--	--
Filter Shield Cask	7.5	P	R	--	--	I	--	--	--	--

2.1.1 Overhead Heavy Load Handling Systems

a. Summary of Licensee Statements and Conclusions

The Licensee's review of overhead handling systems identified the containment polar crane and primary auxiliary building fuel handling crane to be the only cranes subject to the criteria of NUREG-0612.

Other load handling systems were eliminated from further consideration under NUREG-0612 for the following reasons:

1. Single-purpose system. Each of the following load handling systems is used for maintenance of a single piece of safety-related equipment; consequently, these systems carry heavy loads over safety-related equipment only when plant conditions have been established to allow such equipment to be removed from service:

- monorail over diesel generator 1A
- monorail over diesel generator 1B
- trolley over residual heat removal pumps.

2. Loads handled. The following load handling systems do not handle loads weighing in excess of a fuel assembly and its handling tools:

- spent fuel pool bridge and hoist
- reactor cavity manipulator crane.

3. Physical separation and redundancy of equipment. It was determined by inspection that a load drop would not cause the loss of an entire safeguards train:

- turbine building crane.

b. Evaluation

The Licensee's determination that NUREG-0612 is not applicable to the lifting devices identified in 1 and 2 above is consistent with NUREG-0612 guidance for the following reasons: (1) the lifting device is used only when a safety-related component or system that might be damaged by a load drop is placed out of commission (presumably following the establishment of appropriate plant conditions) prior to the lift, or (2) the load handling system does not handle loads weighing in excess of a fuel assembling and handling tool.

However, the Licensee's determination that the turbine building crane may be excluded from handling systems subject to NUREG-0612 is not consistent with the guidance of NUREG-0612. The reliance on redundant systems is not consistent with the NUREG-0612 guidelines for exclusion since the load drop may cause one system train to be damaged while a single active failure in the redundant train will cause the total loss of the system.

c. Conclusion

WPSC's identification of load handling systems subject to compliance with the guidelines of NUREG-0612 is consistent with NUREG-0612 guidance, with the exception of the exclusion of the turbine building crane.

The Licensee should ensure that the turbine building crane and the loads handled by it meet the criteria of Section 5.1 of NUREG-0612.

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 safe load paths have been developed for the majority of heavy loads handled by the containment polar crane and auxiliary building fuel handling crane. These safe load paths were developed with the following considerations:

- minimize the potential for a heavy load drop to impact irradiated fuel or to impact safe shutdown equipment
- use of the shortest distance between the component and its designated laydown area
- limits imposed upon crane travel by the cranes's design and maximum travel
- condition the reactor coolant system must be in prior to the movement of specific components
- personnel safety.

The Licensee stated that written procedures will be generated identifying the applicable requirements from NUREG-0612, Section 5.1.1(2) for the loads identified. Written procedures will be generated if deviations from approved specific pathways are necessary.

In addition, the Licensee stated that not all heavy loads for the auxiliary building crane have safe load paths. The following loads do not require safe load paths for the following reasons:

Spent Fuel Shipping Cask

Has not been acquired and is not expected to be required until the year 2001.

Missile/Radiation Shield - Waste Evaporator

The waste evaporator has not been in use since 1974. Also, plant structural modifications have limited the shield to vertical movement only.

Missile/Radiation Shields - Demineralizer Removal Slabs

The shields are not over any safe shutdown equipment. When access is required, the slabs are lifted several inches and stored immediately east of the openings. They are expected to be handled once every 20 years.

Radwaste Cask Lids

The procedures covering the removal of these lids specify that the lids be placed down on a flatbed truck.

Filter Shield Cask

The filter shield cask is handled by the auxiliary building crane inside the fuel handling and receiving area. No safety-related equipment is located in this area. If this load is moved over other areas, a safe load path will be developed.

Crane Load Block

Except for the exclusion areas over the spent fuel pool and over the RHR heat exchanger discharge piping, the crane load block can move without restriction over all areas. An analysis has been performed which concluded that a single floor barrier would be adequate protection for all components located beneath the floor in the unlikely event of a crane block drop from the high hook position.

b. Evaluation

The Licensee's response indicates that specific load paths have been developed for a majority of the loads, will be defined in procedures, and have been incorporated into drawings. The Licensee's intent not to develop safe load paths for the following is acceptable for the indicated reasons:

- Spent fuel shipping cask - The cask has not yet been obtained and will not be required until the year 2001.
- Waste evaporator missile shield - The shield is physically constrained in its current location and is not located near any safe shutdown equipment.
- Demineralizer removable slabs - These slabs are moved infrequently (once per 20 years) and do not pass over safety-related equipment. However, the Licensee should ensure that the procedures covering the removable slabs specifically restrict the movement of the slabs.
- Radwaste cask lids - The procedures specifically direct movements and cask lids remain in the loading dock area which does not contain any safety-related equipment.
- Filter shield cask - This cask is procedurally restricted to an area defined by physical boundaries.
- Crane load block - Safe load paths are not required for the crane load block.

The Licensee did not provide information as to the marking of safe load paths. Load path visual aids should be provided to crane operators so that the operators can concentrate on movement of the load. These visual aids are used to clearly identify those areas where movement of heavy loads will occur. Alternative methods of providing visual aids, such as matchmarking the crane, identifying physical boundaries, or using dedicated load handling supervisors, are possible approaches which provide operator assistance equivalent to floor markings.

Deviations from safe load paths, not addressed by the Licensee, require the approval of the plant Safety Review Committee in addition to written procedures.

c. Conclusion and Recommendation

The Kewaunee plant partially complies with Guideline 1. In order to fully comply, the Licensee should:

- o provide visual aids to identify safe load paths and restricted areas
- o ensure that deviations from safe load paths are 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

The Licensee stated that written procedures will be generated identifying the applicable requirements from Guideline 2 of NUREG-0612 for the loads identified. Written procedures will be generated when deviations from approved specific safe load paths are necessary.

b. Evaluation and Conclusion

WPSC is revising procedures as necessary to comply with Guideline 2 for the Kewaunee plant.

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' [9]."

a. Summary of Licensee Statements and Conclusions

The Licensee states that existing programs for operator training and qualification have endorsed the requirements of ANSI B30.2-1976 with two exceptions: operator written examinations and use of standard hand signals. Commencing in 1984, examinations will be administered following the crane refresher training course. Hand signals presently being used are in accordance with the WPSC Safety Rule Book; however, the rule book will be revised to incorporate the hand signals of ANSI B30.2-1976.

b. Evaluation

The Kewaunee plant satisfies the requirements for operator training, qualification, and conduct on the basis of existing program compliance and proposed modifications to comply fully with ANSI B30.2-1976.

c. Conclusion

The Kewaunee plant complies with Guideline 3.

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' [9]. 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 stated that the lifting devices at the Kewaunee plant which can be categorized as special lifting devices that handle heavy loads in the containment or near spent fuel are:

1. reactor vessel head lifting rig
2. reactor vessel internals lifting rig
3. load cell
4. load cell linkage
5. reactor coolant pump motor lifting sling.

The reactor vessel head lifting rig, the reactor vessel internals lifting rig, the load cell, the load cell linkage, and the reactor coolant pump motor lifting sling were designed by Westinghouse and built for the Kewaunee plant during 1970-1971. With the exception of the reactor coolant pump motor lift sling, Westinghouse used the design criterion that the resulting stress in the load bearing members, when subjected to the total combined lifting weight, should not exceed one-fifth the ultimate strength of the material. A stress report was prepared for the five above-mentioned lifting devices, and all were found to meet the one-fifth ultimate strength criterion.

The products provided by Westinghouse were designed, fabricated, assembled, and inspected in accordance with internal Westinghouse requirements. Except for a few specific detailed requirements, Westinghouse's requirements meet the intent of ANSI N14.6-1978.

Listed below are paragraphs from ANSI N14.6-1978 with which the special lifting devices are not in strict compliance. Following each item are WPCS's associated remarks which demonstrate equivalent compliance.

Yield Strength

Paragraph 3.2.1.1 requires the design, when using materials with yield strengths above 80% of their ultimate strengths, to be based on the materials fracture toughness and not the listed design factors.

Response

High strength materials were used in the five devices listed above. Although the fracture toughness was not determined, the material was selected for its excellent fracture toughness characteristics. The stress design factors of 3 and 5 listed in ANSI N14.6-1978 were used in the analysis, and the resulting stresses are acceptable.

Load-Bearing Members

Paragraph 3.2.6 requires material for load-bearing members to be subject to drop-weight or Charpy impact tests.

Response

As discussed above, the fracture toughness requirements were not identified for the materials used, but the material selection was based on excellent fracture toughness characteristics.

QA Program

Paragraph 4.1.6 requires a formal quality assurance program for the manufacturer, and Paragraph 4.1.7 requires certification and identification of materials.

Response

At the time of construction of these devices, there was no requirement for a QA program, and, consequently, the manufacturer did not have a formal quality assurance program for all items in the lifting devices. However, the manufacturer's welding and nondestructive testing procedures were reviewed by Westinghouse prior to use. Most of the critical load-bearing members required letters of compliance for material requirements. Westinghouse performed certain checks and inspections during various steps of manufacturing. Final Westinghouse review included visual, dimensional, procedural, cleanliness, personnel qualification, etc., and, in most cases, issuance of a quality release to ensure conformance with drawing requirements. No information that a quality release was issued for the reactor coolant pump motor lift sling has been found, although Westinghouse performed the final inspection.

Owner Responsibilities

Paragraph 5.1 lists Owners Responsibilities, and 5.1.2 requires the owner to verify that the special lifting devices meet the performance criteria of the design specification by records and witness of testing.

Response

Design specifications for these rigs and load testing were not originally required or performed except for the reactor vessel head lifting rig and reactor vessel internals lifting rig. These latter two rigs were load-tested at 100% design load followed by nondestructive testing on critical welds. The Westinghouse Quality Release is an acceptable alternate to verify that the criteria for certified material testing reports, nondestructive evaluation (NDE), and documentation required by Westinghouse drawings and purchasing documents were satisfied.

Special Identification

Paragraphs 5.1.5, 5.1.5.1, and 5.1.5.2 require special identification and marking of these special lifting devices to prevent misuse.

Response

These rigs are specific lifting devices which can only be used for their intended purpose, and have non-interchangeable parts. Therefore, special identification is not necessary.

Testing Requirements

Paragraph 5.2.1 requires the rigs to be initially tested at 150% maximum load followed by nondestructive testing of critical load bearing parts and welds. Also, paragraph 5.3 requires testing to verify continuing compliance and annual 150% load tests or annual nondestructive tests and examinations.

Response

The requirement from paragraph 5.2.1 to load-test to 150% of the total weight before each use would require special fixtures and is impractical. WPSC proposes to visually check the structural members of the earlier mentioned lifting devices at the initial lift prior to moving to full lift and movement. Additionally, lifting and lowering of most of the loads handled by these special lifting devices are monitored with the use of the load cell.

The Kewaunee Nuclear Power Plant has been in operation since 1974 and, for the past eight years, has had no problems with these special lifting rigs. Therefore, WPSC feels the 150% load-test requirement on all special lifting devices should be waived.

Stress Design Factors

NUREG-0612, Section 5.1.1(4) states that special lifting devices should satisfy the guidelines of ANSI N14.6-1978. It goes on to state, "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."

Response

The intent of this paragraph is that the stress design factors specified in Section 3.2.1.1 of ANSI N14.6 (3 and 5) are not all inclusive and should be increased by an amount based on dynamic characteristics. The dynamic characteristics of the crane would be based on the main hook and associated wire ropes holding the hook. The containment polar crane at Kewaunee uses 16 wire ropes to handle the load on the main hook. Should the crane hook suddenly stop during the lifting or lowering of a load, a shock load could be transmitted to the connecting device. Because of the elasticity of the sixteen wire ropes, the dynamic factor for the containment polar crane is not much larger than one (1). The maximum design factor that is recommended by most design texts is a factor of 2 for loads that are suddenly applied. The stress design factors required in Section 3.2.1.1 of ANSI N14.6-1978 are:

$$3(\text{weight}) < \text{Yield Strength}$$
$$5(\text{weight}) < \text{Ultimate Strength}$$

The specified factor of 3 certainly includes consideration of suddenly applied loads for cases where the dynamic impact factor may be as high as 2. Thus, the use of the design criteria in ANSI N14.6-1978 is considered to satisfy the NUREG-0612 requirement.

To provide flexibility on stress design factor, the analysis of the special lifting devices was performed with stress design factors of 1, 3, and 5. In all cases, using a stress design factor of 5 resulted in stress limits below the yield strength of the material.

b. Evaluation

Although it cannot be determined that specific requirements of ANSI N14.6-1978 for component design and fabrication have been satisfied for the special lifting devices in use at the Kewaunee plant, it is evident that the devices were designed to provide a high degree of load handling reliability. The Licensee has verified that all devices satisfy the recommended stress design margins of 5 on ultimate strength. Review of Licensee-provided information indicates that stress design factors for ultimate strength are in compliance with the requirements of ANSI N14.6-1978. No information has been provided, however, to indicate that stress design factors for these devices comply with ANSI requirements regarding yield strength. In addition, the use of the design criteria of ANSI N14.6-1978 is not considered to meet the NUREG-0612 requirements to compensate for dynamic loadings in the design of special lifting devices. The intent of this guideline is to increase the stress design factors to account for dynamic loads which routinely occur due to crane acceleration/deceleration, while reserving the full design factors of 3 and 5 for unaccountable factors such as aging or fatigue-cycling, or unexpected dynamic loads such as a load hangup. This is not expected to be of consequence to the Licensee since speeds for these cranes are, in general, very slow and do not impart a significant impact load to the special lifting device. It has been argued and previously found acceptable that if these dynamic loads can be demonstrated to be a relatively small percentage of the overall static load (typically less than 10%), the dynamic load factor may be disregarded. Regarding annual requirements for inspection/testing, the visual inspection of structural members prior to use of the devices for full load handling is not sufficient to satisfy either the load test or nondestructive examination requirements of ANSI N14.6-1978. Section 5.3.1 of ANSI N14.6 requires dimensional checks and nondestructive testing as well as visual inspection of major load-carrying welds. In addition, the devices have not been load-tested to 150% of the maximum load carried as specified by ANSI N14.6-1978, Sections 5.2.1 and 5.3.1. The intent of this load test is to provide an appreciable overstress condition above the maximum load lifted as a proof of workmanship and mechanical elements in the assembled device. Satisfactory use of the device for a period of years at or near maximum load does not meet this intent, particularly since the frequency and duration of use were, in all probability, limited.

The Licensee has indicated that the reactor vessel head lifting rig and reactor vessel internals lifting rig have been tested to 100% design load followed by nondestructive testing of critical welds. This load test does not satisfy the intent of this guideline: to provide an overstress condition in excess of the rated load.

All special lifting devices should be proof-tested by the Licensee at the first convenient opportunity. As guidance for this load test, the Licensee is referred to the recommendations of ANSI B30.2-1976, Section 2-2.2.2, which specifies accepted industrial practices for weight-testing of cranes. Such practices have been found acceptable as bases for which to load-test these special lifting devices.

c. Conclusion and Recommendations

Special lifting devices in use at the Kewaunee plant substantially comply with this guideline. In order to comply fully, the following major items should be accomplished:

- o verify that the design of special lifting devices is based upon a stress design factor of 3 for yield strength and that routine dynamic loads are accommodated in these stress design factors.
- o conduct a load test of all special lifting devices to a capacity sufficiently in excess of the maximum load lifted.
- o develop and implement a rigorous program for continued compliance in accordance with the provisions of Section 5, ANSI N14.6-1978, including requirements for dimensional testing, visual inspection, and nondestructive testing.

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' [11]. However, in selecting the proper sling, the load used should be the sum of 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 has not provided any information with regard to this guideline.

b. Evaluation and Conclusion

Insufficient information has been provided by the Licensee to allow a determination of compliance with Guideline 5. The Licensee should provide an evaluation concerning compliance with ANSI B30.9-1971, "Slings."

In addition, the Licensee should address the imposition of dynamic loads on the slings. The rating of the sling should be identified in terms of the combined static and maximum dynamic loading. 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. It has been found acceptable to determine the dynamic loading by applying the formula found in Section 3.3.2.1.1.3 of CMAA-70 [11].

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

As reported by the Licensee, "the turbine building, auxiliary building, and containment polar cranes are tested, maintained, and inspected in a manner that satisfies Chapter 2-2 of ANSI B30.2-1976." In addition, the Licensee states that preoperational testing of these cranes was not conducted in verbatim compliance with the ANSI standard; however, sufficient testing was conducted to ensure crane operability, including tests of rated load by the various load controlling functions and a 125% load test of each crane.

b. Evaluation

The Kewaunee plant satisfies the requirements of this guideline on the basis of the Licensee's statement that programs currently in effect are compatible and consistent with ANSI B30.2-1976, Chapter 2-2. In addition, preoperational testing performed by the Licensee is consistent with the guidance of this guideline.

c. Conclusion

The Kewaunee plant complies with Guideline 6.

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' [12]. An alternative to a specification in ANSI B30.2 or CMMA-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 the major cranes for the Kewaunee Nuclear Power Plant, i.e., the 125-ton turbine building crane, 125-ton auxiliary building fuel handling crane, and 230-ton containment polar crane, were purchased from Whiting Corporation of Illinois in the late 1960s and early 1970s. The specification against which these cranes were purchased predates CMAA-70. However, the cranes were qualified against ECCI-61, which was superseded by CMAA-70. The other codes and standards invoked by the crane specification include:

American Society for Testing and Materials Standard Specification (ASTM).
American Institute of Steel Construction Specification (AISC)
American Welding Society Standards (AWS)
National Electrical Manufacturer's Association (NEMA)
National Electric Code (NEC).

A comparison of sections of EOCI-61 with corresponding sections of CMAA-70 was prepared by the Whiting Corporation and brings out the deficiencies that may exist in the cranes designed per EOCI-61 if judged by CMAA-70 standards.

CMAA-70 specifications address the design loads for the footwalks and the construction features of the cabs. Kewaunee Nuclear Power Plant's experience with both footwalks and cabs has been satisfactory.

With respect to material properties, although the two codes specify different materials, a careful review indicates that the structural strength of the cranes manufactured in accordance with either of the two specifications would have the same factors of safety. Structural steel used for the cranes at the Kewaunee plant conforms to ASTM A36 steel as required by CMAA-70 specifications which exceed those for ASTM A7 steel specified by EOCI-61.

A comparison of crane specifications with CMAA requirements was made, and it was concluded that the two sets of specifications are in agreement for the following:

a. rated motor voltage
b. squirrel cage motor design
c. specification for remote control
d. classification of resistors
e. means for disconnecting
f. overload of ac motors
g. criteria for floor-operated pendant pushbutton stations
h. runway voltage drop criteria.

The following sections of CMAA-70 specifications important to crane safety were evaluated in detail.

Impact Factor

Section 3.3.2.1.1.3 of CMAA-70 requires that the impact allowance shall be 0.5% of the load per foot per minute (fpm) of hoist speed but not less than 15% of rated capacity. The corresponding section of EOCI-61 requires a minimum impact of 15% without regard to hoist speed. For hoist speeds less than 30 fpm, the two specifications are equivalent.

Response

The speeds of these three cranes are significantly lower than 30 fpm. The cranes designed according to EOCI-61 are therefore satisfactory.

Torsional Forces

CMAA-70, Section 3.3.2.1.3 requires that twisting moments due to overhanging loads and lateral loads acting eccentric to the horizontal neutral axis of the girder be calculated on the basis of the distance between the center of gravity of the load, or force center line, and the girder shear center measured normal to the force vector. EOCI-61 states that such moments are to be calculated with reference to the girder center of gravity.

Response

A review of the girder sections used for the three cranes reveals that asymmetrical sections were not used. For the symmetrical sections, the shear center coincides with the center of gravity and the two codes are equivalent.

Longitudinal Stiffeners

Section 3.3.3.1 of CMAA-70 specifies the design requirements for the longitudinal stiffeners. EOCI-61 allows the use of longitudinal stiffeners but does not provide design guidance for them.

The following tables provide the comparison between the CMAA-70 longitudinal stiffener requirements and those applied to the cranes at the Kewaunee plant:

Distance from Inner Surface of Compression Flange
to the Center Line of the Stiffener

	As Built	CMAA-70
Reactor Building Crane	28 inches	$\leq$ 20.8 inches
Auxiliary Building Crane	20 inches	$\leq$ 19.4 inches
Turbine Building Crane	26 inches	$\leq$ 23.0 inches

h/t Ratios

	As Built	CMAA-70
Reactor Building Crane	332.8	$\leq$ 324
Auxiliary Building Crane	310.4	$\leq$ 324
Turbine Building Crane	368.0	$\leq$ 324

Response

At the present stage, WPSC has no reason to doubt design adequacy of the cranes in spite of difficulty in assessing that equivalent design practices were followed for the cranes. It must be remembered that the cranes have been used to lift the heaviest loads in the plant within their design limits without any structural problems.

Allowable Compressive Stress

Section 3.3.3.1.3 of CMAA-70 identifies allowable compressive stresses of approximately 50% of yield strength of the recommended structural material (A-36) for girders, where the ratio of the distance between web plates to the thickness of the top cover plate (b/c ratio) is less than or equal to 38. Allowable compressive stresses decrease linearly for b/c ratios in excess of 38. EOCI-61 provides a similar method for calculating allowable compressive stresses except that the allowable stress decreases from approximately 50% of yield only after the b/c ratio exceeds 41.

Response

The b/c ratios for the cranes at the Kewaunee plant do not exceed 38 and hence the two specifications are equivalent.

Fatigue Consideration

Table 3.3.3.1.3-1 of CMAA-70 provides allowable stresses for cranes subjected to fatigue loads based on the classification of the crane. EOCI-61 does not provide such a guidance in the design of the crane.

Response

The cranes at the Kewaunee plant are not governed by this consideration since the maximum number of cycles of significant load handling events for each crane is less than 20,000. For this purpose, significant loads are defined as loads greater than 25% of the rated capacity of the crane. It is estimated that heavy loads would be lifted by a given crane fewer than 800 times during the 40-year plant life. This provides for 20 lifts per year.

Hoist Rope Requirements

Section 4.2.1 of CMAA-70 requires that the weight of the bottom block plus the rated capacity load divided by the number of parts of rope shall not exceed 20% of the published rope breaking strength. EOCI-61 ignored the weight of the bottom block for this specification.

Response

WPSC concluded that, for the Kewaunee plant cranes, the rated capacity load plus the weight of the bottom block divided by the number of parts of rope does not exceed 20% of the published breaking strength of the rope. The breaking strengths for the ropes used for this review were obtained from the Whiting Crane Handbook, 3rd Ed., 1967.

Drum Design

Section 4.4.1 of CMAA-70 requires that the drum be designed for combined crushing and bending loads. ECCI-61 specified the design to withstand maximum bending and crushing loads but did not specifically ask for combinations of the stresses.

Response

The cranes for the Kewaunee plant were purchased from the Whiting Corporation. The Whiting Crane Handbook (3rd edition), page 83, states that for the design of the drum the crushing strength is combined with bending strength to arrive at a combined stress which must be compared with the allowable stress. Hence, it is concluded that the cranes meet the design requirement of CMAA-70.

Drum Groove Depth and Pitch Design

Section 4.4.3 requires the minimum drum groove depth to be 3/8 times the rope diameter and the minimum drum groove pitch to be either 1.14 times the rope diameter or the rope diameter plus 1/8 inch, whichever is smaller.

Response

The depths of the drum grooves for all Kewaunee plant cranes, except the main hoist of the polar crane, meet CMAA-70 requirements.

The groove depth of the main hoist drum of the polar crane is 0.500 inch, whereas the minimum recommended by CMAA-70 is 0.515 inch.

The pitches of the drum grooves for Kewaunee plant cranes meet the rope-diameter-plus 1/8-inch criterion. All auxiliary hoist drums have rope diameters equal to 9/16 (0.5625) inch. The drum groove pitch, based on rope diameter plus 1/8 inch (0.125), is 0.6875 inch. This exceeds the minimum drum groove pitch based on 1.14 times the rope diameter, which equals 0.6438 inch.

Gear Design

Section 4.5 of CMAA-70 specifies that the gearing horsepower rating shall be based on specific standards of American Gear Manufacturers Association and provides a method for determining allowable horsepower.

Response

Whiting Corporation has informed WPSC that gearings were purchased from gear manufacturers who complied with the American Gear Manufacturers Association Standards. CMAA-70, Article 4.5.2, design standards are the same as those in existence at the time of the crane purchase.

Bridge Brake Design

Section 4.7.7.2 of CMAA-70 requires that brakes for cranes with cab control, with a cab-on-trolley arrangement, shall have a torque rating of at least 75% of the bridge motor rating instead of the 50% specified by EOCI-61.

Response

Kewaunee cranes do not have cab-on-trolley control arrangements.

Hoist Brake Design

Section 4.7.4.2 of CMAA-70 requires that the minimum torque rating of holding brakes, in relation to the motor torque, at the point of application shall be 125% when used with a nonmechanical control braking means. EOCI-61 requires a hoist holding brakes torque rating of no less than 100% of the hoist motor torque without regard to the type of control brakes employed.

Response

The torque rating for the hoist holding brakes for the cranes at Kewaunee Nuclear Plant is a minimum of 125% of the hoist motor torque.

The cranes are equipped with two 13-inch SESA electric solenoid brakes servicing the main hoist and one 13-inch SESA electric solenoid brake servicing the auxiliary hoist. Each brake has a rated torque capacity of 550 ft-lb. The torque rating for the reactor building main hoist motor is 345 ft-lb. This is the smallest ratio among the cranes.

Bumpers and Stops

Section 4.12 of CMAA-70 provides requirements for the design and installation of the bridge and trolley bumpers and stops. Similar requirements are not specified by EOCI-61.

Response

The following verification of Kewaunee Nuclear Plant cranes was made to check that the bumpers and stops satisfy the intent of CMAA-70.

Bridge Bumpers and Stops

Auxiliary and turbine building cranes are both equipped with four spring bumpers with safety cables. The polar crane in the reactor building does not have bridge bumpers or stops, to allow 360-degree rotation of the crane.

Bridge stops were designed for the loads established by the crane manufacturer.

Trolley Bumpers and Stops

All cranes under review are equipped with trolley bumpers and stops. The criteria for the design of bumpers and stops match those of CMAA-70.

The bridge and trolley bumpers are mounted in such a manner that the attaching bolts are not in shear.

The bridge bumpers were designed to criteria more stringent than those specified by CMAA-70.

Static Control Systems

Section 5.4.6 of CMAA-70 provides design guidelines for the use of static control systems, whereas EOCI-61 did not discuss static control systems. EOCI-61 specified design criteria for magnetic controls only.

Response

WPSC has reviewed Kewaunee cranes and concluded that the cranes are equipped with magnetic controls. This segment of CMAA-70 is, therefore, not applicable.

Restart Protection

Section 5.6.2 of CMAA-70 states that cranes not equipped with spring-return controllers, or momentary-contact pushbuttons, shall be provided with a device which will disconnect all motors from the line on failure of power and will not permit any motor to be restarted until either the controller handle is brought to the "OFF" position or a reset switch or button is operated. EOCI-61 does not specify any requirements for restart protection.

Response

WPSC has confirmed with the crane manufacturer that all controllers used are of the momentary-contact pushbutton type and satisfy this requirement of CMAA-70.

b. Evaluation

The designs of the turbine building crane, containment polar crane, and auxiliary building crane at the Kewaunee plant meet the intent of Section 5.1.1(7) of NUREG-0612 on the basis of the point-by-point review of CMAA-70 provided by the Licensee. As indicated by the Licensee, the cranes substantially comply with CMAA-70 criteria.

c. Conclusion

The cranes at the Kewaunee plant comply with Guideline 7.

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. Summary of Licensee Statements and Conclusions

The Licensee stated that the plant technical specifications prohibit the movement of heavy loads over the spent fuel storage pool. Access to this restricted area is required for:

- Loading of irradiated reactor vessel surveillance capsule into shipping cask - The Licensee stated that the shipping cask is brought into the small pool for loading of irradiated specimens. During loading, strict procedures are followed, and whenever the possibility exists, the small pool is kept free of all spent fuel elements.

- Relocation of pool and fuel transfer canal divider gates - The Licensee stated that for the relocation of divider gates the crane is allowed to operate over the entire spent fuel area. Operation over the spent fuel pool is under strict procedural control and safe load paths are defined. The extent of the damage to spent fuel elements from an accidental drop of the pool divider gate was evaluated to be less than that due to a postulated turbine missile accident described in the updated FSAR.

b. Evaluation

Although the Licensee states that movement of heavy loads is prohibited over the spent fuel pool, examples have been identified (irradiated specimen shipping cask and pool divider gates) which may be lifted over spent fuel assemblies, apparently in contradiction to the Licensee's technical specifications. If this is not the case, additional information should be provided to demonstrate that adequate measures and precautions are taken in plant procedures to ensure that such lifts over spent fuel assemblies are not conducted.

c. Conclusion

WPSC partially complies with Interim Protection Measure 1. In order to comply fully, the Licensee should prohibit the movement of the irradiated specimen shipping cask and the pool divider gates over spent fuel assembies in the spent fuel pool.

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

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

a. Evaluation

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

b. Conclusions and Recommendations

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

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

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

a. Summary of Licensee Statements and Conclusions

Although not specifically addressed by the Licensee, it is apparent from responses to Guidelines 2 and 3 that procedures for handling loads over the core and for operator training have been reviewed and upgraded as appropriate. In addition, a review of special lifting devices for compliance with ANSI N14.6-1978 has been completed and proposed modifications are in progress. No information has been provided, however, to substantiate a review of selection and use of non-specially designed slings. Finally the design of cranes at the Kewaunee plant has been reviewed by the Licensee and found to comply with NUREG-0612 guidelines.

b. Conclusion

The Kewaunee plant partially complies with Interim Protection Measure 6. To fully comply, the Licensee should implement the recommendations identified in Guideline 5.

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 the Kewaunee plant. Overall conclusions and recommended Licensee actions, where appropriate, are provided with respect to both general provisions for load handling (NUREG-0612, Section 5.1.1) and completion of the staff recommendations for interim protection (NUREG-0612, Section 5.3).

3.1 GENERAL PROVISIONS FOR LOAD HANDLING

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

- o implement the provisions of Guidelines 1 through 7 for the turbine building crane and loads associated with this crane.
- o provide suitable visual aids to assist the crane operator and ensure that the loads follow designated load paths while remaining outside of exclusion areas. Reasonable alternatives to the floor marking requirement of Guideline 1 should be based on the principle that the operator should not have to rely on memory or the reading of a

procedure while operating a loaded crane and moving a substantial distance.

- o ensure that deviations from safe load paths are approved by the plant safety review committee.

- o verify that the design of special lifting devices is based upon a stress design factor of 3 for yield strength and that routine dynamic loads are accommodated in these design factors.

- o conduct a load test of all special lifting devices to a capacity sufficiently in excess of the maximum load lifted.

- o develop a program consistent with ANSI N14.6-1978, Section 5 to maintain the assurance of reliability of special lifting devices.

- o provide verification that slings are selected and used in accordance with ANSI B30.9-1971, with due consideration for the effects of routine dynamic load.

3.2 INTERIM PROTECTION

The NRC staff has established certain measures (NUREG-0612, Section 5.3) that should be initiated to provide reasonable assurance that handling of heavy loads will be performed in a safe manner until final implementation of the general guidelines of NUREG-0612, Section 5.1 is complete. Specified measures include: the implementation of a technical specification to prohibit the handling of heavy loads over fuel in the storage pool; compliance with Guidelines 1, 2, 3, and 6 of NUREG-0612, Section 5.1.1; a review of load-handling procedures and operator training; and a visual inspection program, including component repair or replacement as necessary of cranes, slings, and special lifting devices to eliminate deficiencies that could lead to component failure. In addition to implementation of appropriate procedures for slings, the evaluation of information provided by the Licensee indicates that the following action is required:

- o Prohibit the movement of the pool divider gates and irradiated specimen shipping cask over spent fuel assemblies in the spent fuel pool.

4. REFERENCES

1. NRC
   "Control of Heavy Loads at Nuclear Power Plants"
   July 1980
   NUREG-0612

2. V. Stello, Jr. (NRC)
   Letter to all Licensees
   Subject: Request for Additional Information on Control of Heavy Loads Near Spent Fuel
   17 May 1978

3. D. G. Eisenhut (NRC)
   Letter to all operating reactors
   Subject: Control of Heavy Loads
   22 December 1980

4. E. R. Mathews (WPSC)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   22 June 1981

5. E. R. Mathews (WPSC)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   17 August 1981

6. E. R. Mathews (WPSC)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   9 October 1981

7. C. W. Giesler (WPSC)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   23 December 1982

8. Nine-Month Response to Generic Letter 81-07 (WPSC)
   Subject: Control of Heavy Loads
   09 March 1983

9. American National Standards Institute
   "Overhead and Gantry Cranes"
   New York: 1976
   ANSI B30.2-1976

10. American National Standards Institute
"Standard for Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials"
ANSI N14.6-1978

11. American National Standards Institute
"Slings"
ANSI B30.9-1971

12. Crane Manufacturers Association of America
"Specifications for Electric Overhead Traveling Cranes"
Pittsburgh, PA
CMAA-70