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CONTROL OF HEAVY LOADS AT NUCLEAR POWER PLANTS

WATERFORD GENERATING STATION, UNIT 3

LOUISIANA POWER AND LIGHTING COMPANY (PHASE I)

DOCKET NO. 50-382

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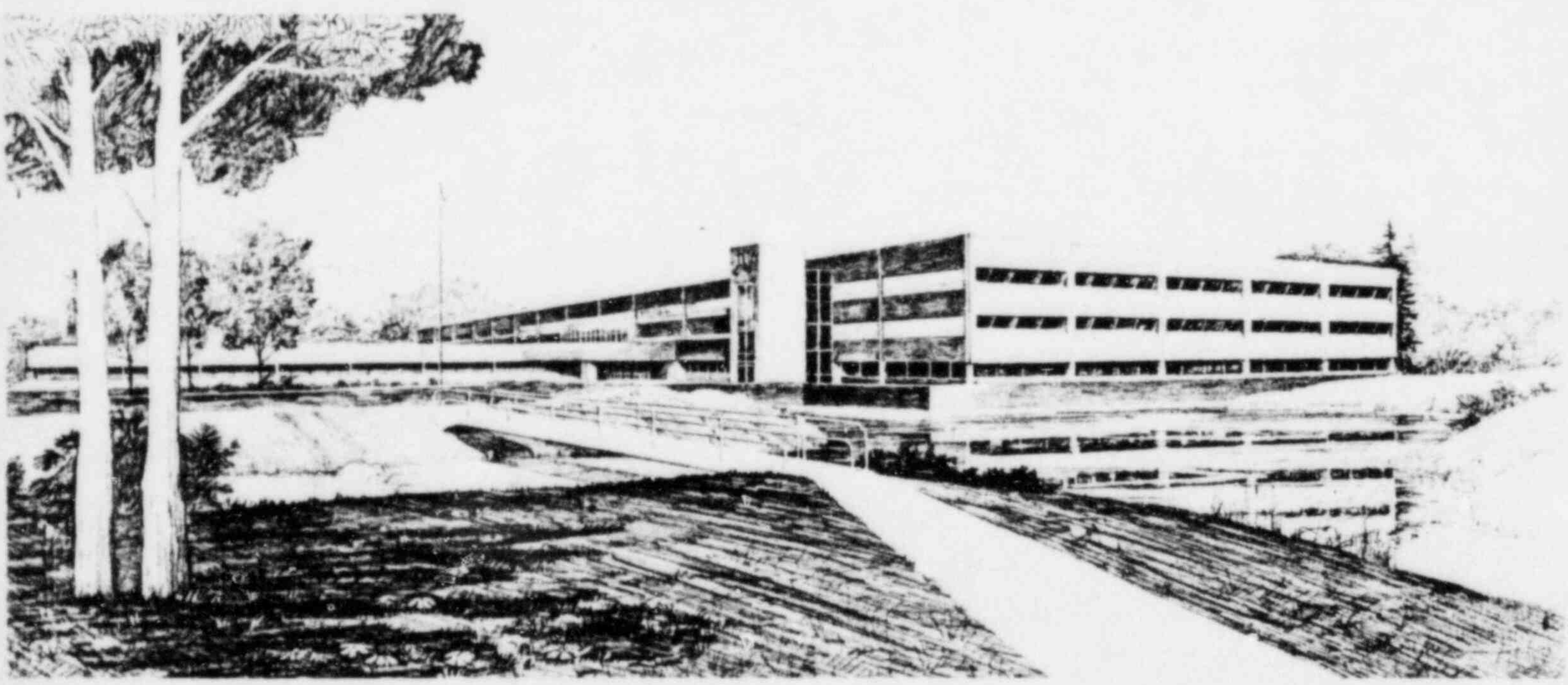
Idaho National Engineering Laboratory
Operated by the U.S. Department of Energy



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EG&G Idaho

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WATERFORD GENERATING STATION, UNIT 3
LOUISIANA POWER AND LIGHTING COMPANY
(Phase I)
Docket No. [50-382]

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ABSTRACT

The Nuclear Regulatory Commission (NRC) has requested that all nuclear plants, either operating or under construction, submit a response of compliancy with NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." EG&G Idaho, Inc., has contracted with the NRC to evaluate the responses of those plants presently under construction. This report contains EG&G's evaluation and recommendations for the Louisiana Power and Light Company (LP&L) Waterford Generating Station, Unit 3 (WGS No. 3).

EXECUTIVE SUMMARY

WGS No. 3 does not totally comply with the guidelines of NUREG-0612. An examination by EG&G Idaho of the applicant's report and response indicate that, although several sections were well presented and developed, there is still an area of noncompliance, specifically special-lift devices. Programs or procedures have not yet been completed; however, commitment toward their completion has been indicated.

The main report contains recommendations which will aid in bringing the above items into compliance with the appropriate guidelines.

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CONTROL OF HEAVY LOADS AT NUCLEAR POWER PLANTS
WATERFORD GENERATING STATION, UNIT 3
(Phase I)

1. INTRODUCTION

1.1 Purpose of Review

This technical evaluation report documents the EG&G Idaho, Inc., review of general load-handling policy and procedures at Waterford Generating Station (WGS) No. 3. This evaluation was performed with the objective of assessing conformance to the general load-handling guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants" [1], Section 5.1.1.

1.2 Generic Background

Generic Technical Activity Task A-36 was established by the U.S. Nuclear Regulatory Commission (NRC) staff to systematically examine staff licensing criteria and the adequacy of measures in effect at operating nuclear power plants to assure the safe handling of heavy loads and to recommend necessary changes to these measures. This activity was initiated by a letter issued by the NRC staff on May 17, 1978 [2], to all power reactor applicants, 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-phase 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, Article 5.1.1, is to ensure that all load-handling systems at nuclear power plants are designed and operated such 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, Articles 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 (a) 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 (b) conservative evaluations of load-handling accidents indicate that the potential consequences of any load drop are acceptably small. Acceptability of accident consequences is quantified in NUREG-0612 into four accident analysis evaluation criteria.

The approach used to develop the staff guidelines for minimizing the potential for a load drop was based on defense in depth and is summarized as follows:

- Provide sufficient operator training, handling system design, load-handling instructions, and equipment inspection to assure reliable operation of the handling system

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

Staff guidelines resulting from the foregoing are tabulated in Section 5 of NUREG-0612.

1.3 Plant-Specific Background

On December 22, 1980, the NRC issued a letter [3] to Louisiana Power and Lighting Company (LP&L) the applicant for WGS No. 3 requesting that the applicant review provisions for handling and control of heavy loads at WGS No. 3, 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 June 19, 1981, LP&L provided the initial response [4] to this request.

On September 21, 1981, LP&L submitted a second or follow-up response to this request. Only Phase I guidelines will be addressed in this report. These involve approximately 60% of the June 19, 1981, response. The remaining sections of the June 19, 1981, and all of the September 21, 1981, response are concerned with Phase II. Compliance to Phase II requirements are semi-independent on Phase I and will not be addressed in this report. Based on the information submitted, a preliminary draft of this report was prepared and discussed with the applicant. Additional information [5] was provided on January 27, 1983. The current (final) draft of this report was prepared from information contained in those submittals.

2. EVALUATION AND RECOMMENDATIONS

2.1 Overview

The following sections summarize LP&L's review of heavy load handling at WGS No. 3 accompanied by EG&G's evaluation, conclusions, and recommendations to the applicant for bringing the facilities more completely into compliance with the intent of NUREG-0612. The applicant has indicated the weight of a heavy load for this facility (as defined in NUREG-0612, Article 1.2) as 1450 pounds [4].

2.2 Heavy Load Overhead Handling Systems

This section reviews the applicant's list of overhead handling systems which are subject to the criteria of NUREG-0612 and a review of the justification for excluding overhead handling systems from the above-mentioned list.

2.2.1 Scope

> "Report the results of your review of plant arrangements to identify all overhead handling systems from which a load drop may result in damage to any system required for plant shutdown or decay heat removal (taking no credit for any interlocks, technical specifications, operating procedures, or detailed structural analysis) and justify the exclusion of any overhead handling system from your list by verifying that there is sufficient physical separation from any load-impact point and any safety-related component to permit a determination by inspection that no heavy load drop can result in damage to any system or component required for plant shutdown or decay heat removal."

A. Summary of Applicant's Statements

The applicant's review of overhead handling systems identified the cranes and hoists shown in Table 2.1 as those which handle heavy loads in the vicinity of irradiated fuel or safe shutdown equipment.

TABLE 2.1 OVERHEAD HANDLING DEVICES IN VICINITY OF SAFE SHUTDOWN EQUIPMENT, WATERFORD GENERATION STATION UNIT 3

Handling System	Capacity (Tons)	Location
Reactor Circular Bridge	200/30	Reactor Building
Fuel-Handling Building Bridge	125/15	Fuel-Handling Building

The applicant has also identified numerous other cranes that have been excluded from satisfying the criteria of the general guidelines of NUREG-0612. These are listed in Table 2.2. These overhead handling devices were reviewed by the applicant to the criteria of NUREG-0612 and were excluded based on sufficient physical separation from any load impact point that could damage any system or component required for plant shutdown or decay heat removal. Some of the devices have been excluded because the applicant has indicated that the heavy load of approximately 1450 pounds for this facility would not be exceeded. Tables 2.3 and 2.4 identify heavy loads to be handled by each crane, load weight, designated lift device, procedure, and load-drop analysis.

B. EG&G Evaluation

The applicant's response [5] indicates that each overhead handling device at WGS No. 3 is listed in Tables 2.1 and 2.2. The applicant provided a listing of all plant overhead handling systems, identified equipment to be handled, crane or hoist location, elevations, and rate capacities. Drawings were also provided to show the proximity of the handling devices to safe shutdown equipment. The applicant addressed each handling system and provided justification for its exclusion from the list of OHS from which load drops may result in damage to any system required for plant shutdown or decay heat removal. They further addressed the handling of heavy loads identified in NUREG-0612 (Table 3.1-1).

TABLE 2.2 OVERHEAD HANDLING SERVICES EXCLUDED FROM FURTHER CONCERN, WATERFORD GENERATING STATION UNIT 3

Handling System	Capacity (Tons)	Location
Cranes		
Radwaste Cask-Handling Bridge	30	Reactor Auxiliary Building
Machine Shop Bridge	6	Service Building
Steam Generator Feeder Pump Bridge	10	Turbine Building
Intake Structure Bridge	40	Intake Structure
Turbine Building Gantry	200/35	Turbine Building
Monorail/Hoist		
Roof Hatch Cover	10	Reactor Auxiliary Building
Water Chiller	7-1/2	Reactor Auxiliary Building
Water Chiller (2)	7-1/2	Reactor Auxiliary Building
HVAC Fan Motors	7-1/2	Reactor Auxiliary Building
Cask Handling	7-1/2	Reactor Auxiliary Building
CEA Drive-MG Set	7-1/2	Reactor Auxiliary Building
RSD Equipment Access	7-1/2	Reactor Auxiliary Building
Emergency Diesel Generator (4)	3	Reactor Auxiliary Building
Emergency Diesel Generator (4)	14	Reactor Auxiliary Building
Purification Filter	5	Reactor Auxiliary Building
Misc. Equipment Jib Crane	1/2	Plant Shack
Spent-Fuel Handling Machine	3/4	Fuel-Handling Building
Refueling Machine	3/4	Reactor Building
Fuel-Pool Filter	5	Reactor Auxiliary Building

TABLE 2.2 (continued)

Handling System	Capacity (Tons)	Location
Monorail/Hoist (continued)		
Boric Acid Precon Filter	5	Reactor Auxiliary Building
Waste, Oil, & Laundry Filter	5	Reactor Auxiliary Building
Charging Pumps	5	Reactor Auxiliary Building
HP-LP Safety Injection Cont. Spray Pumps (2)	5	Reactor Auxiliary Building
HP Safety Inject, Drain Pump	5	Reactor Auxiliary Building
Safety VA Maintenance (2)	5	Reactor Auxiliary Building
Equipment Decon Room	5	Reactor Auxiliary Building
Equipment Decon Room (4)	1	Reactor Auxiliary Building
Equipment Hot Machine Shop	2	Reactor Auxiliary Building
General Storage (Above Machine Shop)	1	Reactor Auxiliary Building
Miscellaneous Equipment	1	Reactor Building
1PH Drain Pump (3)	5	Turbine Building
Chillers (2)	5	Chiller Building

TABLE 2.3 REACTOR CONTAINMENT BUILDING POLAR CRANE--WATERFORD GENERATING STATION UNIT 3

	Load	Approximate Weight (Ton)	Lift Equipment	Procedure	Remarks
1.	Reactor Vessel Head w/Lift Rig	189	Reactor Vessel Head Lift Rig	a	Load drop analysis over Reactor Vessel[b]
2.	Reactor Internals Lifting Rig	16.5	N/A	a	Less critical than (1)
3.	Reactor Upper Guide Structure w/Lift Rig	73	Upper Guide Structure Lift Rig	a	Less critical than (4)
4.	Reactor Core Barrel w/Lift Rig	79	Core Support Barrel Lift Rig	a	Load drop analysis[c] over canal bottom
5.	Stud Tensioner	1.5	e	a	Less critical than (4)
6.	RC Pump 1A-Motor w/Lift Rig	59	Reactor Coolant Pump Motor Lift Rig	a	Load drop analysis[d] over operating floor
7.	RC Pump 1B-Motor w/Lift Rig	59	Reactor Coolant Pump Motor Lift Rig	a	Load drop analysis[d] over operating floor
8.	RC Pump 2A-Motor w/Lift Rig	59	Reactor Coolant Pump Motor Lift Rig	a	Load drop analysis[d] over operating floor
9.	RC Pump 2B-Motor w/Lift Rig	59	Reactor Coolant Pump Motor Lift Rig	a	Load drop analysis[d] over operating floor
10.	Plant Equipment from Lower Floors	5	e	a	Load drop analysis[d] over operating floor
11.	Main Hook Load Block	4.5	N/A	a	Less critical than (10)
12.	Auxiliary Hook Load Block	1	N/A	a	Less critical than (10)

a. Procedures will be developed and implemented 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. These procedures will include the information identified in NUREG-0612 Section 5.1.1.(2). [5]

b. Analysis currently being performed. Results will be reported in Applicant's Report Part II as Appendix B. [5]

c. Analysis has been performed. Results will be reported in Applicant's Report Part II as Appendix D. [5]

d. Analysis has been performed and consequential effects have been found acceptable by the applicant. [5]

e. No special lifting devices identified by the applicant.

f. The spent-fuel cask cannot be brought over the spent-fuel storage pool; also, it cannot be lifted more than 30 feet from the floor. Both the spent-fuel cask storage and wash-down areas are supported on the huge mass concrete slabs which are structurally independent of the spent-fuel storage pool. Therefore, the impact due to a cask drop on the storage- and wash-down-area slabs will not have a detrimental structural effect on the spent-fuel storage pool structures. No other load drop analysis is required. [4]

TABLE 2.4 FUEL-HANDLING BUILDING BRIDGE CRANE--WATERFORD GENERATING STATION UNIT 3

Load	Approximate Weight (Ton)	Lift Equipment	Procedure	Remarks
1. Spent-Fuel Cask w/10 Fuel Assemblies	100	e	a	f
2. Gate No. 1	1.6	e	a	Less critical than (4)
3. Gate No. 2	1.6	e	a	Less critical than (4)
4. Gates No. 3A and 3B	12.7	e	a	Load drop analysis over storage area bottom
5. Gate No. 4	10.8	e	a	Less critical than (4)
6. Hatch Cover HC-6	11.5	e	a	Load will be handled at minimum height from floor
7. Hatch Cover HC-5	12	e	a	Load will be handled at minimum height from floor
8. Hatch Cover HC-15	5.5	e	a	Load will be handled at minimum height from floor
9. New Fuel Containers w/2 Fuel Assemblies	3.5	e	a	Load will be handled at minimum height from floor
10. Plant Equipment from Lower Floor	10.5	e	a	Load will be handled at minimum height from floor
11. Main Hook Load Block	2.1	e	a	Load drop analysis over operating floor

a. Procedures will be developed and implemented 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. These procedures will include the information identified in NUREG-0612 Section 5.1.1.(2). [5]

b. Analysis currently being performed. Results will be reported in Applicant's Report Part II as Appendix B. [5]

c. Analysis has been performed. Results will be reported in Applicant's Report Part II as Appendix D. [5]

d. Analysis has been performed and consequential effects have been found acceptable by the applicant. [5]

e. No special lifting devices identified by the applicant.

f. The spent-fuel cask cannot be brought over the spent-fuel storage pool; also, it cannot be lifted more than 30 feet from the floor. Both the spent-fuel cask storage and wash-down areas are supported on the huge mass concrete slabs which are structurally independent of the spent-fuel storage pool. Therefore, the impact due to a cask drop on the storage- and wash-down-area slabs will not have a detrimental structural effect on the spent-fuel storage pool structures. No other load drop analysis is required. [4]

C. EG&G Conclusions and Recommendations

Since there is no information to the contrary, EG&G concludes that the applicant has included all applicable hoists and cranes in their list of handling systems in compliance with the requirements of the general guidelines of NUREG-0612.

2.3 General Guidelines

This section addresses the extent to which the applicable handling systems comply with the general guidelines of NUREG-0612, Article 5.1.1. EG&G's conclusions and recommendations are provided in summaries for each guideline.

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 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 succeeding paragraphs address the guidelines individually.

2.3.1 Safe Load Paths [Guideline 1, NUREG-0612, Article 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 Applicant's Statements

The applicant submitted drawings identifying safe load paths, location of spent fuel, and safety-related equipment. Crane travel over areas not defined as safe load paths (i.e., exclusion areas) is prohibited without safety review. Safe load paths and exclusion areas will be defined in all load-handling procedures and clearly marked on equipment and floor layout drawings appended to each procedure. Any heavy-load-handling operation, prior to movement through an exclusion area, will be required by administrative control to undergo a plant engineering safety review and evaluation. Analyses have shown that the floor structure will withstand the impact of heavy load drops in safe load path areas where safe shutdown or decay heat removal equipment may lie below the floor structure. Based on the above, the applicant feels that marking the floors is unnecessary and impractical [5]. The applicant

identified those heavy operations over or near irradiated fuel, reactor vessel, spent-fuel storage pool, or safe shutdown equipment and identifies those cases for which a load drop analysis will be performed [4].

B. EG&G Evaluation

The applicant provided detailed and well-illustrated drawings of the load paths for each overhead handling system and stated that the load paths were generally defined in accordance with the NUREG guidelines. LP&L stated that the load paths and exclusion areas will be defined and clearly marked on each load-handling procedure, and safety review is required for any deviations. EG&G concludes that adequate measures have been taken to ensure that load-handling operations remain within safe load paths.

C. EG&G Conclusions and Recommendations

Waterford Generating Station, Unit 3 fully complies with the criteria of NUREG-0612, Guideline 1, Safe Load Paths.

2.3.2 Load-Handling Procedures [Guideline 2, NUREG-0612, Article 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 Applicant's Statements

"Prior to Fuel Load, procedures will be developed and implemented 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. These procedures will 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 areas; and special precautions; if necessary [5]."

B. EG&G Evaluation

On the basis of the applicant's statement, EG&G feels that the criteria of NUREG-0612, Guideline 2 will be satisfied. Procedures must be prepared and made available for audit prior to fuel load.

C. EG&G Conclusions and Recommendations

EG&G concludes that Waterford Generating Station, Unit 3 is in compliance with the intent of criteria of NUREG-0612, Guideline 2, Load-Handling Procedures.

2.3.3 Crane Operator Training [Guideline 3, NUREG-0612, Article 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 Applicant's Statements

"LP&L has trained and qualified crane operators in accordance with Chapter 2-3 of ANSI B30.2-1976 [5]."

B. EG&G Evaluation

On the basis of the applicant's statement, EG&G concludes that the criteria of NUREG-0612 Guideline 3 has been satisfied. Training and qualification records must be made available for audit.

C. EG&G Conclusions and Recommendations

EG&G concludes that the Waterford Generating Station, Unit 3 is in compliance with NUREG-0612, Guideline 3, Crane Operator Training.

2.3.4 Special Lifting Devices [Guideline 4, NUREG-0612, Article 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) or the load and of the intervening components of the special handling device."

A. Summary of Applicant's Statements

The applicant identified six special lift devices that are to be used and discussed their evaluation as follows [5]:

1. Two of these devices (Disposable Cask Liner Lift Rig and Shipping Cask Lift Rig) were excluded from further consideration because they are designated for use on a monorail/hoist that has been excluded from further consideration because of physical separation by distance or limited load path.

2. The Reactor Coolant Motor Lift Rig complies with the stress design factors addressed in ANSI N14.6-1978, Section 3.2.1.1, as supplemented by NUREG-0612, Section 5.1.1.(4). In addition, an analysis for a postulated drop of the RC pump motor to the operating floor elevation -11 ft was performed and its consequent effects were found acceptable.

3. A heavy load drop analysis, prepared for the Core Support Barrel, indicates that the local and overall effects of the impact on the structure are acceptable The analysis also determined that the travel path is not over any irradiated fuel and that the effects of a postulated drop of the Core Support Barrel are less critical than that of the upper guide structure. No postulated load drop was initiated for the upper guide structure since its effect is less critical than that of the vessel head. The CSB lift rig is part of the UGS lift rig and this device was evaluated with regard to the design and fabrication compliance with NUREG-0612 and ANSI N14.6-1978 criteria. Both lift rigs exceed NUREG-0612 stress allowances in a number of locations and do not fully meet all ANSI N14.6-1978 requirements.

4. A Heavy load drop analysis is currently being performed for the Reactor Vessel Head and the RV head lift rig is currently undergoing review. It is expected that the review will show nearly identical results to those of the UGS/CSB lift rig, including areas of noncompliance.

B. EG&G Evaluation

On the basis of the information submitted,

1. EG&G agrees that the Disposable Cask Liner Lift Rig and the Shipping Cask Lift Rig may be excluded from further consideration.

2. EG&G concludes that the Reactor Coolant Motor Lift Rig is in compliance.

3. The applicant submitted sketches of the UGS/CSB lift rig to show areas where stress levels exceed the NUREG-0612 criteria, however, neglected to state what action, if any, would be taken toward compliance. In evaluating the applicant's comparison to ANSI N14.6 criteria, it was noted that the applicant identified numerous areas where the Lift Rig Specification differed from the ANSI N14.6 requirements; however, the applicant again neglected to identify actions to be taken.

4. Load drop analysis and ANSI N14.6 comparison review for the RV Head Lift Rig have not yet been completed.

C. EG&G Conclusions and Recommendations

EG&G concludes that Waterford Generating Station, Unit 3 is not in compliance with the criteria of NUREG-0612, Guideline 4, Special Lift Devices.

It is recommended that LP&L:

(1) Take a more positive approach toward defining actions to be taken toward meeting the intent of this NUREG guideline. Differences noted between the Lift Rig Specification and ANSI N14.6 include critical item

requirements, design load, ASME Section III allowable stress versus yield strength (i.e., in most cases $S_{all} \sim (.6)S_y$), lamellar tearing, load testing, requirements placed on the material suppliers (i.e., material normally procured to ASTM specifications require drop weight or charpy impact tests), and non-destructive examinations.

(2) Complete load drop analysis and ANSI N14.6 comparison review for the Reactor Vessel Head Lift Rig.

2.3.5 Lifting Devices (Not Specially Designed) [Guideline 5, NUREG-0612, Article 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 Applicant's Statements

"A review of other lifting devices used in Waterford 3 including ropes, slings, and cables, will be done to determine the extent that the design, fabrication, and proof-testing methods used comply with the guidelines of ANSI B30.9-1971, as supplemented by NUREG-0612, Section 5.1.1.(5).

"In selecting the proper sling where the load is based on a combination of static and dynamic loads, the dynamic contribution of the rated load is taken as 1/2% (sic) of

hoisting speed in feet per minute (fpm), but not less than 15%, nor more than 50% of the rated load. The hoisting speeds at Waterford 3 do not exceed 30 fpm. Hence, the dynamic contribution is 15%. While LP&L does not agree that dynamic loads must be addressed, the safety factor of 5 required by ANSI B30.9 is considered adequate to account for any required dynamic effect. This is ... strains (i.e., ... blocks). Additionally, if compliance with the above cannot be verified for a particular sling, then the sling will be load-tested to demonstrate its equivalency in terms of load handling reliability, or the sling will be replaced with one which meets the guidelines [5]."

B. <u>EG&G Evaluation</u>

EG&G feels that LP&L should not only perform a review to determine "extent of compliance" but should also take necessary actions to "demonstrate" compliance. On the basis of the applicant's statement, EG&G concludes that LP&L will in fact utilize a dynamic factor of 15% of the operating load in their equipment selection. EG&G does not agree that an established safety factor should be considered as contingency to account for dynamic effects. Equipment selection should be based on the design load, comprised of "dead" load plus "live" load, which, in this case, would be operating static load plus dynamic effect. Two slings of different load-capacity ratings may be capable of handling a given load safely; however, they will not be equivalent in terms of load-handling reliability, since they will have different factors of safety and reliability is based on factor of safety. The NRC has agreed to utilize the guidelines given in CMAA-70 (3.3.2.1.1.3) which indicates the acceptability of using 1/2% of the load per foot per minute of hoisting speed, but not less than 15% or more than

50% for the dynamic effect. The sum of the static and dynamic loads can then be incorporated into written procedures as the weight of the load. Lifting devices could then be selected on the basis of that total load (i.e., the design load).

C. EG&G Conclusions and Recommendations

EG&G concludes that Waterford Generating Station, Unit 3 will comply with the intent of NUREG-0612, Guideline 5 Lifting Devices (not specially designed).

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

"The crane should be inspe..ted, 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 Applicant's Statements

"All cranes concerned will be inspected, tested, and maintained in accordance with the guidelines of Chapter 2-2 of ANSI B30.2-1976, Overhead and Gantry Cranes, with the exception that tests and inspections will only be performed prior to their use when it is not practical to meet the

frequencies of ANSI B30.2 for periodic inspection and test, or where the frequency of crane use is less than the specified inspection and test frequency, and where the requirements of the rated load tests do not conflict with safe handling practices [4]."

B. <u>EG&G Evaluation</u>

The applicant noted the possible conflict between the Rated Load Test (ANSI B30.2-1976, Section 2-2.2.2) and Industry safe handling practice. However, the applicant stated that they do not anticipate any such situation to exist. It should be further noted that the Rated Load Test should be conducted prior to initial use. EG&G is in agreement with LP&L's proposed program.

C. <u>EG&G Conclusions and Recommendations</u>

EG&G concludes that Waterford Generating Station, Unit 3 is in compliance with the intent of the criteria of NUREG-0612, Guideline 6 Cranes (Inspection, Testing, and Maintenance).

2.3.7 <u>Crane Design [Guideline 7, NUREG-0612, Article 5.1.1(7)]</u>

"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. <u>Summary of Applicant's Statements</u>

All cranes were designed, fabricated, installed, and tested in accordance with Ebasco specification which generally complies with the guidelines of CMAA-70, "Specification for Electric Overhead Traveling Cranes" and Chapter 2-1 of ANSI

B30.2-1976, "Overhead and Gantry Cranes" or better [4]. A comparison was made for selected pertinent items between the Ebasco specification and CMAA-70. The applicant concluded that cranes furnished through the Ebasco specification in conjunction with CMAA-70 definitely satisfy the intent of either CMAA-70 and/or Chapter 2-1 of ANSI B30.2-1976 or better [5].

B. EG&G Evaluation

On the basis of the applicant's submittal, EG&G concludes that the Ebasco specification is more stringent that CMAA-70 for the selected pertinent items. Since CMAA-70 (1.8.1) invokes the safety features of ANSI B30.2.0 safety code and the applicant stated that the cranes were designed fabricated, installed, and tested in accordance with CMAA-70 or Ebasco specifications, whichever is more stringent [5], it must be concluded that the cranes also meet the requirements of ANSI B30.2. Procurement documents and specifications should be made available for audit.

C. EG&G Conclusions and Recommendations

EG&G concludes that Waterford Generating Station, Unit 3 is in compliance with the criteria of NUREG-0612, Guideline 7, Crane Design.

2.4 Interim Protection Measures

The NRC staff has established (NUREG-0612, Article 5.3) that six 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. Four of these six interim measures consist of general 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:

- Heavy load technical specifications

- Special review for heavy loads handled over the core.

However, because the WGS No. 3 plant is currently not an operating facility nor will it be operating in the near future, EG&G recommends that LP&L not spend time and effort addressing the interim protection phase of NUREG-0612, but instead devote its efforts towards the completion of operating procedures and qualifications and addressing the guideline deficiencies noted. It should be noted that guidelines must be satisfied prior to plant operation.

3. CONCLUDING SUMMARY

3.1 Applicable Load-Handling Systems

The list of cranes and hoists supplied by the applicant as being subject to the provisions of NUREG-0612 appears to be complete (see Section 2.2.1). The applicant has fulfilled the requirements of NUREG-0612 concerning exclusion of various overhead handling systems.

3.2 Guideline Recommendations

Compliance with the seven NRC guidelines for heavy load handling (Section 2.3) are partially satisfied at WGS No. 3. This conclusion is represented in tabular form as Table 3.1. Specific recommendations to aid in compliance with the intent of these guidelines are provided as follows:

Guideline	Recommendation
1. Section 2.3.1 Safe Load Paths WGS No. 3 is in compliance	a. None
2. Section 2.3.2 Load Handling Procedures WGS No. 3 is in compliance	a. Procedures must be completed and made available for audit prior to fuel loading

Guideline	Recommendation
3. Section 2.3.3 Crane Operator Training WGS No. 3 is in compliance	a. Training and Qualification records must be made available for audit prior to fuel loading
4. Section 2.3.4 Special Lift Device WGS No. 3 is not in compliance	a. Take more positive approach toward identifying actions to be taken to ensure compliance. b. Complete analysis and comparison for the RV Head Lift Rig.
5. Section 2.3.5 Lifting Devices (Not Specially Designed) WGS No. 3 is in compliance	a. None.
6. Section 2.3.6 Cranes (Inspection and Testing) WGS No. 3 is in compliance	a. Inspection and test procedures and records should be made available for audit prior to fuel load

Guideline	Recommendation
7. Section 2.3.7 Crane Design WGS No. 3 is in compliance	a. Procurement documents and specifications should be made available for audit prior to fuel load

TABLE 3.1. COMPLIANCE MATRIX WATERFORD GENERATING STATION UNIT 3

Equipment Designation	Heavy Loads	Capacity (Tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Specification Lift Devices	Guideline 5 Slings	Guideline 6 Crane-Test and Inspect	Guideline 7 Crane Design
Reactor Cont. Building Polar Crane	C	200/30	C	C	C	NC	C	C	C
Fuel-Handling Building	C	125/15	C	C	C	C	C	C	C

C = Applicant action fully complies with NUREG-0612 Guideline, subject to review by NRC Staff.

NC = Applicant action doe not fully comply with NUREG-0612 Guideline, subject to review by NRC Staff.

4. REFERENCES

1. NUREG-0612, Control of Heavy Loads at Nuclear Power Plants, NRC.

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

3. USNRC, Letter to LP&L Co. Subject: NRC Request for Additional Information on Control of Heavy Loads Near Spent Fuel, NRC, December 22, 1980.

4. Letter to NRC; Subject: Waterford 3 SES Control of Heavy Loads, from L. V. Maurin, Assoc. Vice Pres. LP&L Co. to D. G. Casennut, Director Division of Licensing, USNRC, dated June 19, 1981.

5. Letter to NRC; Subject: Response to EG&G Draft Tech Evaluation Report, from L. V. Maurin, LP&L Co. dated January 27, 1983.

6. ANSI B30.2-1976, "Overhead and Gantry Cranes."

7. ANSI N14.6-1978, "Standard for Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or more for Nuclear Materials."

8. ANSI B30.9-1971, "Slings."

9. CMAA-70, "Specifications for Electric Overhead Traveling Cranes."

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16. ABSTRACT (200 words or less)

The Nuclear Regulatory Commission (NRC) has requested that all nuclear plants, either operating or under construction, submit a response of compliancy with NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." EG&G Idaho, Inc. has contracted with the NRC to evaluate the responses of those plants presently under construction. This report contains EG&G's evaluation and recommendations for Washington Nuclear Project No. 2 (WNP-2) for the requirements of Section 5.1.1 of NUREG-0612 (Phase I). Sections 5.1.4, 5.1.5, and 5.1.6 (Phase II) will be covered in a separate report.

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ENCLOSURE

SYNOPSIS OF ISSUES ASSOCIATED WITH NUREG 0612

The following information is provided to identify exceptions or interpretations related to verbatim compliance with NUREG 0612 Guidelines that have occurred during the course of this review. For each of the major Guidelines specific exceptions are identified, a discussion concerning the underlying objective of that Guideline is provided, and approaches felt to be consistent and inconsistent with that guideline are identified. While each such exception has been handled on a case by case basis, and has been considered in light of overall compliance with NUREG 0612 at a particular plant, the topics are of a nature general enough to be of interest to other plants.

GUIDELINE 1 SAFE LOAD PATHS

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 güideline 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.

GUIDELINE 3 CRANE OPERATOR TRAINING

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.

GUIDELINE 4 SPECIAL LIFTING DEVICES

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.

GUIDELINE 6 CRANE INSPECTION TESTING AND MAINTENANCE.

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.

GUIDELINE 7 CRANE DESIGN

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.