ENCLOSURE 1

EGG-HS-6371

CONTROL OF HEAVY LOADS AT NUCLEAR POWER PLANTS
VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1
(PHASE I)
Docket No. 50/395

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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 Virgil C. Summer Nuclear Station, Unit 1.

EXECUTIVE SUMMARY

Virgil C. Summer Nuclear Station, Unit 1 is not totally consistent with the guidelines of NUREG-0612. In general, inconsistencies exist in the following areas:

- Special lifting devices
- Lifting devices (not specially designed) (slings)

The main report contains recommendations which will aid in making the above items consistent with the appropriate guidelines.

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VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1
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 Virgil C. Summer Nuclear Station, Unit 1. 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 South Carolina Electric and Gas Company, the applicant for Virgil C. Summer Nuclear Station, Unit 1 requesting that the applicant review provisions for handling and control of heavy loads at Virgil C. Summer Nuclear Station, Unit 1; 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 26, 1981, South Carolina Electric and Gas Company provided the initial response [4] to this request.

2. EVALUATION AND RECOMMENDATIONS

2.1 Overview

The following sections summarize South Carolina Electric and Gas Company's review of heavy load handling at Virgil C. Summer Nuclear Station, Unit 1 accompanied by EG&G's evaluation, conclusions, and recommendations to the applicant for making the facilities more consistent 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 2500 pounds.

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 just fy 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.

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 indicated in Table 2.2. These various overhead handling devices were reviewed by the applicant to criteria of NUREG 0612 and were excluded based on sufficient physical separation from any impact-load 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 the "heavy load" of 2500 pounds for this facility would not be exceeded.

B. EG&G Evaluation

The applicant's response indicates that each overhead handling device at the Virgil C. Summer Nuclear Station, Unit 1 is listed in Tables 2.1 and 2.2. Figures 1 through 11 of Reference 5 shows the locations of all overhead handling systems in the plant and their proximity to safety-related components. EG&G concludes that the applicant's list of cranes and hoists in the aforementioned tables is complete and satisfies the requirements of NUREG-0612. The applicant performed a review of the various overhead handling devices to the criteria of NUREG-0612 by a physical inspection of the plant and by studying up-to-date layout drawings. For those devices which were excluded, the applicant has provided justification that indicates sufficient physical separation exists between components

TABLE 2.1 NON EXEMPT HEAVY LOAD-HANDLING SYSTEM
VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1

Crane I.D.	Crane Type	Heavy Loads Handled and Lifting Device	Load Weight
XCR-1	Reactor Cavity Manipulator Crane	Spent- and New-Fuel Assembly and Handling Tool	2,500 lbs
XCR-2 &XCR-16	Spent-Fuel Pit Bridge Crane	Spent-Fuel Assembly and Handling Tool	2,500 lbs
XCR-49	Fuel-Handling Building, Fuel Transfer Canal Gate Hoist	Fuel Transfer Canal Gates and Two-Part Sling	4,500 lbs
XCR-4	Reactor Building Polar Crane	a) CRDM Missile Shields	54,000 lbs
		b) Upper Internals and Internals Lifting Rig	92,000 lbs
		c) Lower Internals and Internals Lifting Rig	268,000 lbs
		d) Internals LIfting Rig	19,000 lbs
		e) ISI Tool and Vendor-Supplied Lifting Device	20,000 lbs
		f) RCP Internals	48,000 lbs
		g) RCP Casing and Lifting Beam	52,000 lbs
		h) RCP Motor	77,140 lbs
		i) RV Studs, Nuts, a d Washer Stand	8,500 lbs
		j) Equipment Bridge	4,000 lbs
		k) Reactor Vessel Head Assembly, Lifting Rig, and Sling	143,500 lbs
		l) Reactor Vessel Head Lifting Rig	21,000 lbs
XCR-23A &XCR-23B	2-ton Manual Chain Hoise and Trolley	a) RB Sprague Sump Isolation Valve Protective Chambers	3,000 lbs

TABLE 2.1 (continued)

Crane I.D.	Crane Type	Heavy Loads Handled and Lifting Device	Load Weight
XCR-23A &XCR-23B (continued)		b) SI Recirculation Sumps Isolation Valves Protective Chambers	Top 3,000 lbs
XCR-36	20-ton Electric Cable Hoist and Trolley	Radwaste Facility Equipment	Less than or equal to maximum capacity
XCR-40A, XCR-40B, XCR-40C	10-ton Hand Chain Hoists and Trolleys	Main Steam Isolation Valves	Less than maximum capacity
XCR-46	3-ton Bridge Crane	a) Concrete Plugs b) Filters and Cartridges c) Storage Casks	1770 lbs Negligible 2590 lbs
XCR-47	10-ton Bridge Crane	Hot Machine Shop and Low Level Waste Storage	Less than maximum capacity
XCR-50 & XCR-51	10-ton Bridge Crane and Hoist	a) Service Water Traveling Screen b) Service Water Pump c) Service Water Pump Motor	Less than maximum capacity 14,000 lbs 15,650 lbs
XRW-13	3-ton Jib Crane	a) Concrete Plugs b) Spent Filters and Cartridges c) Storage Casks d) Lifting Beam	1,770 lbs Negligible 2,590 lbs 1,350 lbs

TABLE 2.2 EXEMPT HEAVY LOAD-HANDLING SYSTEMS
VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1

Crane I.D.	Crane Type	Heavy Loads Handled and Lifting Device	Load Weight
XCR-3	Fuel-Handling Building Crane	a) New Fuel Shipping Container and Vendor-Supplied Lifting Device	6,600 lbs
		b) Spent-Fuel Shipping Cask and Vendor-Supplied Lifting Device	(late)
		c) Irradiated-Specimen Shipping Cask and Vendor-Supplied Lifting Device	(later)
XCR-45	Fuel-Handling Building, New-Fuel Elevator Winch	NA NA (Not overhead handling device)	
XCR-17	Turbine Building Crane	General Electric Turbine Generator and Associated Power Plant Equipment	Less than or equal to maximum capacity
XCR-18	10-ton Cable Hoist and Trolley	Power Plant Equipment	Less than or equal to maximum
XCR-19	7.5-ton Electric Cable Hoist and Trolley	Power Plant Equipment	Less than or equal to maximum capacity
XCR-20A & XCR-20B	5-ton Hand Chain Hoist and Trolley	a) RHR Pumps	4,400 lbs
		b) RHR Pump Motor	3,200 lbs
XCR-21A	5-ton Manual Chain Hoist and Trolley	a) RB Spray Pumps	5,400 lbs
		b) RB Spray Pump Motors	5,800 lbs
XCR-54A, XCR-54B, & XCR-54C	5-ton Manual Chain Hoist and Trolley	SI Charging Pumps	
		a) Pump	7,500 lbs
		b) Base	6,000 lbs
		c) Gear	2,100 lbs
		d) Motor	6,700 lbs

TABLE 2.2 (continued)

Crane I.D.	Crane Type	Heavy Loads Handled and Lifting Device	Load Weight
XCR-24	8-ton Hand Chain Hoist and Trolley	Main Steam Stop Valves	Less than or equal to maximum capacity
XCR-25A, XCR-25B, XCR-25C, & XCR-25D	10-ton Hand Hoist and Trolley	Main Condenser Water Boxes (2 Cranes per Water Box)	26,500 lbs
XCR-26	4-ton Hand Chain Hoist and Trolley	Feedwater Booster Pumps	
		a) Pump	7,000 lbs
		b) Driver	8,500 lbs
		c) Bedplate	5,900 lbs
XCR-27	5-ton Electric Cable Hoist and Trolley	Power Plant Equipment	Less than or equal to maximum capacity
XCR-28	2-ton Electric Cable Hoist and Trolley	Chemical Storage Containers	Less than or equal to maximum capacity
XCR-29A, XCR-29B	2-ton Hand-Operated Hoist and Trolley	Generator Parts	Less than or equal to maximum
XCR-31	1/2-ton Hand Chain Host and Trolley	Under Heavy load limit	NA
XCR-33	2-ton Hand Chain Hoist and Trolley	Turbine-Driven Emergency Feed-water Pump	
		a) Pump	3,000 lbs
		b) Base	2,40C lbs
		c) Driver	3,260 lbs
XCR-34	1-ton Electric Cable Hoist and Trolley	Under heavy load limit	NA
XCR-42	10-ton Bridge Crane	Hot Machine Shop Applications	Less than or equal to maximum capacity

TABLE 2.2 (continued)

Crane I.D.	Crane Type	Heavy Loads Handled and Lifting Device	Load Weight
XCR-43	10-ton Bridge Crane	Service Building Applications	Less than or equal to maximum capacity
XCR-48	1-1/2-ton Hand Chain Hoist and Trolley	Instrument and Service Air Compressors	Less than or equal to maximum capacity
XCR-53A, XCR-53B, XCR-53C	2-ton Twin Hook Extension Hoists	CRDM Cable Support Structures	NA
XRW-11	1-ton Jib Crane	Under heavy load limit	NA
	Reactor Building Equipment Access Hatch Door	Equipment Hatch	NA

necessary for safe shutdown or decay heat removal and load-impact points. EG&G concludes that the applicant has met the requirements of NUREG-0612 concerning exclusion of overhead handling systems.

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 which must comply with the requirements of the general guidelines of NUREG-0612. The Virgil C. Summer Nuclear Station, Unit 1 is, therefore, consistent with the criteria of Heavy Load Overhead Handling Systems.

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

Inside the Reactor Building, the applicant has identified areas where cranes XCR-4, XCR-53A, XCR-53B, XCR-53C, and the Reactor Building equipment access hatch crane can be operated safely without damaging vital plant components or releasing radioactive material to the environment. In other areas, cranes XCR-1 and XCR-34 must operate where a safe load path cannot be defined. For these two cases, the applicant is developing procedures to protect vital components or mitigate radioactive releases due to an inadvertent load drop. Figures 4, 5, and 6 of Reference 5 describe the safe load path areas for the Reactor Building Cranes.

In the Fuel Handling Building area, cranes XCR-2 and XCR-16 operate over the spent-fuel pit where a safe load path cannot be defined. The operation of these cranes are governed by the Westinghouse Refueling Procedures which are currently being reviewed and placed into a standard format. Cranes XCR-3, XCR-45, and XCR1-49 do have safe load paths defined and are shown on Figures 5 and 7 of Reference 5.

The Turbine Building cranes XCR-17, XCR-24, XCR-25A, XCR-25B, XCR-25C, XCR-25D, XCR-26, and XCR-48 have safe load paths defined in the various figures of Reference 5. All have been excluded from further study or concern by the applicant.

The applicant has defined safe load paths for the Auxiliary Building cranes in the figures of Reference 5 and have excluded them from further study or concern with the exception of XCR-23A, XCR-23B, and XCR-46. These three cranes could affect safe shutdown equipment or radioactive releases. In this instance, procedures are being developed to preclude an inadvertent heavy load drop.

In the Intermediate Building, the cranes have safe load paths depicted in the figures of Reference 5 and are excluded from further study or concern with the exception of chain hoists XCR-40A, XCR-40B, XCR-40C. These chain hoists service the main steam isolation valves and preliminary study has shown that a dropped valve could deform the floor at point of impact. Consequently, the applicant is writing procedures to minimize the effects of an inadvertent valve drop.

Cable hoist XCR-28, in the Water Treatment Building, has a safe load path defined in Figure 1 of Reference 5 and is excluded from further study or concern as there are no components necessary for safe shutdown or for decay heat removal in the area.

For the Diesel Generator Building, hoists XCR-29A and XCR-29B have safe load paths shown in Figure 4 of Reference 5. The applicant has chosen to exclude these cranes from further study or concern because of the redundancy of the diesel generator system.

The cranes located in the Drumming Station have safe load paths defined in Figure 4 of Reference 5. Hoist XCR-36 is used to handle low- and high-level radiation shipping casks and, even though an inadvertent drop could result, no damage would occur to the floor or the spent-fuel pit cooling pumps below. However, the applicant is preparing procedures to prevent dropping of a radwaste cask and minimize potential hazards. Crane XCR-47 is used to handle shielded and unshielded low-level waste storage containers and the applicant is preparing procedures to ensure safe handling of the containers. Jib crane XRW-11 is excluded from further study as its rated capacity is under the heavy load limit. Jib crane XRW-13, in the same area as hoist XCR-36, is used to handle spent filters and their storage casks. The applicant is developing procedur s to ensure proper handling of these filters to minimize possibility of an inadvertent load drop.

Hot Machine Shop crane XCR-42 has a safe load path depicted in Figure 4 of Reference 5. The applicant has excluded this crane as no components necessary for safe shutdown or decay heat removal is located in the area.

Crane XCR-43 in the Service Building has a safe load path shown in Figure 1 of Reference 5. This crane is excluded from further study or concern because the Service Building does not contain equipment necessary for safe shutdown or decay heat removal.

In the Service Water Intake Screen and Pump House, cranes XCR-50 and XCR-51 are used for the service water pumps and have a safe load path shown in Figure 8 of Reference 5. The applicant is developing procedures to ensure that the cranes do not travel over an operating service water pump.

B. EG&G Evaluation

For those overhead handling devices which have safe load paths, the applicant has prepared equipment layout drawings identifying the safe load paths. When no safe load can be defined, the applicant is preparing procedures to govern the operation and use of the devices. The applicant also indicated that safe load paths will be permanently marked on the walls or floor of the plant.

EG&G concludes that the applicant is consistent with the requirements of Guideline 1, Safe Load Paths, NUREG-0612.

C. EG&G Conclusions and Recommendations

(1) The Virgil C. Summer Nuclear Plant, Unit 1 is consistent with the criteria of Guideline 1, "Safe Load Paths," NUREG-0612, by defining safe load paths in procedures; providing equipment layout drawings showing safe load paths; and marking load paths on floors or walls in the area where the loads are to be handled.

(2) Special procedures should be completed prior to fuel load.

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

The applicant is developing procedures for handling heavy loads with overhead handling devices. Presently, the applicant is developing maintenance procedures to encompass overhead handling systems with respect to the safe load paths. Where safe load paths could not be defined, special lifting procedures are being developed and, where possible, special lifting instructions are incorporated into specific component maintenance procedures.

B. EG&G Evaluation

With the preparation of the necessary load-handling procedures, EG&G considers the applicant to be consistent with Guideline 2. Presently, the applicant is developing maintenance procedures to encompass overhead handling systems with respect to the safe load paths. Where safe load paths could not be defined, special lifting procedures are being developed and, where possible, special lifting instructions are incorporated into specific component maintenance procedures.

C. EG&G Conclusions and Recommendations

When the necessary load-handling procedures are prepared, the applicant will be consistent with Guideline 2, NUREG-0612. Those items delineated in the guideline concerning identification of the required equipment, inspections, and acceptance criteria required before movement of load, steps and proper sequence in handling the load, defining the safe load path and other special precautions should be specifically addressed in the applicant's procedures where applicable.

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

The applicant conducts an extensive training program for its crane operators and riggers which meets or exceeds all the requirements of Chapter 2-3 of ANSI B30.2. The maintenance group conducts a program for the crane operators and riggers entitled, "Basic Operator and Rigger Training Program." The crane operator and rigger training programs include in-class written examinations and in-plant examinations for practical application. After a crane operator or rigger becomes qualified by the training program, an annual physical examination and a biannual retaining and requalification of the crane operators and riggers are required.

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

The applicant has met the criteria of this guideline for training, qualification, and contact as specified by Chapter 2-3 of ANSI B30.2-1976. EG&G recommends the applicant review the procedures from Guideline 2 and provide training to permit complete familiarization with the procedures prior to their use, especially those infrequently used.

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

The applicant is consistent with the criteria of Guideline 3, NUREG-0612, in which crane operators are trained and qualified in accordance with Chapter 2-3 of ANSI B30.2-1976 "Overhead and Gantry Cranes."

2.3.4 <u>Special Lifting Devices [Guideline 4, NUREG-0612, Article 5.1.1(4)]</u>

"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's lifting devices are not consistent with ANSI N14.6-1978. It is proposed that alternate methods for demonstration of equivalency will be provided by a detailed inspection and testing program. The applicant is developing maintenance procedures to perform frequent and periodic inspection which includes visual and nondestructive examination of critical surfaces. Periodic load tests will be performed, as necessary, to verify structural adequacy of the special lifting devices. All rigging and lifting devices are controlled and maintained using the plant's computerized preventive maintenance program. The applicant's existing inspection and maintenance procedures are outlined in the plant's Mechanical and Maintenance Procedure MMP-165.8, "Use and Control of Rigging Equipment."

B. EG&G Evaluation

The proposed inspection and testing program for special lifting devices partially fulfills the requirements of this guideline. The applicant should provide a design analysis including static and dynamic loads for all special handling devices, particularly those used for critical loads. The stress design factors should be addressed in the analysis. All other aspects of ANSI N14.6 should be addressed by the applicant in their report.

C. EG&G Conclusions and Recommendations

In order to be consistent with the criteria of Guideline 4, the applicant should:

(1) Perform a design analysis of the special lifting devices using the stress design factors for dynamic and static loads showing that these devices meet ANSI N14.6.

(2) Provide analysis for those special handling devices that are considered for critical loads.

(3) Retrieve and examine fabrication records for ANSI N14.6 compliance.

(4) Examine acceptance testing of the special handling devices, per ANSI N14.6 criteria.

(5) Load test all special handling devices, per ANSI N14.6

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

The applicant's lifting devices are not consistent with ANSI B30.9-1971. It is indicated that inspection and testing will provide the reliability needed for slings.

B. EG&G Evaluation

EG&G finds that the use of slings that are not consistent with ANSI B30.9 as unacceptable. The applicant should be consistent with this guideline and ANSI B30.9. If the slings in the applicant's possession can be proof-tested to the load rating based on static and dynamic load in accordance with ANSI B30.9, then by using appropriate markings, those slings can be designated for a particular service.

All the lifting devices for the plant should be installed and used in accordance with ANSI B30.9. The ratings identified on the sling should be in terms of the "static load" which produces the maximum static and dynamic load. Where slings are restricted to use on certain cranes, then the slings should be clearly marked to indicate which cranes they may be used with.

EG&G suggests that the applicant should select slings for lifts based on the next higher sling rating. This would preclude the applicant from accumulating slings for specific lifts and would also simplify consistency with ANSI B30.9-1971.

C. EG&G Conclusions and Recommendations

In order to be consistent with the requirements of this guideline, the applicant should perform the following prior to fuel loading.

(a) Assure that slings for the plant are installed and used in accordance with ANSI B30.9

(b) Proof test the load rating. The load rating should be based on static and dynamic load.

(c) Mark the slings in terms of the static load, which produces the maximum static and dynamic load.

(d) When slings are restricted to certain cranes, mark them accordingly.

2.3.6 Cranes (Inspection, Testing, and Maintenance) [Guideline 6, NUREG-0612, Article 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 Applicant's Statements

The applicant's cranes and rigging equipment are maintained, tested, and inspected to the requirements of ANSI B30.2, Chapter 2-2, by the Plant's Computered history and maintenance program.

B. EG&G Evaluation

EG&G considers that the applicant is consistent with the criteria of NUREG-0612 for inspection, testing, and maintenance of their cranes and rigging equipment.

C. EG&G Conclusions and Recommendations

The applicant is consistent with the criteria of Guideline 6, NUREG-0612, in which their cranes and rigging equipment are inspected, tested, and maintained in accordance with Chapter 2-2 of ANSI B30.2-1976.

2.3.7 Crane Design [Guideline 7, NUREG-0612, Article 5.1.1(7)]

"The crane should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' and of CMAA-70, 'Specifications for Electric Overhead Traveling Cranes' [9]. An alternative to a specification in ANSI B30.2 or CMAA-70 may be accepted in lieu of specific compliance if the intent of the specification is satisfied."

A. Summary of Applicant's Statements

All the applicant's cranes and hoists have been designed in accordance with CMAA Specification 70 and ANSI B30.2 Chapter 2-1.

B. EG&G Evaluation

EG&G considers the applicant to have all its cranes designed in accordance with CMAA-70 or ANSI B30.2.

C. EG&G Conclusions and Recommendations

(1) The Virgil C. Summer Nuclear Plant, Unit 1 is consistent with the criteria of NUREG-0612, Guideline 7 on 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.

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

2.4.1 Interim Protection Measure 1--Technical Specifications

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

A. Summary of Applicant's Statements

Not applicable. Plant is not operational.

B. EG&G Evaluations, Conclusions, and Recommendations

Not applicable. Plant is not operational.

2.4.2 Interim Protection Measures 2, 3, 4, and 5 - Administrative Controls

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

A. Summary of Applicant's Statements

Summaries of applicant's statements are contained in discussions of the respective general guidelines in Sections 2.3.1, 2.3.2, 2.3.3, and 2.3.6, respectively.

B. EG&G Evaluations, Conclusions, and Recommendations

EG&G evaluations, conclusions, and recommendations are contained in discussions of the respective general guidelines in Sections 2.3.1, 2.3.2, 2.3.3, and 2.3.6.

2.4.3 Interim Protection Measure 6--Special Review for Heavy Loads Over the Core

"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: (a) 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; (b) 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; (c) appropriate repair and replacement of defective components; and (d) verify that the crane operators have been properly trained and are familiar with specific procedures used in handling these loads, e.g., hand signals, conduct of operations, and content of procedures."

A. Summary of Applicant's Statements

No applicable. Plant is not operational.

B. EG&G Evaluation

Not applicable. Plant is not operational.

C. EG&G Conclusion

Not applicable. Plant is not operational.

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 is apparently complete (see Section 2.2.1).

3.2 Guideline Recommendations

Consistency with the seven NRC guidelines for heavy load handling (Section 2.3) are not satisfied at Virgil C. Summer Nuclear Station, Unit 1. This conclusion is represented in tabular form as Table 3.1. Specific recommendations to aid in consistency with the intent of these guidelines are provided as follows:

Guideline	Recommendation
1. Section 2.3.1	a. Consistent with guideline.
2. Section 2.3.2	a. Consistent with guideline.
3. Section 2.3.3	a. Consistent with guideline.
4. Section 2.3.4	a. Partially consistent with guideline. See Table 3.1 Compliance Matrix

Guideline	Recommendation
5. Section 2.3.5	a. Not consistent with guideline.
6. Section 2.3.6	a. Consistent with guideline.
7. Section 2.3.7	a. Consistent with guideline.

TABLE 3.1. VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1 COMPLIANCE MATRIX

Equipment Designation	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 Design
Reactor Cavity Manipulator Crane--XCR-1	C	2	C	C	C	NC	NC	C	C
Spent Fuel Pit Bridge Crane--XCR-2	C	2	C	C	C	NC	NC	C	C
Spent Fuel Pit Bridge Crane Protex Cable Reel--XCR-16	C	--	C	C	C	NC	NC	C	C
Fuel Transfer Canal Gate Hoist--XCR-49	C	3	C	C	C	--	NC	C	C
Reactor Building Polar Crane--XCR-4	C	360/25	C	C	C	NC	NC	C	C
Turbine Building Crane--XCR-16	C	220/30	C	C	C	C	NC	C	C
Hoist--XCR-20B	C	5	C	C	C	C	NC	C	C
Auxiliary Building Elevation 412 Hoist-XCR-23A	C	2	C	C	C	C	NC	C	C
Auxiliary Building Elevation 412 Hoist--XCR-23B Hoist--XCR-25B Hoist--XCR-25C Hoist--XCR-25D	C	2	C	C	C	C	NC	C	C
Drumming Station Hoist--XCR-36	C	20	C	C	C	C	NC	C	C
Intermediate Building Elevation 536 Hoists--XCR-40A Intermediate Building Elevation 536 Hoists--XCR-40B Intermediate Building Elevation 536 Hoists--XCR-40C	C	10	C	C	C	C	NC	C	C
Elevation 463 Crane--XCR-46	C	3	C	C	C	NC	NC	C	C

TABLE 3.1. (continued)

Equipment Designation	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 Design
Drumming Station Crane--XCR-47	C	10	C	C	C	C	NC	C	C
Traveling Screens Hoist--XCR-50	C	10	C	C	C	C	NC	C	C
Service Water Pumps Crane--XCR-51 CRDM Cable Support	C	10	C	C	C	C	NC	C	C
Drumming Station Jib Crane--XRW-13	C	3	C	C	C	C	NC	C	C

C = Applicant action is consistent with NUREG-0612 Guideline.
NC = Applicant action is not consistent with NUREG-0612 Guideline

3.3 Interim Protection

EG&G's evaluation of information provided by the applicant indicates that the following actions are necessary to ensure that the six NRC staff measures for interim protection at the Virgil C. Summer Nuclear Station, Unit 1 are met:

Interim Measure	Recommendation
1.	If consistency with all seven guidelines of NUREG-0612 Section 5.1 cannot be achieved by plant operational startup, interim protective measures, as indicated in NUREG-0612 Article 5.3, must be completed prior to operation and refueling.

3.4 Summary

The applicant's action is consistent with four of the NRC guidelines for heavy load handling at the Virgil C. Summer Nuclear Station, Unit 1. These are Safe Load Paths, Load-Handling Procedures, Crane Operator Training, and Crane Design, and Cranes (Inspection, Testing and Maintenance). Partial consistency is met with Guideline 4, Special Lifting Devices, and there is no consistency with Guideline 5, Lifting Devices (Not Specially Designed).

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, 17 May 1978.

3. USNRC, Letter to South Carolina Electric and Gas Company. Subject: NRC Request for Additional Information on Control of Heavy Loads Near Spent Fuel, NRC, 22 December 1980.

4. T. C. Nichols, Jr., South Carolina Electric and Gas Company, Letter to H. R. Denton (NRC) Subject: Response to Staff Position, Interim Actions for Control of Heavy Loads, dated June 26, 1981.

5. Gilbert Associates, Inc., GAI Report No. 2289, "Control of Heavy Loads of Nuclear Power Plants--Virgil C. Summer Nuclear Station Unit 1."

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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The Nuclear Regulatory Commission (NRC) has requested that all nuclear plants, either operating or under construction, submit a response of consistency 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 Virgil C. Summer Nuclear Station, Unit 1.

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ENCLOSURE 2

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 guideline only under circumstances where there is no safety related equipment located beneath the area accessible to the crane hook but outside of the exclusion area. This situation has been found in buildings such as the turbine hall or screen house where safety related equipment is concentrated in a specific area within the crane path. It is unlikely to occur within containment due to the numerous safety related piping and electrical systems provided to support decay heat removal.

Approaches Consistent With This Guideline

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

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

Approaches Inconsistent With this Guideline.

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

Exception 2

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

Discussion

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

Approaches Consistent With this Guideline

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

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

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

Approaches Inconsistent With this Guideline

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

Exception 3

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

Discussion

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

Approach Consistent With this Guideline

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

Approach Inconsistent With this Guideline

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

GUIDELINE 2 LOAD HANDLING PROCEDURES

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

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 likiihood 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.

GUIDELINE 5 LIFTING DEVICES NOT SPECIALLY DESIGNED

Exception

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

Discussion

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

Approach Consistent With This Guideline

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

Approach Inconsistent With This Guideline

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

Exception

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

Discussion

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

Approach Consistent With This Guideline

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

Approaches Inconsistent With This Guideline

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

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.

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