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Revision 1

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 consistent with all seven of the the guidelines of NUREG-0612.

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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. Additional information was provided on January 25, 1985 [10], February 28, 1985 [11], and April 16, 1985 [12].

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 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 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) PCP Motor	77,140 lbs
		i) RV Studs, Nuts, and 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	1770 lbs
		b) Filters and Cartridges	Negligible
		c) Storage Casks	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	Less than maximum capacity
		b) Service Water Pump	14,000 lbs
		c) Service Water Pump Motor	15,650 lbs
XRW-13	3-ton Jib Crane	a) Concrete Plugs	1,770 lbs
		b) Spent Filters and Cartridges	Negligible
		c) Storage Casks	2,590 lbs
		d) Lifting Beam	1,350 lbs

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 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

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	2,400 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

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 procedures 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.

C. EG&G Conclusions and Recommendations

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

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

The applicant is consistent with the intent of Guideline 2.

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. EG&G Evaluation

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. EG&G Conclusions and Recommendations

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 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 has categorized the reactor vessel head lift rig, the reactor vessel internals lift rig and the load cell

and load cell linkage as special lifting devices. These devices were designed to the requirement that the resulting stress in the load carrying members when subjected to the total combined lifting weight should not exceed the allowable stresses specified in the AISC code.

An evaluation, in WCAP-10233, which includes a stress report and a critical items list, has been prepared in accordance with ANSI N14.6-1978 by the applicant. The following conclusions resulted from the evaluation:

(1) Design, fabrication and quality assurance of these special lift devices are generally in agreement with ANSI N14.6.

(2) ANSI N14.6 criteria for stress limits associated with certain stress design factors for tensile and shear stresses are generally satisfied.

(3) ANSI N14.6 criteria for stress design factor of 3 & 5 are for shear and tensile loading conditions. Other loading conditions are analyzed to other appropriate criteria.

(4) The special lift devices are not in strict compliance with ANSI N14.6 requirements for acceptance testing, maintenance, and verification of continuing compliance.

(5) The initial acceptance load tests at 125% of maximum load are considered to meet the ANSI N14.6, Section 5.2.1 requirements to load test at 150% of maximum load.

(6) Non-destructive testing of the lifting device welds is not performed annually because:

a. Items that are welded remain assembled and cannot be misused for lifts other than their intended function.

b. All tensile and shear stresses in the welds are within the allowable stress.

c. Access to welds for surface examination is difficult since these rigs are in containment and contamination is present.

d. Non-destructive testing would require:

- o Removal of contaminated paint from around the area to be examined.
- o Magnetic particle and/or dye penetrant inspection.
- o Repainting welds upon completion of testing.
- o Clean-up of contaminated items.

e. Critical path refueling time would increase if non-destructive tests were performed on these welds at every refueling.

(7) Dimensional checking is not performed since these lifting rig structures are large (~13' diameter by 43' high) and the results would always be questionable. Checks on critical load path parts, such as pins, are also not performed since disassembly of the special lift devices would be required.

The following items address areas of ANSI N14.6 which are incompatible with the special lifting devices for reactor

vessel servicing and which are considered important in demonstrating the continued reliability of these devices:

(1) Stresses are higher than N14.6 allows but are considered acceptable because:

a. Even though the design weight is based on lifting the lower internals, normal use of rig is for moving the upper internals which weigh less than one-half of the lower internals. Lower internals are removed only once/10 years when a periodic inservice inspection of the vessel is required. Therefore, all the stresses could be reduced by ~50% and considered well within the ANSI N14.6 requirements for stress design factors.

b. All fuel is removed prior to removal of the lower internals. Therefore, the concern for handling over fuel is non-existent.

(2) Maintenance manuals are being revised to include consideration of ANSI N14.6, Sections 5.1.3 through 5.1.8 which cover:

a. Scheduled periodic testing.

b. Identification and marking.

c. Maintenance, repair, testing and use.

(3) Maintenance procedures are being revised to include the following in lieu of ANSI N14.6, Section 5.3 which requires annually, either a 150% maximum load test or dimensional, visual and non-destructive testing of major load carrying welds and critical areas:

a. REACTOR VESSEL HEAD LIFT RIG

- o Visually check all welds prior to use and after reassembly of the spreader assembly, lifting lug, and upper lifting lugs to the upper portion of the lift rig.

- o Raise the vessel head slightly above its support and hold for 10 minutes.

- o Continue to lift, if no problems are apparent, monitoring the load cell readout at all times.

b. REACTOR VESSEL INTERNALS LIFT RIG

- o Visually inspect rig components and welds while on the storage stand for signs of cracks or deformation.

- o Check bolted joints to ensure that they are tight and secure.

- o Connect rig to the upper or lower internals.

- o Raise the assembly slightly off its support and hold for 10 minutes.

- o Continue to lift, if no problems are apparent, monitoring the load cell readout at all times.

(4) A periodic non-destructive surface examination of critical welds and/or parts will be performed once every ten years as part of an inservice inspection outage.

B. EG&G Evaluation

The 125% initial acceptance load test and the applicant's proposed alternatives to maintenance and verification of continuing compliance are accepted by EG&G. The above is in accordance with the "SYNOPSIS OF ISSUES ASSOCIATED WITH NUREG 0612."

C. EG&G Conclusions and Recommendations

Virgil C. Summer Nuclear Station, Unit 1 is consistent with the intent of guideline 4.

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

Dynamic load calculations were performed on each hoist to determine loading characteristics. Calculations were conducted in accordance with CMAA Specification No. 70, 1983 Edition, paragraph 3.3.2.1.1.1.4.2. The dynamic load associated with each verified hoist was found to be 15% or less in all cases due to generally slow hoisting speeds. Dynamic load characteristics for manual hoists have not been established by the applicable code, HMI 200. To establish an analysis criteria for these hoists and apply CMAA Specification No. 70 Standard, it was necessary to determine the maximum instantaneous lifting speed. The chain overhaul

speed established for these hoists was 90 fpm which results in extremely slow hoisting speeds and negligible dynamic loading forces.

Lifting devices that are not specially designed will be installed and used consistent with the guidelines of 29 CFR 1910.184 [12].

B. EG&G Evaluation

The dynamic load calculations performed by the applicant to determine dynamic loading characteristics is acceptable. The selection and use of slings consistent with the guidelines of 29 CFR 1910.184 is in accordance with the "SYNOPSIS OF ISSUES ASSOCIATED WITH NUREG 0612."

C. EG&G Conclusions and Recommendations

The Virgil C. Summer Nuclear Station, Unit 1 is consistent with the criteria of NUREG-0612, Guideline 5 on 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 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 Virgil C. Summer Nuclear Plant, Unit 1 is consistent with all seven NRC guidelines for heavy load handling. Implementation of interim protection measures is not necessary.

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 satisfied at Virgil C. Summer Nuclear Station, Unit 1. This conclusion is represented in tabular form as Table 3.1.

Guideline	Recommendation
1. Section 2.3.1	a. Consistent with Guideline 1.
2. Section 2.3.2	a. Consistent with Guideline 2.
3. Section 2.3.3	a. Consistent with Guideline 3.
4. Section 2.3.4	a. Consistent with Guideline 4.
5. Section 2.3.5	a. Consistent with Guideline 5.
6. Section 2.3.6	a. Consistent with Guideline 6.
7. Section 2.3.7	a. Consistent with Guideline 7.

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	C	C	C	C
Spent Fuel Pit Bridge Crane--XCR-2	C	2	C	C	C	C	C	C	C
Spent Fuel Pit Bridge Crane Protex Cable Reel--XCR-16	C	--	C	C	C	C	C	C	C
Fuel Transfer Canal Gate Hoist--XCR-49	C	3	C	C	C	--	C	C	C
Reactor Building Polar Crane--XCR-4	C	360/25	C	C	C	C	C	C	C
Turbine Building Crane--XCR-16	C	220/30	C	C	C	C	C	C	C
Hoist--XCR-20B	C	5	C	C	C	C	C	C	C
Auxiliary Building Elevation 412 Hoist-XCR-23A	C	2	C	C	C	C	C	C	C
Auxiliary Building Elevation 412 Hoist--XCR-23B Hoist--XCR-25B Hoist--XCR-25C Hoist--XCR-25D	C	2	C	C	C	C	C	C	C
Drumming Station Hoist--XCR-36	C	20	C	C	C	C	C	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	C	C	C
Elevation 463 Crane--XCR-46	C	3	C	C	C	NC	C	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	C	C	C
Traveling Screens Hoist--XCR-50	C	10	C	C	C	C	C	C	C
Service Water Pumps Crane--XCR-51	C	10	C	C	C	C	C	C	C
CRDM Cable Support									
Drumming Station Jib Crane--XRW-13	C	3	C	C	C	C	C	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 applicants action is consistent with all seven of the NRC guidelines for heavy load handling, therefore, implementation of additional interim protective measures is considered to be inapplicable.

3.4 Summary

The applicant's action is consistent with all seven of the NRC guidelines for heavy load handling at the Virgil C. Summer Nuclear Station, Unit 1.

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."

10. O. W. Dixon, Jr., South Carolina Electric and Gas Company, Letter to Harold R. Denton (NRC) subject: "Control of Heavy Loads--Virgil C. Summer Nuclear Station," Dated January 25, 1985.

11. O. W. Dixon, Jr., South Carolina Electric and Gas Co., Letter to H. R. Denton (NRC) subject: "Control of Heavy Loads--Virgil C. Summer Nuclear Statiion," dated February 28, 1985.

12. Telecon, Mr. Blue (SCE&G) with Mr. A. Singh (NRC) April 16, 1985.