(DRAFT)

ENCLOSURE 1

TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

FLORIDA POWER COMPANY

CRYSTAL RIVER UNIT 3

NRC DOCKET NO. 50-302

NRC TAC NO. 07983

NRC CONTRACT NO. NRC-03-81-130

FRC PROJECT C5506

FRC ASSIGNMENT 13

FRC TASK 347

Prepared by

Franklin Research Center
20th and Race Streets
Philadelphia, PA 19103

Author: C. Bomberger, F. W. Vosbury

FRC Group Leader: I. H. Sargent

Prepared for

Nuclear Regulatory Commission
Washington, D.C. 20555

Lead NRC Engineer: F. Clemenson

January 28, 1983

Franklin Research Center
A Division of The Franklin Institute
The Benjamin Franklin Parkway, Phila., Pa. 19103 (215) 448-1000

CONTENTS

FOREWORD

This Technical Evaluation Report was prepared by Franklin Research Center under a contract with the U.S. Nuclear Regulatory Commission (Office of Nuclear Reactor Regulation, Division of Operating Reactors) for technical assistance in support of NRC operating reactor licensing actions. The technical evaluation was conducted in accordance with criteria established by the NRC.

Mr. F. W. Vosbury, Mr. C. Bomberger, and Mr. I. H. Sargent contributed to the technical preparation of this report through a subcontract with WESTEC Services, Inc.

1. INTRODUCTION

1.1 PURPOSE OF REVIEW

This technical evaluation report documents an independent review of general load handling policy and procedures at the Florida Power Company's (FPC) Crystal River Unit 3 Nuclear Power Plant. This evaluation had the following objectives:

- o to assess conformance to the general load handling guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants" [1], Section 5.1.1
- o to assess conformance to the interim protection measures of NUREG-0612, Section 5.3.

1.2 GENERIC BACKGROUND

Generic Technical Activity Task A-36 was established by the Nuclear Regulatory Commission (NRC) staff to systematically examine staff licensing criteria and the adequacy of measures in effect at operating nuclear power plants to ensure the safe handling of heavy loads and to recommend necessary changes in these measures. This activity was initiated by a letter issued by the NRC staff on May 17, 1978 [2] to all power reactor licensees, requesting information concerning the control of heavy loads near spent fuel.

The results of Task A-36 were reported in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." The staff concluded from this evaluation that existing measures to control the handling of heavy loads at operating plants provide protection from certain potential problems, but do not adequately cover the major causes of load handling accidents and should be upgraded.

To upgrade measures for the control of heavy loads, the staff developed a series of guidelines with a two-part objective. The first part of the objective, to be achieved through a set of general guidelines expressed in NUREG-0612, Section 5.1.1, is to ensure that all load handling systems at nuclear power plants are designed and operated so that their probability of failure is appropriately small for the critical tasks in which they are employed. The second part of the staff's objective, to be achieved through

guidelines expressed in NUREG-0612, Section 5.1.2.5, is to ensure that, for load handling systems used in areas where their failure might result in significant consequences, either (1) features are provided, in addition to those required for all load handling systems, to make the potential for a load drop extremely small (e.g., a single-failure-proof crane) or (2) conservative evaluations of load handling accidents indicate that the potential consequences of any load drop are acceptably small. Acceptability of accident consequences is quantified in NUREG-0612 into four accident analysis evaluation criteria.

The approach used to develop the staff guidelines to ensure that all load handling systems are designed and operated so that their probabilities of failure is appropriately small was based on defense-in-depth. The intent of the guidelines is to ensure that licensees of all operating nuclear power plants perform the following:

- o define safe load travel paths through procedures and operator training so that, to the extent practical, heavy loads are not carried over or near irradiated fuel or safe shutdown equipment
- o provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to ensure reliable operation of the handling system.

Staff guidelines resulting from the foregoing are tabulated in Section 5 of NUREG-0612; Section 6 recommended that a program be initiated to ensure that these guidelines are implemented at operating plants.

1.3 PLANT-SPECIFIC BACKGROUND

On December 22, 1980, the NRC issued a letter [3] to FPC, the Licensee for Crystal River Unit 3, requesting that the Licensee review and evaluate provisions for handling and control of heavy loads 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. FPC responded on September 2, 1981 [4]. In response to an April 19, 1982 conference call between NRC, the reviewer, and FPC, additional information was provided on June 15, 1982 [5] and November 26, 1982 [6] and has been incorporated into this technical evaluation.

2. EVALUATION

This section presents a point-by-point evaluation of load handling provisions at Crystal River Unit 3 with respect to NRC staff guidelines provided in NUREG-0612. Separate subsections are provided for both the general guidelines of NUREG-0612, Section 5.1.1 and the interim measures of NUREG-0612, Section 5.3. In each case, the guideline or interim measure is presented, Licensee-provided information is summarized and evaluated, and a conclusion as to the extent of compliance, including recommended additional action where appropriate, is presented. These conclusions are summarized in Table 2.1.

2.1 GENERAL GUIDELINES

The NRC has established seven general guidelines to provide the defense-in-depth appropriate for the safe handling of heavy loads. They are identified under the following topics in Section 5.1.1 of NUREG-0612:

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

These seven guidelines should be satisfied by all overhead handling systems and programs used 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.

2.1.1 NUREG-0612, Overhead Heavy Load Handling Systems

a. Summary of Licensee Statements and Conclusions

The following systems at Crystal River Unit 3 have been identified by the Licensee as overhead heavy load handling systems subject to the criteria of NUREG-0612:

Table 2.1 Crystal River/NUREG-0612 Compliance Matrix

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
1. Containment Polar Crane (RCCR-1)	180(30)	--	--	C	--	--	C	P	--	--
Reactor Vessel Missile Shields	26	C	C	--	--	C	--	--	--	C
Pressurizer Missile Shields	15	C	C	--	--	C	--	--	--	C
Stud Tensioners	1	C	C	--	--	C	--	--	--	C
ISI Tool	17	C	C	--	--	C	--	--	--	C
Crane Block and Hook	5	C	C	--	--	--	--	--	--	C
Refueling Machine Components	1.3	C	C	--	--	C	--	--	--	C
Hatch Covers	10	C	C	--	--	C	--	--	--	C
Plenum	58.5	C	C	--	--	--	--	--	--	C
Internals Storage Stand	4.1	C	C	--	--	C	--	--	--	C
Core Barrel	162	C	C	--	--	--	--	--	--	C
RP Motors	50.5	C	C	--	--	C	--	--	--	C

C = Licensee action complies with NUREG-0612 Guideline.
P = Licensee action partially complies with NUREG-0612 Guideline.
-- = Not applicable.

Table 2.1 (Cont.)

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
RCPs	23	C	C	--	--	C	--	--	--	C
Reactor Vessel Head with Tripod	160	C	C	--	C	--	--	--	--	C
Index Fixture	6.3	C	C	--	--	C	--	--	--	C
Service Structure Platforms	1.5	C	C	--	--	C	--	--	--	C
Refueling Cavity Seal Plate	1.5	C	C	--	--	C	--	--	--	C
Fuel Transfer Tube Covers	1	C	C	--	--	C	--	--	--	C
2. Reactor Vessel Tool Handling Jib Crane (RCCR-2)	2.5	--	--	C	--	--	C	--	--	C
3. Auxiliary Building Crane (FHCR-5)	120(15)	--	--	C	--	--	C	P	P	--
New Fuel Shipping Cask	3.6	C	C		--	P	--	--	--	--
Crane Bottom Block and Hook	3.5	C	C		--	--	--	--	--	--
New Fuel Pit Missile Shields	7	C	C		--	--	--	--	--	--

Table 2.1 (Cont.)

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
Spent Fuel Cask Pit Gate	2	C	C		--	P	--	--	--	--
Spent Fuel Pool Missile Shields	4.5	C	C		--	--	--	--	--	--
4. Missile Shield Gantry Crane (FHCR-7)	10	--	--	C	--	--	C	--	--	--
5. Spent Fuel Pit Gate Hoist (SFHT-7)	2	--	--	C	--	--	C	--	--	--
Spent Fuel Pool Missile Shields	3.2	C	C	--	--	--	--	--	P	--
Spent Fuel Pool Gate	2	C	C	--	--	C	--	--	P	--
6. Intake Structure Gantry Crane (CWCR-1)	50	C	C	C	--	--	C	P	--	--

- o (RCCR-1) reactor building polar crane
- o (RCCR-2) reactor vessel tool handling jib crane
- o (FHCR-5) auxiliary building crane
- o (FHCR-7) spent fuel pool missile shield crane
- o (SFHT-7) spent fuel pool gate chain hoist
- o (CWCR-1) intake structure gantry crane.

The Licensee has also excluded several other load handling systems from compliance with NUREG-0612 for one or more of the following reasons:

1. The device is not an overhead handling system as defined in NUREG-0612
2. The rated capacity is less than or equal to 1000 lb
3. Sufficient physical separation exists between safe shutdown or decay heat removal equipment or spent fuel.

b. Evaluation and Conclusion

The Licensee's conclusions concerning load handling systems subject to the general guidelines of Section 5.1.1 are consistent with the objectives of NUREG-0612.

2.1.2 Safe Load Paths [Guideline 1, NUREG-0612, Section 5.1.1(1)]

> "Safe load paths should be defined for the movement of heavy loads to minimize the potential for heavy loads, if dropped, to impact irradiated fuel in the reactor vessel and in the spent fuel pool, or to impact safe shutdown equipment. The path should follow, to the extent practical, structural floor members, beams, etc., such that if the load is dropped, the structure is more likely to withstand the impact. These load paths should be defined in procedures, shown on equipment layout drawings, and clearly marked on the floor in the area where the load is to be handled. Deviations from defined load paths should require written alternative procedures approved by the plant safety review committee."

a. Summary of Licensee Statements and Conclusions

The Licensee states that a comprehensive load handling program has been established for Crystal River Unit 3 which defines load paths for load handling operations to avoid or minimize the time of load travel over spent fuel or equipment required for safe shutdown or decay heat removal. For those

load handling systems which have been designated to comply with NUREG-0612, the Licensee has noted that safe load paths have been developed and identified in plant drawings. Exclusion areas, rather than safe load paths, have been established for the intake structure gantry crane, which is used primarily for pulling the circulating water pumps and motors for maintenance and for placing the stop logs in the intake structure. These exclusion areas protect buried conduits and associated equipment carrying water to the nuclear service water pumps.

Permanent marking of safe load paths will not be performed by the Licensee; however, the intent of NUREG-0612 is met through the use of a comprehensive set of administrative controls. In compliance with Crystal River Unit 3 technical specifications, a senior reactor operator (SRO) will directly supervise all core alterations after the initial fuel loading. The SRO in charge of the alterations will have no other concurrent responsibilities during those operations. A reactor building coordinator (RBC) will be present in the reactor building to supervise and coordinate operations. The RBC will be familiar with NUREG-0612 requirements and aware of safe load handling procedures. All lifts will be approved by the RBC or the shift supervisor prior to the lift. In addition, written procedures containing figures designating the proper load paths have been prepared. In conjunction with the use of the load path diagrams, the person in charge of the lift will have the option of using visual reinforcements to temporarily mark the load paths when he determines that these visual aids are necessary.

Similar administrative controls will be used to control heavy loads in other critical areas. During a refueling outage (or other major outages) an auxiliary building coordinator (ABC) will be present in the auxiliary building to supervise and coordinate operations. The ABC will be familiar with NUREG-0612 requirements and aware of safe load handling practices. During operations, when an ABC is not assigned, the shift supervisor or a position similarly qualified in NUREG-0612 requirements will assume the same responsibilities. All lifts involving FHCR-5 or FHCR-7 will be approved by the ABC, or the shift supervisor or his designee prior to the lift. There is

only one load path available to SFHT-7; therefore, these administrative controls will not be applied to this crane.

When it is not possible to follow a safe load path, or a safe load path does not exist for a particular load, a temporary procedure change request must be processed in accordance with Administrative Instruction AI-400. This instruction requires that authorization for change be acquired from the nuclear operations shift supervisor. It must be authorized by a supervisor, determined by the shift supervisor to be qualified in the discipline for which the change is generated, or by the nuclear operations technical advisor. Temporary changes to procedures are reviewed by the plant review committee within 14 days. Temporary changes will not alter the intent of the original procedure.

b. Evaluation

Safe load paths developed at Crystal River Unit 3 meet the intent of Section 5.1.1(1) of NUREG-0612. Further, the use of an exclusion area for the intake structure crane is consistent with NUREG-0612 because the essential equipment (e.g., nuclear service water conduit) occupies only a small portion of the crane's operational area. Load paths for the remaining hoists and monorails are described by the physical limits of the handling device rails.

Load path deviations are handled in a manner consistent with NUREG-0612 because all permanent deviations are reviewed by the plant review committee. In addition, all temporary deviations are authorized by a designee of the plant review committee with a formal committee review within 14 days.

Movements along safe load paths inside containment are ensured by the RBC. The RBC is familiar with NUREG-0612 requirements and aware of safe load handling procedures. Therefore, the alternative approach of using the RBC as the visual aid for the crane operator provides the degree of load handling control intended by NUREG-0612. Similarly, movements of heavy loads along safe load paths in the auxiliary building are ensured by the ABC.

c. Conclusion

Crystal River Unit 3 complies with Guideline 1 of NUREG-0612.

2.1.3 Load Handling Procedures [Guideline 2, NUREG-0612, Section 5.1.1(2)]

"Procedures should be developed to cover load handling operations for heavy loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment. At a minimum, procedures should cover handling of those loads listed in Table 3-1 of NUREG-0612. These procedures should include: identification of required equipment; inspections and acceptance criteria required before movement of load; the steps and proper sequence to be followed in handling the load; defining the safe path; and other special precautions."

a. Summary of Licensee Statements and Conclusions

As a part of the comprehensive load handling program developed at Crystal River Unit 3, the Licensee states that operating procedures have been developed to ensure that load handling follows defined load paths. Numerous procedures are identified in the Licensee's response, including:

OP 421 - Operation of CR-3 Overhead Cranes and Hoists

OP 421A - Operation of the Reactor Building Polar Crane

OP 421C - Operation of the Auxiliary Building Overhead Crane

OP 421D - Operation of the Missile Shield Gantry Crane

OP 421E - Operation of the Reactor Vessel Tool Handling Jib Crane

OP 421F - Operation of the Intake Structure Gantry Crane.

A typical Crystal River Unit 3 procedure for crane operation will contain the following information:

1. A description of the overhead handling systems to be used, including type of crane, its rating, type of drive units, type of hoists, controls, and applicable limit switches and wheel stops

2. References to other applicable procedures

3. Limits and precautions for handling particular loads

4. Setpoints

5. General crane operating procedures describing handling of the bridge travel, trolley travel, and hoist motion; the use of appropriate and signals; and procedures for pre-operational checkout and visual inspection

6. Post-operational checkout procedures

7. Design data

8. Attachments including crane load matrix and safe load path sketches.

Further, the Licensee will develop procedures in compliance with NUREG-0612 for handling spent fuel shipping casks. These procedures will be prepared prior to use of these casks.

b. Evaluation

Load handling procedures at Crystal River Unit 3 are consistent with the guidance in Section 5.1.1(2) of NUREG-0612. The Licensee has chosen to use generic procedures for each load handling device to address individual load handling. Information provided indicates that these generic procedures contain the information recommended in Guideline 2 of NUREG-0612.

c. Conclusion

Crystal River Unit 3 complies with Guideline 2 of NUREG-0612.

2.1.4 Crane Operator Training [Guideline 3, NUREG-0612, Section 5.1.1(3)]

"Crane operators should be trained, qualified and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, 'Overhead and Gantry Cranes' [7]."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that the program developed by FPC for the training, qualification, and conduct of crane operators has been prepared in compliance with the requirements of ANSI B30.2-1976.

b. Evaluation and Conclusion

Crystal River Unit 3 complies with Guideline 3 of NUREG-0612 on the basis of the Licensee's confirmation of compliance to ANSI B30.2-1976 for crane operator training, qualification, and conduct.

2.1.5 Special Lifting Devices [Guideline 4, NUREG-0612, Section 5.1.1(4)]

"Special lifting devices should satisfy the guidelines of ANSI N14.6-1978, 'Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials' [8]. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is in lieu of the guideline in Section 3.2.1.1 of ANSI N14.6 which bases the stress design factor on only the weight (static load) of the load and of the intervening components of the special handling device."

a. Summary of Licensee Statements and Conclusions

FPC has identified one special lifting device, the reactor vessel head and internals lifting device, to be subject to the criteria of ANSI 14.6-1978. ANSI guideline criteria were not considered applicable to another identified lifting device, the spent fuel pool missile shield lifting beam, since the load handled will float if dropped and will not impact irradiated fuel in the spent fuel pool, as noted in Section 9.6.1.5 of the Crystal River FSAR. For the reactor vessel head and internals lifting device, the Licensee states that design and fabrication were performed prior to the existence of ANSI N14.6-1978 and, therefore, it is difficult to make strict comparisons between the actual lifting device and the standard. The Licensee's analysis of applicable sections of ANSI N14.6-1978 which deal with the load handling reliability of the lifting device is contained in the following paragraphs.

1. Section 3 of ANSI N14.6. The Licensee states that the reactor vessel head and internals lifting device was designed to industry standards and Babcock & Wilcox Company (B&W) engineering practices that were in effect at

the time. No specific design specification was prepared for the special lifting device design, although the Licensee states that use of B&W standard engineering and design practices as well as B&W's knowledge of how the device would be used should adequately fulfill these requirements. The lifting device and its components were designed to be capable of lifting three times the design capacity (180 tons) without exceeding the yield strength of the materials used and without consideration for dynamic loading. Due to excess design margin, this stress design factor is in compliance with the ANSI N14.6-1978 standard as supplemented by NUREG-0612. The Licensee has been unable to retrieve any information on materials testing. In addition, since the head and internals lifting device was specifically designed for the reactor vessel head and internals, the Licensee states that the design considerations of ANSI-N14.6, Sections 3.3, 3.4, 3.5, and 3.6, were all considered in the context of the design practices in use when the device was built.

2. Section 4 of ANSI N14.6. The Licensee states that the lifting device design incorporated B&W fabrication practices in effect at the time of fabrication, although no quality assurance requirements were placed on the fabrication of the device. Application of this section in retrospect to the standard B&W manufacturing practices, however, is not considered by the Licensee to be practical.

3. Section 5 of ANSI N14.6. Proper use and maintenance of the head and internals device, which the Licensee regards as the responsibilities of the owner, are addressed in various refueling and surveillance procedures. Inspections are performed at each refueling outage. Regarding the initial acceptance load test specified in ANSI N14.6-1978, the head and internals lifting device and components were initially load-tested to 255 tons, which is 160% of the weight of the reactor vessel head, the maximum load to which the device is subjected. Following this load test, non-destructive examination (NDE) was performed on all load-bearing welds.

In lieu of an annual 150% load test, the Licensee states that NDE is performed on the head and internals lifting device prior to its use, in accordance with ANSI N14.6-1978, Section 5.3.1(2). These inspections are performed prior to use of the device or at refueling outages, rather than at

the specified periodicity due to the inaccessibility of the handling device when stored within the containment.

4. Section 6 of ANSI N4.6. FPC cannot determine the applicability of this section at this time due to the structural, impact, and other analyses that are required to make a determination of critical loads.

b. Evaluation

Although it cannot be determined that the specific requirements of ANSI N14.6-1978 for component design and fabrication have been satisfied for the reactor vessel head and internals lifting device, it is evident that this device will provide a high degree of load handling reliability. The employment of a stress design factor on yield of three times the static load provides yield and ultimate stress margins comparable to those specified in ANSI N14.6-1978. The B&W requirements for design details also provide for a quality product. Finally, a proof test to 160% of the maximum load lifted, followed by NDEs, provides a high degree of confidence in workmanship quality.

In addition, the Licensee has developed and implemented a program for continued testing, maintenance, and repair that will provide a degree of load handling reliability consistent with that provided through comformance to Guideline 4.

c. Conclusion

Crystal River Unit 3 complies with Guideline 4 of NUREG-0612.

2.1.6 Lifting Devices (Not Specially Designed) [Guideline 5, NUREG-0612, Section 5.1.1(5)]

"Lifting devices that are not specially designed should be installed and used in accordance with the guideline of ANSI B30.9-1971, 'Slings' [9]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in terms of the 'static load' which produces the maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

a. Summary of Licensee Statements and Conclusions

The Licensee states that plant procedures governing the testing and use of slings are in accordance with ANSI B30.9-1971. The procedures for testing include requirements for visual inspection, load testing, and magnetic particle or liquid penetrant testing.

All cranes not exempt from NUREG-0612 have hoist speeds less than 17 feet per minute (fpm) except RCCR-2 which has two hoisting speeds: 27 fpm and 9 fpm. To minimize the effects of dynamic loading during lifts performed by RCCR-2, the 27-fpm hoisting speed switch will be disconnected. Based on these data and applying a factor of 0.5% of rated load per foot minute of hoist speed (CMAA-70, Section 3.3.2.1.1.3) to determine sling dynamic loading, all slings and lifting devices not specially designed have been derated by 10% to compensate for dynamic loading.

b. Evaluation

Procedures being implemented for testing and installation of slings at Crystal River Unit 3 are acceptable based upon the Licensee's statement that these procedures will comply with ANSI B30.9-1971.

The Licensee's intention to derate all slings and lifting devices not specially designed by 10% is sufficient to compensate for dynamic loads considering the maximum hoist speeds of less than 17 fpm and applying the impact loading factor used in CMAA-70.

c. Conclusion

Crystal River Unit 3 complies with Guideline 5 of NUREG-0612.

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

"The crane should be inspected, tested, and maintained in accordance with Chapter 2-2 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' with the exception that tests and inspections should be performed prior to use where it is not practical to meet the frequencies of ANSI B30.2 for periodic inspection and test, or where frequency of crane use is less than

the specified inspection and test frequency (e.g., the polar crane inside a PWR containment may only be used every 12 to 18 months during refueling operations, and is generally not accessible during power operation. ANSI B30.2, however, calls for certain inspections to be performed daily or monthly. For such cranes having limited usage, the inspections, test, and maintenance should be performed prior to their use)."

a. Summary of Licensee Statements and Conclusions

FPC is currently upgrading crane inspection, testing, and maintenance procedures to meet the intent of ANSI B30.2-1976, Chapter 2-2.

b. Evaluation and Conclusion

Crystal River Unit 3 complies with Guideline 6.

2.1.8 Crane Design [Guideline 7, NUREG-0612, Section 5.1.1(7)]

"The crane should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' and of CMAA-70, 'Specifications for Electric Overhead Traveling Cranes' [10]. An alternative to a specification in ANSI B30.2 or CMAA-70 may be accepted in lieu of specific compliance if the intent of the specification is satisfied."

a. Summary of Licensee Statements and Conclusions

The Licensee states that the three cranes of concern (the reactor building polar crane, the auxiliary building crane, and the intake structure gantry crane) were originally built in 1969 to industry standards in effect at that time, the "Specification for Electric Overhead Traveling Cranes" (EOCI-61) [11] and the detailed crane procurement specification prepared by Gilbert Associates, Inc. On the basis of a detailed comparison of the reactor building polar crane and the fuel (auxiliary) building crane with the requirements of CMAA-70, the Licensee states that, with two exceptions, these cranes either fully satisfy or meet the intent of the CMAA-70 and ANSI B30.2-1976 criteria. (Analysis of the intake structure gantry crane will be submitted with the Phase II response which is due June 15, 1983.)

Regarding the two exceptions, the Licensee has provided the following comments. For the fuel building crane, the moment of intertia of the longitudinal stiffeners is significantly less than the CMAA-70 minimum value. This represents a lower than normal margin to prevent buckling; therefore, the Licensee has proposed performance of detailed analyses to evaluate the potential for buckling and to determine the adequacy of the present design. Modifications may be required as a result of these analyses.

The second exception identified the lack of bumpers on the trolleys on both the polar and fuel building cranes. Considerations currently under review by the Licensee include (1) modification of the trolleys to install bumpers or travel limit switches or (2) performance of analyses to determine lateral loads and potential consequences. The Licensee further stated that requirements for structural changes to reactor building polar crane RCCR-1 and auxiliary building crane FHCR-5 will be determined subsequent to FPC's final review of the crane design evaluation (submitted June 15, 1982) [6] and the load drop analysis (to be submitted with the 9-month report). This will allow FPC to evaluate and schedule all of the proposed modifications in an efficient and cost-effective manner.

b. Evaluation

Cranes at Crystal River Unit 3 substantially satisfy the criteria of Guideline 7 on the basis that they were procured in accordance with EOCI-61 and industry standards of that period. The polar crane and fuel building crane have been further compared in detail with the additional criteria of CMAA-70 and ANSI B30.2-1976. For the polar crane, implementation of one of the recommended modifications to the trolley should satisfy the design requirements of this guideline. Similarly, for the fuel building crane, the Licensee should also perform the recommended trolley modifications as well as analyses and resultant modifications of the longitudinal stiffeners. The analyses and comparison of the intake structure crane should be performed similar to that performed for the polar and fuel building cranes.

c. Conclusion and Recommenda.ions

Crystal River Unit 3 partially complies with Guideline 7 of NUREG-0612. In order to fully comply, the Licensee should provide the following information:

1. Resolution of the longitudinal stiffener and trolley bumper deficiencies on the fuel (auxiliary) building and reactor building polar cranes

2. Design verification for the intake structure crane.

2.2 INTERIM PROTECTION MEASURES

The NRC has established six interim protection measures to be implemented at operating nuclear power plants to provide reasonable assurance that no heavy loads will be handled over the spent fuel pool and that measures exist to reduce the potential for accidental load drops to impact on fuel in the core or spent fuel pool. Four of the six interim measures of the report consist of 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:

1. Heavy load technical specifications

2. Special review for heavy loads handled over the core.

The status of the Licensee's implementation and the evaluation of these interim protection measures are summarized in the succeeding paragraphs of this section.

2.2.1 Technical Specifications [Interim Protection Measure 1, NUREG-0612, Section 5.3]

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

a. Summary of Licensee Statements and Conclusions

The Crystal River Unit 3 Technical Specifications, Section 3.9.7, prohibits loads in excess of 2750 pounds from travel over fuel assemblies in the spent fuel pool with the exception of the pool divider gates and missile shields, which may be moved as necessary to gain access to the fuel assemblies. The Licensee has noted that Crystal River Unit 3 FSAR Section 9.6.1.5 states that the spent fuel pool missile shields have been designed to float. Therefore, the spent fuel pool is not considered a possible load drop target for the missile shields. The question of the pool divider gates will be reviewed in the 9-month report. Further, the Licensee has stated that a detailed structural analysis will be performed to determine whether the spent fuel pool missile shields can withstand the impact of the 5-ton hydraulic jack used to retension the reactor containment tendons. Tendon inspection is required every 5 years and was last completed during Refuel III in 1981. Therefore, the hydraulic jack will not have to be used until 1986. Prior to the next use of the 5-ton jack, the analysis will be complete and requirements will be addressed in technical specifications at that time.

b. Evaluation

The Licensee has implemented a technical specification which substantially complies with the intent of Interim Protection Measure 1. It is acceptable to exclude the missile shields as a potential load drop impacting fuel since the missile shields were designed to float; however, the Licensee has provided no information to evaluate the potential for the spent fuel pool divider gate to impact spent fuel. The Licensee has committed to resolve this deficiency in the submission of the nine-month report. Finally, use of the 5-ton jack should be administratively prohibited until the issue is resolved and appropriate corrective actions completed.

c. Conclusion and Recommendations

Crystal River Unit 3 partially complies with Interim Protection Measure 1 of NUREG-0612. In order to fully comply, the Licensee should be required to perform the following actions:

1. Prohibit the movement of the pool divider gates over spent fuel in the spent fuel pool.
2. Prohibit the use of the 5-ton jack over the fuel building until the issue of impact on spent fuel is resolved and the appropriate corrective actions are completed.

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

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

a. Summary of Licensee Statements and Conclusions

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

b. Evaluations, Conclusions, and Recommendations

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

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

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

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that the requirements of Interim Protection Measure 6 were met and implemented prior to the use of the applicable equipment during the 1981 refueling outage.

b. Evaluation and Conclusion

Crystal River Unit 3 complies with Interim Protection Measure 6.

3. CONCLUSION

This summary is provided to consolidate the results of the evaluation contained in Section 2 concerning individual NRC staff guidelines into an overall evaluation of heavy load handling at Crystal River Unit 3. Overall conclusions and recommended Licensee actions, where appropriate, are provided with respect to both general provisions for load handling (NUREG-0612, Section 5.1.1) and completion of the staff recommendations for interim protection (NUREG-0612, Section 5.3).

3.1 GENERAL PROVISIONS FOR LOAD HANDLING

The NRC staff has established seven guidelines concerning provisions for handling heavy loads in the area of the reactor vessel, near stored spent fuel, or in other areas where an accidental load drop could damage equipment required for safe shutdown or decay heat removal. The intent of these guidelines is twofold. A plant conforming to these guidelines will have developed and implemented, through procedures and operator training, safe load travel paths such that, to the maximum extent practical, heavy loads are not carried over or near irradiated fuel or safe shutdown equipment. A plant conforming to these guidelines will also have provided sufficient operator training, handling system design, load handling instructions, and equipment inspection to ensure reliable operation of the handling system. As detailed in Section 2, it has been found that load handling operations at Crystal River Unit 3 can be expected to be conducted in a reliable manner generally consistent with the staff's objectives as expressed in these guidelines.

There are several areas, however, in which additional Licensee action is necessary to ensure that the overall intent of NUREG-0612, Section 5.1.1 is satisfied:

- o FPC should resolve the longitudinal stiffener and trolley bumper deficiencies on the fuel (auxiliary) building crane and reactor building polar crane.
- o FPC should complete the design verification of the intake structure crane.

3.2 INTERIM PROTECTION MEASURES

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

- o FPC should prohibit the movement of the pool divider gates over spent fuel in the spent fuel pool.
- o FPC should limit the use of the 5-ton jack over the fuel building until the issue of impact on spent fuel is resolved and appropriate actions completed.

4. REFERENCES

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

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

3. NRC
   Generic letter to Crystal River Unit 3
   22 December 1980

4. P. Y. Baynard (FPC)
   Letter to R. A. Clark (NRC)
   Subject: Control of Heavy Loads at Nuclear Power Plants
   2 September 1981

5. D. G. Mardis (FPC)
   Letter to J. F. Stolz (NRC)
   Subject: NUREG-0612 Control of Heavy Loads
   15 June 1982

6. P. Y. Baynard (FPC)
   Letter to J. F. Stolz (NRR, ORB #4)
   Subject: NUREG-0612 Control of Heavy Loads
   26 November 1982

7. ANSI B30.2-1976
   "Overhead and Gantry Cranes"
   American Society of Mechanical Engineers, 1976

8. ANSI N14.6-1978
   "Standard for Special Lifting Devices for Shipping Containers
   Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials"
   American National Standards Institute, Inc.
   February 15, 1978

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

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

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 DEV.CES

Exception 1

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

Discussion

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

Approaches Consistent With This Guideline

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

Approaches Inconsistent With This Guideline

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

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

Exception 2

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

Discussion

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

Approaches Consistent With This Guideline

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

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

Approaches Inconsistent With This Guideline

See this topic for Exception 1 above.

Exception 3

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

Discussion

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

Approaches Consistent With This Guideline

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

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

Approach Inconsistent With This Guideline

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

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.

GUIDELINE 6 CRANE INSPECTION TESTING AND MAINTENANCE.

Exception

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

Discussion

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

Approach Consistent With This Guideline

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

Approaches Inconsistent With This Guideline

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

GUIDELINE 7 CRANE DESIGN

Exception

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

Discussion

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

Approach Consistent With This Guideline

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

Approach Inconsistent With This Guideline

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

ENCLOSURE 2

Cooper
Crystal River 3
D. C. Cook 1 & 2
Dresden 2 & 3
Ft. Calhoun
Haddam Neck
Maine Yankee
Monticello
Palisades

North Anna 1 & 2
Rancho Seco
Surry 1 & 2
Trojan
Turkey Point 3 & 4
Vermont Yankee
McGuire 1 & 2
Zion 1 & 2
Duane Arnold