TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

FLORIDA POWER COMPANY

CRYSTAL RIVER UNIT 3

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FOREWORD

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

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1. INTRODUCTION

1.1 PURPOSE OF REVIEW

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

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

1.2 GENERIC BACKGROUND

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

The results of Task A-36 were reported in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." The staff 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, Sections 5.1.2 through 5.1.5, 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.

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

- 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 January 29, 1982 [5], June 15, 1982 [6], November 26, 1982 [7], December 1, 1982 [8], and June 11, 1984 [9], 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	R	--	--
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.
R = Licensee has proposed revisions or modifications which meet the intent of NUREG-0612.
-- = 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	R	k	--
New Fuel Shipping Cask	3.6	C	C		--	C	--	--	--	--
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 5 Technical Specifications	Interim Measure 6 Special Attention
Spent Fuel Cask Pit Gate	2	C	C		--	C	--	--	--	--
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	--	R	--
Spent Fuel Pool Missile Shields	3.2	C	C	--	--	--	--	--	R	--
Spent Fuel Pool Gate	2	C	C	--	--	C	--	--	R	--
6. Intake Structure Gantry Crane (FHCR-1)	50	C	C	C	--	--	C	C	--	--

- (RCCR-1) reactor building polar crane
- (RCCR-2) reactor vessel tool handling jib crane
- (FHCR-5) auxiliary building crane
- (FHCR-7) spent fuel pool missile shield crane
- (SFHT-7) spent fuel pool gate chain hoist
- (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 stated 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 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

Development of safe load paths at Crystal River Unit 3 is consistent 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 stated 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 hand 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

Implementation of load handling procedures at Crystal River Unit 3 is performed in a manner consistent 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' [10]."

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 meets the intent of 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' [11]. 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 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 stated 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 stated 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 was 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 stated 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 stated 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 stated 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

Initial design as well as programs which ensure continuing compliance of special lifting devices at Crystal River Unit 3 meet the intent of 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' [12]. 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 stated 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 a factor of 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

Selection and use of slings at Crystal River Unit 3 are consistent 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

Inspection, maintenance, and testing of cranes at Crystal River Unit 3 satisfies 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' [13]. 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 stated 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 the industry standard 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, the fuel (auxiliary) building crane, and the intake structure gantry crane with the requirements of CMAA-70, the Licensee stated that these cranes either fully satisfy or meet the intent of the CMAA-70 and ANSI B30.2-1976 criteria.

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, fuel building crane, and intake structure gantry crane have been further compared in detail with the additional criteria of CMAA-70 and ANSI B30.2-1976. Based upon comparisons with the more restrictive criteria of CMAA-70, the Licensee has demonstrated that all cranes meet the intent of these criteria by use of analysis which demonstrate the adequacy of current design, or through commitment to modify present design.

c. Conclusion and Recommendations

Design of cranes at Crystal River Unit 3 is consistent with the intent of Guideline 7 of NUREG-0612.

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 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. In addition, the following commitments have been made by the Licensee with respect to the spent fuel divider gates:

1. Movement of the divider gates will be prohibited until after 50 days following transfer of spent fuel to the spent fuel pools.

2. Only spent fuel will be placed in the vicinity of the gate handling areas.

The Licensee also identified the 5-ton reactor building tendon jack to require periodic movement over the spent fuel pool area while retensioning reactor building tendons (every 5 years). Analysis and calculations performed by the Licensee indicate that the spent fuel pool missile shields can withstand a drop of this heavy load without failure. Therefore, no interim restrictions on the movement of the tendon jack are deemed necessary.

b. Evaluation

The technical specification implemented by the Licensee substantially satisfies the intent of this interim protection measure. Exceptions noted by the Licensee are also acceptable, based upon the following discussions:

1. The missile shields are designed to float and therefore do not present a hazard to stored spent fuel.

2. Suitable restrictions have been placed on the allowed mov sents of the divider gates.

3. Performance of analyses for the tendon jack (which address Phase II consequences of a load drop) provides suitable justification for its movement, since the intent of this measure was to provide interim protection until such analyses were completed.

c. Conclusion

Implementation of Interim Protection Measure 1 at Crystal River Unit 3 is performed in a manner consistent with NUREG-0612.

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 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.

3.2 INTERIM PROTECTION MEASURES

The NRC staff has established certain measures (NUREG-0612, Section 5.3) that should be initiated to provide reasonable assurance that handling of heavy loads will be performed in a safe manner until final implementation of the general guidelines of NUREG-0612, Section 5.1 is complete. Specified measures include: the implementation of a technical specification to prohibit

the handling of heavy loads over fuel in the storage pool; compliance with Guidelines 1, 2, 3, and 6 of NUREG-0612, Section 5.1.1; a review of load handling procedures and operator training; and a visual inspection program, including component repair or replacement as necessary of cranes, slings, and special lifting devices, to eliminate deficiencies that could lead to component failure. Evaluation of information provided by the Licensee indicates that all interim protection actions have been satisfactorily implemented at Crystal River Unit 3.

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